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Fish and Wildlife Resources of the Great Lakes Coastal Wetlands within the United States

OHSU-T-80-007 c.3

VOLUME FIVE: LAKE MICHIGAN, PA[illegible]

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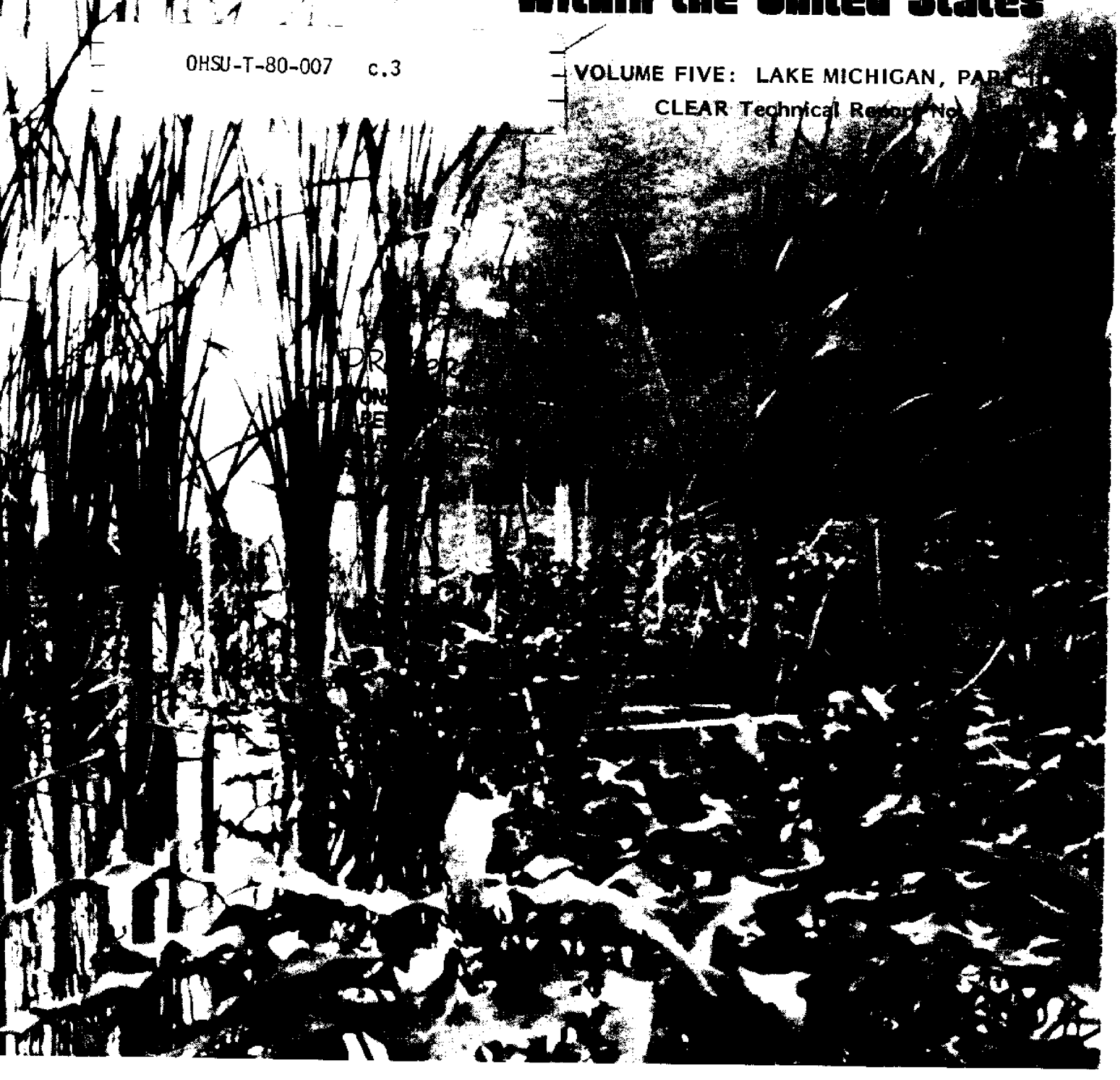

Prepared for U.S. Fish and Wildlife Service, Division of Ecological Services-Region 3
Twin Cities, Minnesota. Project Officer: Herbert W. Hyatt. Grant No. 14-16-0009-77-076

The Ohio State University, Center for Lake Erie Area Research,
and Ohio Sea Grant Program. Columbus, Ohio

in cooperation with

Indiana University, Environmental Systems Application Center. Bloomington, Indiana

OHSU-T-80-007 C3

LAKE SECTION 6

INTRODUCTION

Lake Section 6 extends along the eastern shoreline of Lake Michigan from the Allegan County-Van Buren County border in Michigan to the Michigan-Indiana border. The lake section is located in Van Buren and Berrien Counties. Van Buren County is sparsely populated, while Berrien County has a moderate population density.

Most of the wetlands in Lake Section 6 are situated on a lacustrine plain. The topography inland of these wetlands generally ranges from flat to rolling. The predominant shore types in the vicinity of the wetlands are low and high sand dunes, but erodible high bluffs are also present along a portion of the shoreline (Great Lakes Basin Commission, 1975).

Figures 6-1 and 6-2 show the approximate location of the nine wetlands in Lake Section 6. Latitude, longitude, acreage, and classification for each of these wetlands are presented in Table 6-1. Elevations of the wetlands range from 580 to 660 feet above sea level (lake level to 80 feet above the approximate mean elevation of Lake Michigan). Palustrine wetlands are predominant in Lake Section 6. Lacustrine and Riverine Systems are also present.

Information related to the physiographic and cultural features of the wetlands is summarized in the individual wetland narratives presented in this chapter. In most instances, puublished sources did not provide site-specific information on the biotic characteristics of these wetlands. However, site-specific biotic data are available for Galien River Wetland, and extensive biotic information is available for the Grand Mere area which may be particularly relevant to Grand Mere Lakes Wetlands #1-#4.

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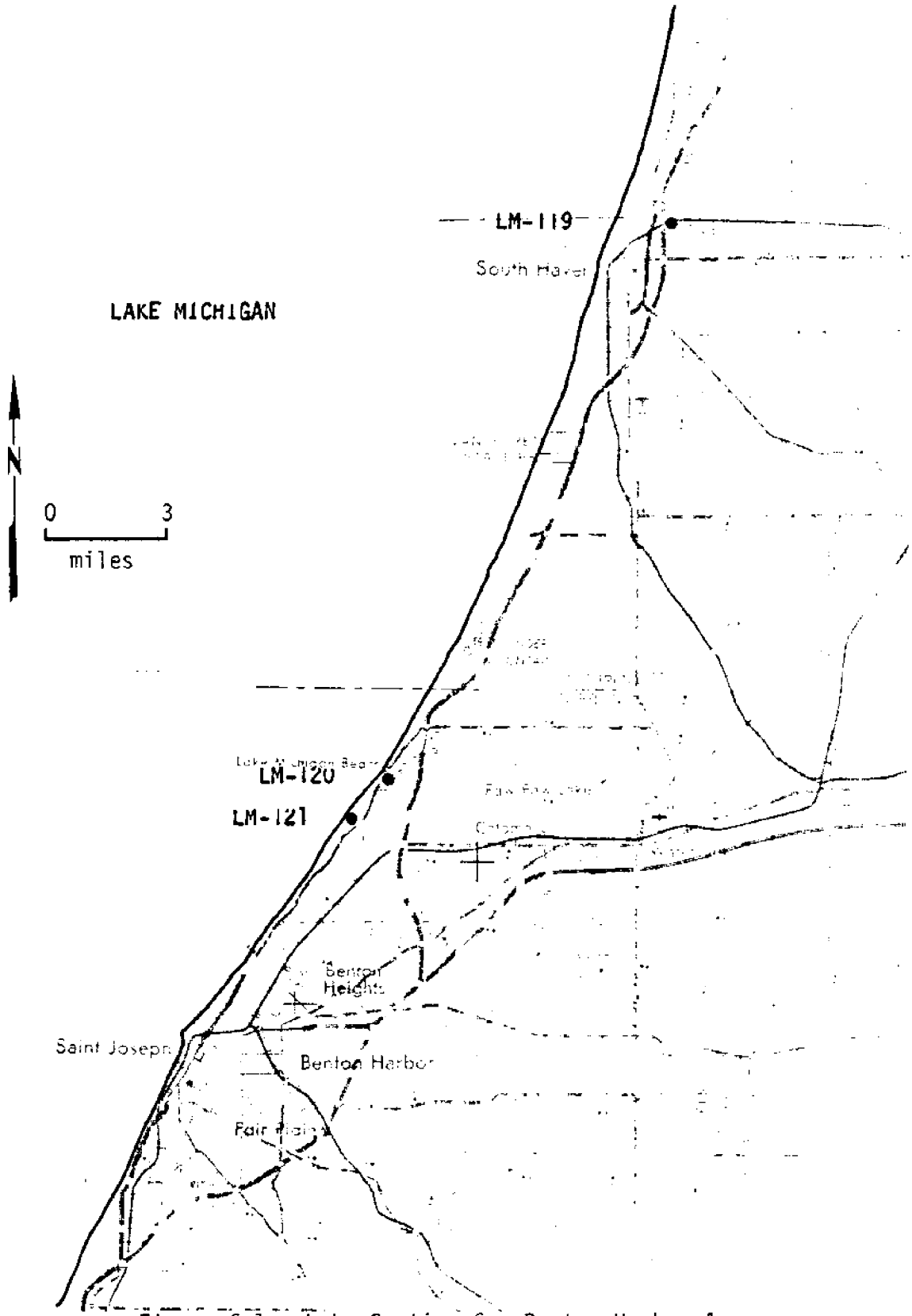

Figure 6-1. Lake Section 6 - Benton Harbor Area

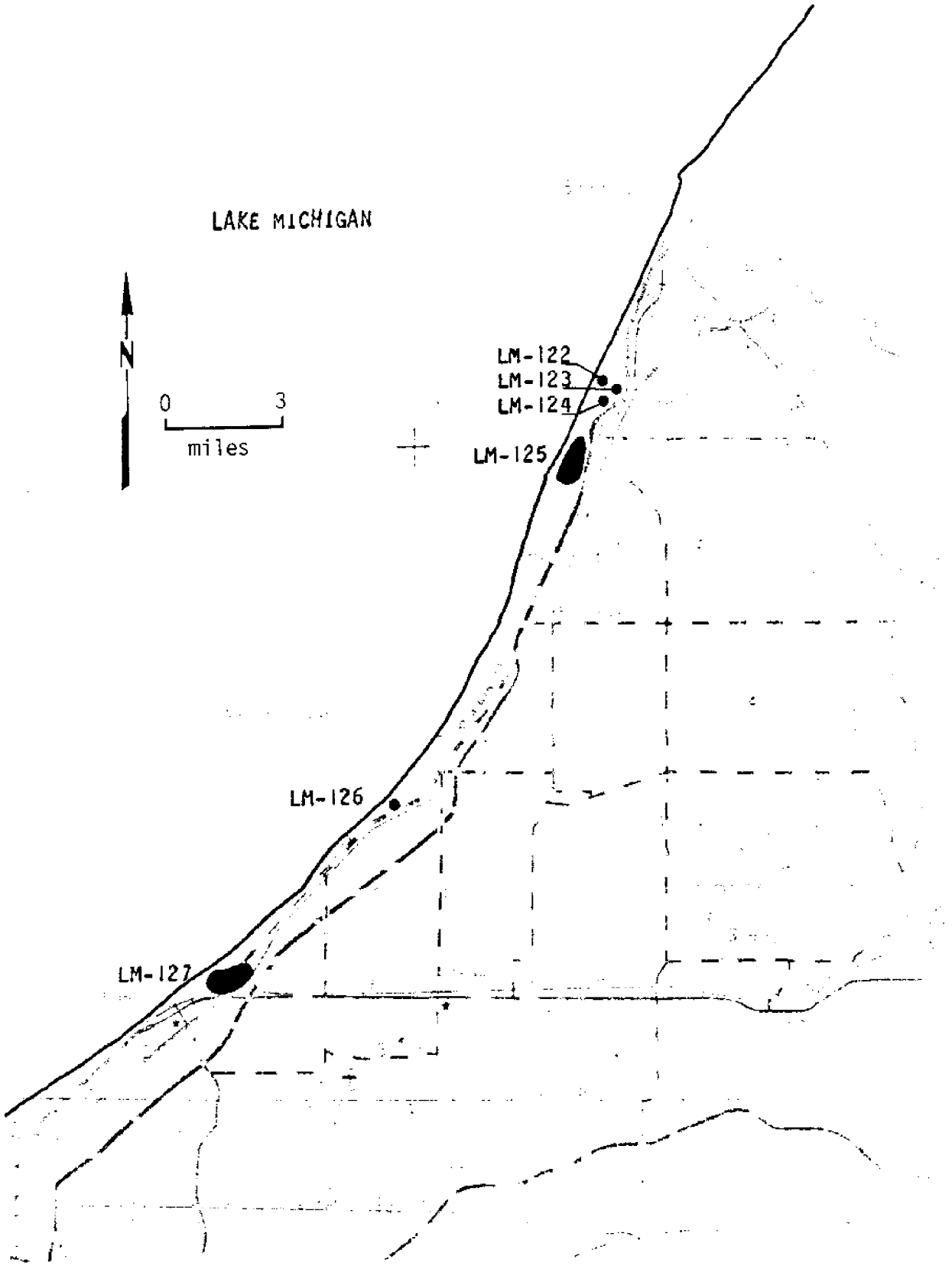

Figure 6-2. Lake Section 6 - Warren Dunes State Park Area

Table 6-1. Location, Acreage, and Classification of Wetlands in Lake Section 6

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
119	Black River Wetland	42°24'35"	86°16'12"	68	R
120	Hagar Township Wetland #1	42°12'42"	86°23'10"	2	P
121	Hagar Township Wetland #2	42°11'40"	86°24'06"	2	P
	GRAND MERE LAKES AREA WETLAND COMPLEX				
122	Grand Mere Lakes Wetland #1	42°01'11"	86°32'28"	1	P
123	Grand Mere Lakes Wetland #2	42°01'02"	86°32'06"	2	P
124	Grand Mere Lakes Wetland #3	42°00'14"	86°32'41"	244	P,L
125	Grand Mere Lakes Wetland #4	42°00'47"	86°32'44"	7	L
126	Harbert Wetland	41°52'18"	86°38'30"	11	P
127	Galien River Wetland	41°48'15"	86°43'52"	441	R

[a] P=palustrine
L=lacustrine
R=riverine

PHYSIOGRAPHIC SETTING LM 119

Setting

Black River Wetland is located 0.3 mile from the eastern shoreline of Lake Michigan in Van Buren County, Michigan, adjacent to the city of South Haven. The Black River, which flows through the wetland, features wide meanders and abandoned oxbows. Black River Wetland is a Lower Perennial Riverine System and occupies a low, non-wooded site (U.S.G.S. quadrangle map, South Haven, Michigan, 1927; Agricultural Stabilization and Conservation Service aerial photograph, 1972).

Topography

The total relief of Black River Wetland is 25 feet; wetland elevations range from 580 to 605 feet above sea level, 0 to 25 feet above the approximate mean elevation of Lake Michigan. The wetland lies on a lacustrine plain; the surrounding topography is flat to gently rolling. Sand dunes are common near the lakeshore. The shoreline near Black River Wetland is described by the Great Lakes Basin Commission (1975) as an erodible high bluff.

Surficial Geology

The surficial geology of Black River Wetland is characterized by lake beds comprised mainly of sand. These glaciolacustrine sediments consist of fine-grained products of glacial erosion and are found throughout much of the Black River Basin (Martin, 1957; Dorr and Eschman, 1970).

Soils

The soil type in Black River Wetland is Muck, which consist of dark brown to black organic matter that may include some clay, sand, and silt of alluvial origin. Muck is very poorly drained. The water table under this soil is usually high (Wildermuth et al., 1926).

Hydrology

The Black River flows through Black River Wetland on its way to Lake Michigan (U.S.G.S. quadrangle map, South Haven, Michigan, 1927). Water quality in the Black River is variable; the quality is generally good, except for those reaches nearest the river mouth. The stream near the mouth exhibits high nutrient and coliform levels and occasional low dissolved oxygen concentrations (Great Lakes Basin Commission, 1975). The effect of the Black River's substandard water quality on Black River Wetland is unknown. The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Black River Wetland.

Climate

The closest weather station providing climatic data for Black River Wetland is located in South Haven Experimental Farm, Michigan. In 1975, the average monthly temperature was 49.0°F, the average daily low for January was 22.4°F and the average daily high in July was 78.9°F. The average annual precipitation is 33.41 inches, with a mean monthly precipitation of 2.08 inches in January and 2.99 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 13 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Black River Wetland (U.S.G.S. quadrangle map, South Haven, Michigan, 1927; Agricultural Stabilization and Conservation Service aerial photograph, 1974).

BIOTIC SETTING LM 119

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Black River Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Black River Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Black River Wetland.

Reptiles and Amphibians

Appendix C-7 and C-8 contain general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Black River Wetland. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Appendix D-11, D-12, D-13, D-14, and D-15 contain general information on the wetland birds of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Black River Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Black River Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan Endangered and Threatened Species Program, 1976) were documented in Black River Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 119

Population

Black River Wetland is located in South Haven Township of Van Buren County, Michigan. The county is sparsely populated, having a density of 93 persons per square mile. Table 6-2 indicates that Van Buren County and South Haven Township experienced a rapid rate of population growth between 1970 and 1975. Projections for 1990 indicate that Van Buren County is expected to undergo continued rapid population growth.

Table 6-2. Population Data for the Vicinity of Black River Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Van Buren County	61,734	9.9	79,288
South Haven Township	3,593	5.2	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Black River Wetland is urban open space. The surrounding area is characterized by residential, commercial, and industrial development (the city of South Haven), while agricultural open space uses predominate inland. An access road and rail lines lie south of Black River Wetland, and a bridge crosses the Black River a short distance south of the wetland (U.S.G.S. quadrangle map, South Haven, Michigan, 1927; Agricultural Stabilization and Conservation Service aerial photograph, 1974). The wetland lies within the corporate limits of the city of South Haven (Rockford Map Publishers, Inc., 1975), and is probably privately owned. These factors suggest moderate to high development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Black River Wetland.

Mineral, Energy, and Forest Resources

There are no active sand or gravel extraction operations in the vicinity of Black River Wetland (Michigan Geological Survey, 1975), nor are there any coal resources or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey, 1977; Smith, 1915). There are no significant forest resources in Black River Wetland (U.S.G.S. quadrangle map, South Haven, Michigan, 1927).

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Black River Wetland (U.S.G.S. quadrangle map, South Haven, Michigan, 1927).

Pollution Sources

There are no NPDES permit holders adjacent to Black River Wetland (Michigan Water Quality Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Black River Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Peebles and Black, 1976).

RESEARCH PROJECTS. LM 119

The literature search identified no on-going or impending research projects pertaining to Black River Wetland.

HAGAR TOWNSHIP WETLAND #1

PHYSIOGRAPHIC SETTING LM 120

Setting

Hagar Township Wetland #1 is located 0.2 mile from the eastern shoreline of Lake Michigan in Berrien County, Michigan, one mile southwest of the community of Lake Michigan Beach. Hagar Township Wetland #1 is a Palustrine System and occupies a raised, partially wooded site (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

Topography

The total relief of Hagar Township Wetland #1 is 10 feet; wetland elevations range from 620 to 630 feet above sea level, 40 to 50 feet above the approximate mean elevation of Lake Michigan. The wetland lies on a morainal plain; the surrounding topography is rolling to hilly. A steep bluffline, approximately 60 feet high, lies along the shoreline near Hagar Township Wetland #1. The Great Lakes Basin Commission (1975) describes this shoreline as high sand dunes.

Surficial Geology

The surficial geology of Hagar Township Wetland #1 is characterized by sand dunes, which are found along much of the Lake Michigan shoreline between South Haven and an area south of Lake Michigan Beach (Martin, 1957).

Soils

The soil type in Hagar Township Wetland #1 is Oakville fine sand, which has a surface layer of black organic matter mixed with dark, loose fine sand. This soil has low natural fertility and very slow surface runoff, although permeability is rapid. Oakville soils were formed in coarse-textured glacial drift (U.S. Department of Agriculture, Soil Conservation Service, 1974; Persinger, 1972).

Hydrology

There are no streams flowing through Hagar Township Wetland #1 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Hagar Township Wetland #1 is located in Benton Harbor Airport, Michigan. In 1975, the average daily low temperature for January was 23.3 ^{0}F and the average daily high in July

was 80.5°F. The average annual precipitation is 36.04 inches, with a mean monthly precipitation of 2.67 inches in January and 3.17 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 13 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Hagar Township Wetland #1 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

BIOTIC SETTING LM 120

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Hagar Township Wetland #1.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Hagar Township Wetland #1.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Hagar Township Wetland #1.

Reptiles and Amphibians

Appendices C-7 and C-8 contain general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Hagar Township Wetland #1. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Appendices D-11, D-12, D-13, D-14, and D-15 contain general information on the wetland birds of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Hagar Township Wetland #1. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use,

health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Hagar Township Wetland #1.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan Endangered and Threatened Species Program, 1976) were documented in Hagar Township Wetland #1 by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 120

Population

Hagar Township Wetland #1 is located in Hagar Township of Berrien County, Michigan. The county has a moderate population density of 283 persons per square mile. Table 6-3 indicates that Berrien County experienced a moderate rate of population growth between 1970 and 1975, but Hagar Township underwent a slow decline in population during the same time period. Projections for 1990 indicate that the population of Berrien County will have a slow rate of growth in the future.

Table 6-3. Population Data for the Vicinity of Hagar Township Wetland #1

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Berrien County	170,544	4.0	179,692
Hagar Township	3,987	-2.5	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Hagar Township Wetland #1 is rural open space. The surrounding area is characterized by low-density residential development, interspersed with rural open space and a limited amount of agricultural open space. Access roads lie to the north and east of Hagar Township Wetland #1 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970; Berrien County Planning Commission, 1975). The wetland is privately owned, and its location suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Hagar Township Wetland #1.

Mineral, Energy, and Forest Resources

Dune and coastal strip sands, such as those surrounding Hagar Township Wetland #1, are the leading sources of industrial quality sand owing to their purity and superior physical qualities. There are no sand extraction operations in or near the wetland at present (Michigan Geological Survey, 1975). Gravel resources are also found in the vicinity of the wetland; however, no active gravel operations are present. The vicinity of Hagar Township Wetland #1 contains no coal or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey 1977; Smith, 1915). Hagar Township Wetland #1 is partially wooded (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970), but it was not determined through the literature search whether this wooded area is subject to commercial timber harvest.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Hagar Township Wetland #1 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

Pollution Sources

There are no NPDES permit holders adjacent to Hagar Township Wetland #1 (Michigan Water Quality Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Hagar Township Wetland #1, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Peebles and Black, 1976).

The literature search identified no on-going or impending research projects pertaining to Hagar Township Wetland #1.

HAGAR TOWNSHIP WETLAND #2

PHYSIOGRAPHIC SETTING LM 121

Hagar Township Wetland #2 is located 250 feet from the eastern shoreline of Lake Michigan in Berrien County, Michigan, 1.1 miles from the community of Riverside. A bluffline, approximately 70 feet high, lies lakeward of the wetland. Hagar Township Wetland #2 is a Palustrine System and occupies a raised, non-wooded site (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

Topography

The total relief of Hagar Township Wetland #2 is 5 feet; wetland elevations range from 655 to 660 feet above sea level, 75 to 80 feet above the approximate mean elevation of Lake Michigan. The wetland lies on a morainal plain; the surrounding topography is rolling. The shoreline near Hagar Township Wetland #2 is described by the Great Lakes Basin Commission (1975) as high sand dunes.

Surficial Geology

The surficial geology of Hagar Township Wetland #2 is characterized by sand dunes, which are found along much of the Lake Michigan shoreline between South Haven and an area south of Lake Michigan Beach (Martin, 1957).

Soils

The soil type in Hagar Township Wetland #2 is Oakville fine sand, which has a surface layer of black organic matter mixed with dark, loose fine sand. This soil has low natural fertility and very slow surface runoff, although permeability is rapid. Oakville soils were formed in coarse-textured glacial drifts (U.S. Soil Conservation Service, 1974; Persinger, 1972).

Hydrology

There are no streams flowing through Hagar Township Wetland #2 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Hagar Township Wetland #2 is located in Benton Harbor Airport, Michigan. In 1975, the average daily low temperature for January was 23.3°F and the average daily high in July was 80.5°F. The average annual precipitation is 36.04 inches, with a mean monthly precipitation of 2.67 inches in January and 3.17 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April

13 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Hagar Township Wetland #2 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

BIOTIC SETTING LM 121

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Hagar Township Wetland #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Hagar Township Wetland #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Hagar Township Wetland #2.

Reptiles and Amphibians

Appendices C-7 and C-8 contain general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Hagar Township Wetland #2. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Appendices D-11, D-12, D-13, D-14, and D-15 contain general information on the wetland birds of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Hagar Township Wetland #2. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Hagar Township Wetland #2.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan Endangered and Threatened Species Program, 1976) were documented in Hagar Township Wetland #2 by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 121

Population

Hagar Township Wetland #2 is located in Hagar Township of Berrien County, Michigan. The county has a moderate population density of 283 persons per square mile. Table 6-4 indicates that Berrien County experienced a moderate rate of population growth between 1970 and 1975, but Hagar Township underwent a slow decline in population during the same time period. Projections for 1990 indicate that the population of Berrien County will have a slow rate of growth in the future.

Table 6-4. Population Data for the Vicinity of Hagar Township Wetland #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Barrien County	170,544	4.0	179,692
Hagar Township	3,987	-2.5	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Hagar Township Wetland #2 is rural open space. Residential areas are located to the north, east, and west of the wetland; they are part of a band of residential development along the bluffs overlooking Lake Michigan. Access roads lie to the north, east, and south of Hagar Township Wetland #2. To the south of Hagar Township Wetland #2, as well as further inland, agricultural and other rural open space uses predominate (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970; Berrien County Planning Commission, 1975). The wetland is privately owned, and its location suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Hagar Township Wetland #2.

Mineral, Energy, and Forest Resources

Dune and coastal strip sands such as those in the vicinity of Hagar Township Wetland #2, are the leading sources of industrial quality sand, owing to their purity and superior physical qualities. At present there are no sand extraction operations in or near Hagar Township Wetland #2 (Michigan Geological Survey 1975). Gravel resources are also found in the vicinity of the wetland; however, no active gravel operations are present.

The area in the vicinity of Hagar Township Wetland #2 contains no coal deposits or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey, 1977; Smith, 1915), and no significant forest resources are present in the wetland (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Hagar Township Wetland #2 (U.S.G.S. quadrangle map, Benton Heights, Michigan, 1970).

Pollution Sources

There are no NPDES permit holders adjacent to Hagar Township Wetland #2 (Michigan Water Quality Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Hagar Township Wetland #2 (Peebles and Black, 1976). However, the Michigan Coastal Zone Inventory indicates that two archaeological sites are present in the vicinity of the

wetland. Site 20-BE-210 is a habitation of the Middle Woodland Culture, and site 20-BE-67 is a habitation of an unknown culture and date (Peebles and Black, 1976). Further information regarding the field research and location of these sites can be obtained from the Michigan History Division.

RESEARCH PROJECTS LM 121

The literature search identified no on-going or impending research projects pertaining to Hagar Township Wetland #2.

PHYSIOGRAPHIC SETTING LM 122-125

Setting

The Grand Mere Lakes Area Wetland Complex, comprised of Grand Mere Lakes Wetlands #1-#4, is located near the southeastern shoreline of Lake Michigan in Berrien County, Michigan, in the vicinity of the three Grand Mere Lakes. The locations of the wetlands relative to the Lake Michigan shoreline and to the community of Stevenville are shown in Table 6-5.

Table 6-5. Locations of Grand Mere Lakes Wetlands #1-#4

Wetland	Distance to shoreline (miles)	Distance to Stevenville, Michigan
Grand Mere Lakes Wetland #1	0.1	1.0 mile northwest
Grand Mere Lakes Wetland #2	0.4	0.7 mile west
Grand Mere Lakes Wetland #3	0.1	0.5 mile west
Grand Mere Lakes Wetland #4	0.1	1.0 mile west

Grand Mere Lakes Wetland #1 lies to the north of the northernmost Grand Mere Lake. An intermittent stream lies to the east of this wetland. Grand Mere Lakes Wetland #1 is a Palustrine System and occupies a low, non-wooded site. Grand Mere Lakes Wetland #2 is located to the east of the northernmost Grand Mere Lake. This wetland is a wooded, Palustrine System occupying a low site. Grand Mere Lakes Wetland #3 extends from a point east of the northernmost Grand Mere Lake, to a point south of the southernmost Grand Mere Lake; this wetland encircles the middle and southernmost Grand Mere Lakes. Grand Mere Lakes Wetland #3 is a Palustrine and Lacustrine System occupying both raised and low, wooded and non-wooded sites. Grand Mere Lakes Wetland #4 is located along the southwestern shoreline of the northernmost Grand Mere Lake. This wetland is a low, partially wooded, Lacustrine System (U.S.G.S. quadrangle maps, Stevenville, Michigan, 1970; Bridgman, Michigan, 1970).

Topography

The elevations of the four wetlands in the Grand Mere Lakes Area Wetland Complex range between 581 and 600 feet above sea level, 1 to 20 feet above the approximate mean elevation of Lake Michigan. The elevations and total relief of the individual wetlands in the wetland complex are indicated in Table 6-6.

Table 6-6. Elevations and Total Relief of Individual Wetlands in the Grand Mere Lakes Area Wetland Complex

Wetland	Minimum elevation (feet)[a]	Maximum elevation (feet)[a]	Total relief (feet)
Grand Mere Lakes Wetland #1	585	590	5
Grand Mere Lakes Wetland #2	585	590	5
Grand Mere Lakes Wetland #3	581	600	19
Grand Mere Lakes Wetland #4	581	590	9

[a] Elevations measured in feet above sea level; approximate mean Lake Michigan elevation is 580 feet above sea level.

Grand Mere Lakes Wetlands #1-#4 lie on a low lacustrine plain, landward of coastal sand dunes. Inland topography is rolling.

Surficial Geology

The surficial geology of Grand Mere Lakes Wetlands #1-#4 is characterized by sand dunes, which are found along much of the Lake Michigan shoreline in the Stevensville area (Martin, 1957).

Soils

Houghton muck is found in the southern part of Grand Mere Lakes Wetland #3; Marsh is found in Grand Mere Lakes Wetlands #1, #2, and #4 and in the northern part of Grand Mere Lakes Wetland #3, around the lakes. The surface layer of Houghton muck is comprised of brown to black, fibrous, loose granular matter. This well decomposed organic material includes some roots and is underlain with fibrous material, such as sedges and grasses, that is also well decomposed. Houghton muck is generally found in old lake beds (Wonser et al., 1939). Marsh soil is wet throughout the year and consists of peat. The vegetation supported by Marsh soil includes cattails, sedges, water weeds, and water-tolerant trees (Pregitzer, 1968; U.S. Soil Conservation Service, 1974).

Hydrology

Two short, unnamed intermittent streams flow into Grand MereLake Wetland #3. No streams flow through Grand Mere Lakes Wetlands #1, #2, and #4. Grand Mere Lakes Wetlands #3 and #4 are adjacent to Grand Mere Lakes (U.S.G.S. quadrangle maps, Stevensville, Michigan, 1970; Bridgman, Michigan, 1970). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, water level depth, or seasonal changes in Grand Mere Lakes Wetlands #1-#4.

Climate

The closest weather station providing climatic data for the Grand Mere Lakes Area Wetland Complex is located in Benton Harbor Airport, Michigan. In 1975, the average daily low temperature for January was 23.3°F and the average daily high in July was 80.5°F. The average annual precipitation is 36.04 inches, with a mean monthly precipitation of 2.67 inches in January and 3.17 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 13 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Grand Mere Lakes Wetland Complex. An interstate highway lies to the east of the wetlands (U.S.G.S. quadrangle maps, Stevensville, Michigan, 1970; Bridgman, Michigan, 1970).

BIOTIC SETTING LM 122-125

Vegetation

Wetland habitats of the Grand Mere Area (Medley, 1973) include a hardwood swamp and a hemlock swamp, both associated with an old lake bed; a cranberry bog, in the southern-most lake of Grand Mere; and aquatic areas, associated with the three remaining lakes of this once five-lake system.

Major species composing the hardwood swamp are red maple (Acer rubrum), white ash (Fraxinus americana), and speckled alder (Alnus rugosa). Scattered through the area are a few hemlocks (Tsuga canadensis), white cedar (Thuja occidentalis) and tamarack (Larix laricina). The herbaceous flora occurring in this habitat is not distinctive but is composed of wild flowers and ferns indigenous to this portion of Michigan.

Also occupying portions of an ancient lake bed are hemlock swamps. One hemlock swamp occurs in what was once a fourth lake of the five-lake complex, while the other lies between I-94 and the covert moraine forming the east boundary of the Grand Mere embayment. While these two areas are dominated by hemlock, fairly large numbers of white pine (Pinus strobus), tamarack, and white cedar also occur here. Noteworthy herbaceous species of the hemlock swamps include star flower (Trientalis borealis), bunchberry (Cornus canadensis), goldbread (Coptis groenlandice), purple avens (Geum rivale), moccasin flower (Cyripedium acaule), yellow ladyslipper (C. calceolus), clubspur orchid (Habeneria clavellaja), Loese's twayblade (Liparis loeselii), twin flower (Linnaea borealis), and shining clubmoss (Lycopeium lucidluum). Also in areas of sufficient incident light are scattered depauperate specimens of pitcher plant (Sarracenia purpurea).

Formerly, a cranberry bog surrounded the south lake and was developed as a commercial enterprise. The flora of this area was composed of sphagnum moss (Sphagnum sp.), cranberries (Vaccinium macrocarpon), pitcher plants, and marsh

St. John's wort (Hypericum virginicum). Owing to rising water tables the bog area has reverted to a lake habitat being invaded by swamp rose (Rosa palustris) and other marsh vegetation.

Three lakes remain at Grand Mere, connected to each other and to Lake Michigan by the Thornton Valley Drain. Emergent vegetation of these wetlands includes cattails (Typha angustifolia, T. latifolia), arrowhead (Sagittaria latifolia), arrow arum (Peltandra virginica), pickerel weed (Pontederia cordata), spatterdock (Nuphar advena), and various rushes (Juncus spp.). Floating-leaved species include white water lily (Nymphaea tuberosa), water shield (Brasenia schreberi), duckweed (Lemma minor) and pondweeds (Potamogeton spp.). Submersed aquatic vegetation is composed predominantly of coontail (Ceratophyllum demersum), slender naiad (Najas flexilis), water milfoil (Myriophyllum exalbescens), elodea (Elodea canadensis), and several species of pondweed. Algae is abundant in these lakes.

The literature search yielded no site-specific information pertaining to density and productivity or relationship to water levels for the vegetation of Grand Mere Lakes Wetlands #1-#4.

Fish

A few of the fish that have been reported from the Grand Mere Lakes include norhtern pike (Esox lucius), grass pickerel (Esox americanus), largemouth bass (Micropterus salmoides), bluegill (Lepomis gibbosus), and central mudminnow (Umbra limi) (Grand Mere Association, 1973). All are probably associated with the surrounding Grand Mere Lakes Wetlands #1, #2, #3, and #4. A search of the literature provided no site-specific information pertaining to species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Grand Mere Lakes Wetlands #1-#4.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Grand Mere Lakes Wetlands #1-#4.

Reptiles and Amphibians

An account of the herpetofauna of the Grand Mere area, including Grand Mere Lakes Wetlands #1-#4, is available in Grand Mere Association (1973). Table 6-7 lists species observed in the Grand Mere area.

Table 6-7. Amphibians and Reptiles Observed in the Grand Mere Area[a]

Species	Characteristic Habitat at Grand Mere
central newt	openwater
eastern tiger salamander	wooded lake bed
American toad	wooded lake bed
Fowler's toad	wooded lake bed
Blanchard's cricket frog	lake edges
northern spring peeper	wooded lake bed, lake edges
western chorus frog	wooded lake bed
bullfrog	lake edges
green frog	lake edges
pickerel frog	lake edges
northern leopard frog	lake edges
snapping turtle	openwater
midland painted turtle	open water
spotted turtle	
Blanding's turtle	open water
map turtle	
eastern box turtle	
blue racer	wooded lake bed
black rat snake	wooded lake bed
eastern hognose snake	
northern water snake	lake edges
eastern garter snake	wooded lake bed
eastern massasauga[b]	

[a] Grand Mere Association (1973)
[b] Appears to have been locally extirpated

Appendices C-7 and C-8 contains general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Grand Mere Lakes Wetlands #1-#4. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

An account of the avifauna of the Grand Mere area, including Grand Mere Lakes Wetlands #1-#4, is available in Grand Mere Association (1973). A total of 235 species of birds were recorded in the Grand Mere area between 1935 and 1973. Of these, over 100 would be expected to have some affinities with wetlands. Birds known to breed in the Grand Mere area include the mallard (Anas platyrhynchos), American woodcock (Philohela minor), black tern (Chlidonias nigra), downy woodpecker (Picoides pubescens), veery (Catharus fuscenscens), yellow warbler (Dendroica petechia), yellow-throat (Geothlypis trichas), hooded

warbler (Wilsonia citrina), Canada warbler (Wilsonia canadensis), and red-winged blackbird (Agelaius phoeniceus). An additional 19 species of wetland-associated birds are suspected of breeding or of having bred in the Grand Mere area.

Grand Mere, in general, is noted as being a mixture of northern and southern elements. Two species which breed at the extremes of their geographic range at Grand Mere are the hooded warbler and Canada warbler which breed in the hemlock swamps.

Waterfowl migration at Grand Mere peaks from spring thaw into April and from October until freeze-over. American wigeons (Anas americana), redheads (Aythya americana), ring-necked ducks (A. collaris), and buffleheads (Bucephala albeola) are the most common of the ducks that use the Grand Mere Lakes as migration stopovers. Horned grebes (Podiceps auritus) and pied-billed grebes (Podilymbus podiceps), American coots (Fulica americana), herring gulls (Larus argentatus) and ring-billed gulls (L. delawarensis) are also present. Common loons (Gavia immer), whistling swans (Olor columbianus), and mute swans (Cygnus olor) are seen occasionally. During the peak of migration, flights of 5,000-20,000 ducks have been observed in a single morning. Lesser scaup (Aythya affinis), greater scaup (A. marila), and ring-necked ducks are the predominant species. Double-breasted cormorants (Phalacrocorax auritus), jaegers, and shorebirds also participate in these migrations.

Songbird migration is at its peak between late April and late May and from mid-September into October. Flycatchers, wrens, thrushes, kinglets, vireos, warblers, orioles, finches, sparrows, and other nocturnal migrants commonly use the Grand Mere area for feeding and resting during the day. Diurnal migrants observed in large flights include blackbirds, American robins (Turdus migratorius), common flickers (Colaptes auratus), blue jays (Cyanocitta cristata), American goldfinches (Carduelis tristis), northern orioles (Icterus galbula), red-headed woodpeckers (Melanerpes erythrocephalus), and cedar waxwings (Bombycilla cedrorum). Hawks are seen in their migration between mid-April and mid-May and between mid-September and early November. It has been stated that during migration seasons more species of birds can be observed at Grand Mere than at any other locality in Berrien County (Grand Mere Association, 1973).

The most regularly observed birds during the winter at Grand Mere include the downy woodpecker, brown creeper (Certhia familiaris), white-breasted nuthatch (Sitta carolinensis), dark-eyed junco (Junco hyemalis), tree sparrow (Spizella arborea), American goldfinch, cardinal (C. cardinalis), black-capped chickadee (Parus atricapillus), tufted titmouse (Parus bicolor), and small numbers of boreal finches. The Grand Mere area receives intensive use for bird-watching.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Grand Mere Lakes Wetlands #1-#4.

Mammals

Mammalian species which may utilize the four wetlands comprising the Grand Mere Lakes Area Wetland Complex are listed in Table 6-8.

Table 6-8. Mammalian Species of the Grand Mere Area[a]

Common name	Common name
masked shrew	muskrat
short-tailed shrew	meadow jumping moust
star-nosed mole	red fox
eastern cottontail	raccoon
red bat	long-tailed weasel
red squirrel	ermine
white-footed mouse	mink
meadow vole	white-tailed deer

[a] Medley, 1973

However, the literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting these wetlands.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan and Threatened Species Program, 1976) were documented specifically in Grand Mere Lakes Wetlands #1-#4 by the literature search. However, many species having endangered, threatened, or rare status have been observed in the Grand Mere area and might be expected to utilize Grand Mere Lakes Wetlands #1-#4. These species are listed in Table 6-9.

Table 6-9. Endangered, Threatened, and Rare Species in the Grand Mere Area[a]

Species	Status
BIRDS	
bald eagle	endangered (federal list)
peregrine falcon	endangered (federal list)
double-crested cormorant	threatened (state list)
Cooper's hawk	threatened (state list)
red-shouldered hawk	threatened (state list)
marsh hawk	threatened (state list)
common loon	rare
black-crowned night heron	rare
American bittern	rare
sharp-shinned hawk	rare
pigeon hawk	rare
sandhill crane	rare
caspian tern	rare
barred owl	rare
REPTILES AND AMPHIBIANS	
eastern box turtle	threatened (state list)
black rat snake	threatened (state list)
spotted turtle	rare

[a] Grand Mere Association (1973)

The Indiana bat (Myotis sodalis), which is on the federal and state endangered lists, and the southern bog lemming (Synatomep cooperii), a species threatened in Michigan, have been recorded in the Grand Mere area in the past, (Medley, 1973) but no recent observations have been documented.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, a nuclear power plant is located in the vicinity of the wetland complex and may have some effect on its health.

CULTURAL SETTING LM 122-125

Population

Grand Mere Lakes Wetlands #1-#4 are located in Lincoln Township of Berrien County, Michigan. The county has a moderate population density of 283 persons

per square mile. Table 6-10 indicates that Berrien County experienced a moderate rate of population growth between 1970 and 1975, and Lincoln Township experienced rapid growth during the same time period. Projections for 1990 indicate that Berrien County is expected to undergo slow population growth in the future.

Table 6-10. Population Data for the Vicinity of the Grand Mere Lakes Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Barrien County	170,544	4.0	179,692
Lincoln Township	12,854	16.8	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Grand Mere Lakes Wetlands #1-#4 is rural open space. The immediate surroundings of the wetlands are primarily rural open space, although there is some residential development south of Grand Mere Lakes Wetland #4 and west of the upper portion of Grand Mere Lakes Wetland #3. Access roads are located adjacent to all of the wetlands in the Grand Mere Lakes Wetland Complex. An interstate highway (I-94) marks the eastern boundary of the wetland. East of the highway is an area of residential, industrial, and commercial development (the town of Stevensville); the area south of Stevensville is characterized primarily by agricultural and other rural open space uses (U.S.G.S. quadrangle maps, Stevensville, Michigan, 1970; Bridgman, Michigan, 1970.

The Grand Mere Lakes area has received nomination as an "area of ecological importance" under Michigan's Coastal Zone Management Program. If this plan is adopted, the area will be preserved in a natural state (Southwestern Michigan Regional Planning Commission, 1976). Portions of the Grand Mere Lakes area have been purchased by the Michigan Department of Natural Resources for use as a state park.

Recreation

The Michigan Department of Natural Resources purchased 383 acres of Grand Mere in 1973 for use as a state park. An additional 10 acres were acquired in 1974. The state park is to be used as a natural-state, limited recreational-educational area. The Michigan Department of Natural Resources has been urged to make every effort to acquire contiguous acreage amounting to approximately 700 acres (Southwestern Michigan Regional Planning Commission, 1976).

Mineral, Energy, and Forest Resources

Dune and coastal strip sands such as those in the vicinity of Grand Mere Lakes Wetlands #1-#4 are the leading sources of industrial quality sand, owing to their purity and superior physical qualities. At present there are no sand extraction operations in Grand Mere Lakes Wetlands #1-#4. However, an industrial sand operation is situated south of Grand Mere Lakes Wetland #3 (Michigan Geological Survey,1975). Gravel resources are also found in the vicinity of the wetlands, but no active gravel operations are present.

The vicinity of Grand Mere Lakes Wetlands #1-#4 contains no coal deposits or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey,1977; Smith, 1915).

Grand Mere Lakes Wetlands #2-#4 are partially wooded (U.S.G.S. quadrangle map, Stevensville, Michigan, 1970). It was not determined through the literature search whether these wooded areas are subject to commercial timber harvest. There are no significant forest resources in Grand Mere Lakes Wetland #1.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Grand Mere Lakes Wetlands #1 and #4. However, Cook Nuclear Power Plant lies southwest of the wetlands near Rosemary Beach (U.S.G.S. quadrangle map, Bridgman, Michigan, 1970; Stevensville, Michigan, 1970).

Pollution Sources

There are no NPDES permit holders adjacent to Grand Mere Lakes Wetlands #1-#4 (Michigan Water Quality Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Grand Mere Lakes Wetlands #1-#4 (Peebles and Black, 1976). However, the Michigan Coastal Zone Inventory indicates that seven archaeological sites are present in the vicinity of the wetlands. Sites 20-BE-177, 20-BE-69, 20-BE-103, 20-BE-14, and 20-BE-121 are habitations of unknown culture and date, but no information is available for sites 20-BE-176 and 20-BE-174 (Peebles and Black, 1976). Information regarding the field research and exact location of these sites can be obtained from the Michigan History Division.

RESEARCH PROJECTS LM 122-125

The literature search identified no on-going or impending research projects pertaining to Grand Mere Lakes Wetlands #1-#4.

PHYSIOGRAPHIC SETTING LM 126

Setting

Harbert Wetland is located 0.1 mile from the southeastern shoreline of Lake Michigan in Berrien County, Michigan, 0.5 mile west of the community of Harbert. Harbert Wetland is a Palustrine System and lies in a depression on a raised, wooded site (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

Topography

The total relief of Harbert Wetland is 5 feet; wetland elevations range from 635 to 640 feet above sea level, 55 to 60 feet above the approximate mean elevation of Lake Michigan. The wetland lies on a coastal lacustrine plain; a bluffline, approximately 50 feet high, parallels the shoreline lakeward of the wetland. The surrounding topography is rolling. The shoreline near Harbert Wetland is described by the Great Lakes Basin Commission (1975) as low sand dunes.

Surficial Geology

The surficial geology of Harbert Wetland is characterized by sand dunes, which are found along portions of the lakeshore in the vicinity of the wetland (Martin, 1957).

Soils

The soil type in Harbert Wetland is Oakville fine sand, which has a surface layer of black organic matter mixed with dark, loose fine sand. This soil has low natural fertility and very slow surface runoff, although permeability is rapid. Oakville soils were formed in coarse-textured glacial drifts (U.S. Soil Conservation Service, 1974; Persinger, 1972).

Hydrology

There are no streams flowing through Harbert Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Harbert Wetland is located in Benton Harbor Airport, Michigan. In 1975, the average daily low temperature for January was 23.3°F and the average daily high in July was 80.5°F. The average annual precipitation is 36.04 inches, with a mean monthly

precipitation of 2.67 inches in January and 3.17 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 13 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Harbert Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

BIOTIC SETTING LM 126

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Harbert Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Harbert Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Harbert Wetland.

Reptiles and Amphibians

Appendices C-7 and C-8 contain general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Harbert Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

General historical information on the avifauna of the area is available in Wood (1922), which was based in part on fieldwork conducted around the village of Harbert. Additional general information on the birds of Lake Section 6 is

presented in Appendices D-11, D-12, D-13, D-14, and D-15, but care should be exercised in the interpretation of the relevance of this information to Harbert Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The eastern cottontail (Sylvilagus floridanus), fox squirrel (Sciurus niger), white-footed mouse (Peromyscus leucopus), and muskrat (Ondatra zibethicus) may utilize Harbert Wetland (Wood, 1922).

The literature search provided no site-specific data pertaining to other major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting this wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan Endangered and Threatened Species Program, 1976) were documented in Harbert Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 126

Population

Harbert Wetland is located in Chikaming Township of Berrien County, Michigan. The county has a moderate population density of 283 persons per square mile. Table 6-11 indicates that Berrien County and Chikaming Township experienced a moderate rate of population growth between 1970 and 1975. Projections for 1990 indicate that Berrien County is expected to have a slow rate of population growth in the future.

Table 6-11. Population Data for the Vicinity of Harbert Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Barrien County	170,544	4.0	179,692
Chikaming Township	4,221	4.2	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Harbert Wetland is rural open space. The immediate surroundings of the wetland are characterized primarily by rural open space, with limited amounts of agricultural open space and residences. An area of residential and commercial development (the town of Harbert) is located to the east of the wetland. Harbert Road crosses Harbert Wetland, and other access roads lie to the west and east of the wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970). The wetland is under private ownership, and its location suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Harbert Wetland.

Mineral, Energy, and Forest Resources

Dune and coastal strip sands such as those in the vicinity of Harbert Wetland are the leading sources of industrial quality sand, owing to their purity and superior physical qualities. At present there are no sand extraction operations in or near Harbert Wetland (Michigan Geological Survey, 1975), nor are there any active gravel operations although gravel resources are found in the vicinity of the wetland.

The vicinity of Harbert Wetland contains no coal deposits or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey, 1977; Smith, 1915). Harbert Wetland is wooded (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970), but it was not determined through the literature search whether this wooded area is subject to commercial timber harvest.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Harbert Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

Pollution Sources

There are no NPDES permit holders adjacent to Harbert Wetland (Michigan Water Quality Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Harbert Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Peebles and Black, 1976).

RESEARCH PROJECTS LM 126

The literature search identified no on-going or impending research projects pertaining to Harbert Wetland.

PHYSIOGRAPHIC SETTING LM 127

Setting

Galien River Wetland is located 0.1 mile from the southeastern shoreline of Lake Michigan in Berrien County, Michigan, adjacent to the city of New Buffalo. The wetland lies on either side of the Galien River, within the flood plain, and several broad meanders of the Galien River are within the wetland, which extends along the river for a distance of approximately three miles. Galien River Wetland is a Lower Perennial Riverine System and occupies a low, partially wooded site (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

Topography

The total relief of Galien River Wetland is 10 feet; wetland elevations range from 580 to 590 feet above sea level, 0 to 10 feet above the approximate mean elevation of Lake Michigan. The wetland lies on a coastal lacustrine plain; a bluffline, approximately 50 feet high, parallels the shoreline lakeward of the wetland. The shoreline near Galien River Wetland is described by the Great Lakes Basin Commission (1975) as low sand dunes.

Surficial Geology

The surficial geology of Galien River Wetland is characterized by lake beds comprised mainly of sand. These glaciolacustrine sediments consist of fine-grained products of glacial erosion and are found along much of the Galien River basin (Martin, 1957; Dorr and Eschman, 1970).

Soils

The soil type in Galien River Wetland is Marsh, which is wet throughout the year and consists of peat. The vegetation supported by Marsh soil includes cattails, sedges, water weeds, and water tolerant trees (Pregitzer, 1968; U.S. Soil Conservation Service, 1974).

Hydrology

The Galien River meanders southwest through Galien River Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970). The river has a drainage area of 86.1 square miles and an annual maximum discharge of 830 cubic feet per second (U.S. Geological Survey, 1977). The Galien River exhibits elevated coliform and nutrient levels owing to discharges of raw and partially treated sewage (Great Lakes Basin Commission, 1975). The effect of the substandard water quality on Galien River Wetland is unknown. The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Galien River Wetland.

Climate

The closest weather station providing climatic data for Galien River Wetland is located in Ogden Dunes, Indiana. In 1975, the average monthly temperature was 51.1°F, the average daily low for January was 20.1°F and the average daily high in July was 85.3°F. The average annual precipitation is 40.20 inches, with a mean monthly precipitation of 3.80 inches in January and 2.59 inches in July based on the normal period from 1941-1970. The growing season is approximately five and a half months long, with the last killing frost (28°F) in 1975 occurring on May 7 and the first killing frost on October 21 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Galien River Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

BIOTIC SETTING LM 127

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Galien River Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Galien River Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Galien River Wetland.

Reptiles and Amphibians

Appendices C-7 and C-8 contain general information on the amphibians and reptiles of Lake Section 6, but care should be exercised in the interpretation of the relevance of this information to Galien River Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Galien River Wetland was included in the Mississippi Flyway Waterfowl Habitat Reconnaissance (Martz, 1976) because it is inadequately protected high quality waterfowl habitat. The primary waterfowl users of the area are dabbling ducks, including mallards (Anas platyrhynchos), black ducks (A. rubripes), blue-winged teals (A. discors), green-winged teals (A. crecca) and wood ducks (Aix sponsa). Estimated production and migration data from this evaluation are presented in Table 6-12. The reconnaissance indicated that the area includes abundant wading bird habitat. Galien River Wetland is also a significant refuge for migrating birds along Lake Michigan during severe Great Lakes weather.

A Christmas Bird Count (Table 6-13) is available for the New Buffalo area, which includes Galien River Wetland. Since non-wetland and urban areas are also included in the count, care should be exercised in the interpretation of the relevance of these data to Galien River Wetland.

General historical information on the avifauna of the area is available in Wood (1922), based largely on research work carried out on the upper reaches of the Galien River at Warrens Woods.

The literature search provided no site-specific information pertaining to recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Galien River Wetland.

Mammals

Muskrat (Ondatra zibethicus), mink (Mustela vison), and raccoon (Procyon lotor) have been observed on Galien River Wetland (Wood, 1922; Michigan Department of Natural Resources, open file report, 1972).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Galien River Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Michigan Endangered and Threatened Species Program, 1976) were documented in Galien River Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, a sewage disposal plant discharges into the Galien River and may have some effect on the health of the wetland.

Table 6-12. Estimated Waterfowl Use of Galien River Wetland[a]

Species	Production		Migration			Wintering		
	Avg density (prs/sq mi)	Avg young/ wetland acre	Avg peak pop. (000's)	Avg fall pop. (000's)	Avg duration (no. weeks)	Avg peak pop. (000's)	Avg wintering pop. (000's)	Avg duration (no. weeks)
DUCKS								
mallard	40	1	3	1	3	P	P	All
black duck	5		1	1	3	P	P	All
green-winged teal			1	1	2			
blue-winged teal			1	1	2			
wood duck	10		1	1	2			
redhead			P[b]					
scaup spp.			P					
ring-necked			P					
bufflehead			P					
GEESE								
Canada goose			P					
SWANS								
whistling swan			P					
Total Waterfowl			4000	3000	2-3	2-300		

[a]Martz (1976)
[b]P = present in small numbers

Table 6-13. Wetland Bird Species of the New Buffalo Census Area in the 1972-1975 Christmas Bird Counts[a]

Species	1975	1974	1973	1972
pied-billed grebe	1	2	2	1
mallard	75	76	220	25
black duck	6	13	5	8
scaup sp.	2	7	4	
common goldeneye	26	40	55	15
bufflehead	24	80	1	
hooded merganser	2	1		1
common merganser	10	24	40	
Cooper's hawk	2	4	3	1
red-tailed hawk	7	15	26	7
rough-legged hawk	3	7	2	2
marsh hawk	1	6	4	3
American kestrel	9	21	28	
ring-necked pheasant	11	20	101	39
American coot	6	8	5	
killdeer	1	2	2	1
herring gull	1,719	70	105	40
ring-billed gull	100	16	180	3
screech owl	1	3	4	1
great horned owl	2	1	10	2
barred owl		1		
short-eared owl	1			1
belted kingfisher		2	1	1
winter wren	2	2		6
red-winged blackbird	3	7		16
swamp sparrow	17	7		

[a]Arbib (1973, 1974, 1975, 1976)

Population

Galien River Wetland is adjacent to the city of New Buffalo in New Buffalo Township of Berrien County, Michigan. The county has a moderate population density of 283 persons per square mile. Table 6-14 indicates that Berrien County experienced a moderate rate of population growth between 1970 and 1975, while New Buffalo Township and the city of New Buffalo experienced rapid growth during the same time period. Projections for 1990 indicate that Berrien County is expected to have a slow rate of population growth in the future.

Table 6-14. Population Data for the Vicinity of Galien River Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Barrien County	170,544	4.0	179,692
New Buffalo Township	2,765	7.0	--
City of New Buffalo	2,977	6.9	--

[a] U.S. Bureau of the Census (1977)
[b] Michigan Department of Management and Budget (1977)

Land Use and Ownership

Land use within Galien River Wetland is rural open space. The surrounding area is characterized by residential, industrial, and commercial development (the city of New Buffalo) adjacent to the southwest portion of the wetland, residential development between the wetland and Lake Michigan, and primarily agricultural and other rural open space uses elsewhere. A secondary highway crosses Galien River Wetland, and rail lines and access roads lie adjacent to this wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970, Berrien County Planning Commission, 1976).

Galien River Wetland has been nominated for status as an "area of particular concern" under Michigan's Coastal Zone Management Program. Should this plan be implemented, the wetland will be preserved for its natural features (Southwestern Michigan Regional Planning Commission, 1976).

Recreation

There are no known state or federal recreational facilities in the vicinity of Galien River Wetland.

Mineral, Energy, and Forest Resources

Dune and coastal strip sands such as those near Galien River Wetland are the leading sources of industrial quality sand, owing to their purity and superior physical qualities. At present there are no sand extraction operations in or near Galien River Wetland (Michigan Geological Survey, 1975), nor are there any active gravel operations although gravel resources are found in the vicinity of the wetland.

The vicinity of Galien River Wetland contains no coal deposits or oil and gas pools (Great Lakes Basin Commission, 1975; Michigan Geological Survey, 1977; Smith, 1915). Galien River Wetland is partially wooded (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970), but it was not determined through the literature search whether this wooded area is subject to commercial timber harvest.

Public Utilities and Facilities

A sewage disposal plant is located to the southwest of Galien River Wetland (U.S.G.S. quadrangle map, New Buffalo East, Michigan-Indiana, 1970).

Pollution Sources

There are no NPDES permit holders adjacent to Galien River Wetland (Michigan Water Quality Division, 1978). However, a sewage disposal plant is situated to the southwest of the wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Galien River Wetland (Peebles and Black, 1976). However, the Michigan Coastal Zone Inventory indicates that three archaeological sites are present in the vicinity of the wetland. One is a habitation of an unknown culture and date; one is a Middle Woodland site; and the third contains three mounds of an unknown culture and date (Peebles and Black, 1976). Further information regarding the field research and location of these sites can be obtained from the Michigan History Division.

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The literature search identified no on-going or impending research projects pertaining to Galien River Wetland.

Table 6-15. Data Gaps - Lake Section 6

	Data Gap*	Wetland Number	119	120	121	122-125	126	127
Physiographic Setting		Setting						
		Topography						
		Surficial Geology						
		Soils						
	Hydrology	Water Level Fluctuations	*	*	*	*	*	*
		Groundwater	*	*	*	*	*	*
		Water Quality	*	*	*	*	*	*
		Depth	*	*	*	*	*	*
		Seasonal Changes	*	*	*	*	*	*
		Climate						
		Special Features						
Biotic Setting	Vegetation	Major Species Distribution	*	*	*		*	*
		Major Species Composition	*	*	*		*	*
		Density/Productivity	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*
	Fish	Major species	*	*	*	*	*	*
		Species Composition	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*
		Spawning and Hatching Areas	*	*	*	*	*	*
		Commercial/Recreational Use	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*
	Invertebrates	Species Composition	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*
	Amphibians/Reptiles	Major Species	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*
	Avifauna	Major Species	*	*	*	*	*	
		Seasonal Distribution	*	*	*	*	*	
		Density/Productivity	*	*	*	*	*	
		Recreational/Commercial Use	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*
	Mammals	Major Species	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*
		Endangered Species						
		Health	*	*	*	*	*	*
Cultural Setting		Population						
		Land Use and Ownership						
		Recreation						
		Mineral, Energy, Forest Resource						
		Public Utilities/Facilities						
		Point Pollution Sources						
		Non-Point Pollution Sources	*	*	*	*	*	*
		Historic Features						
		Archaeologic Features	*	*			*	

LAKE SECTION 7

INTRODUCTION

Lake Section 7 extends along the southern shore of Lake Michigan from the Michigan-Indiana border to East Chicago, Indiana. This region is part of the Calumet Lacustrine Plain, an area of generally low relief occupying the bed of glacial Lake Chicago (Reshkin et al., 1975). Predominant land types along this forty-mile stretch of shoreline include artificial fill and both low and high dunes (Great Lakes Basin Commission, 1975). The high dunes range to 40 feet above the surrounding plain.

Figure 7-1 shows the approximate location of the nine coastal wetlands in Lake Section 7. Latitude and longitude, acreage, and classification for each of these wetlands is presented in Table 7-1. Wetland elevations within Lake Section 7 range from 590 to 610 feet above sea level (10 to 30 feet above the approximate mean elevation of Lake Michigan). All of the wetlands are Palustrine Systems.

Information related to the physiographic and cultural features of the wetlands in Lake Section 7 is summarized in the individual wetland narratives presented in this chapter. With the exception of Ogden Dunes Wetland #1, site-specific information on the biotic characteristics of these wetlands has not been found in published sources. However, extensive biotic information is available for areas in the vicinity of the wetlands.

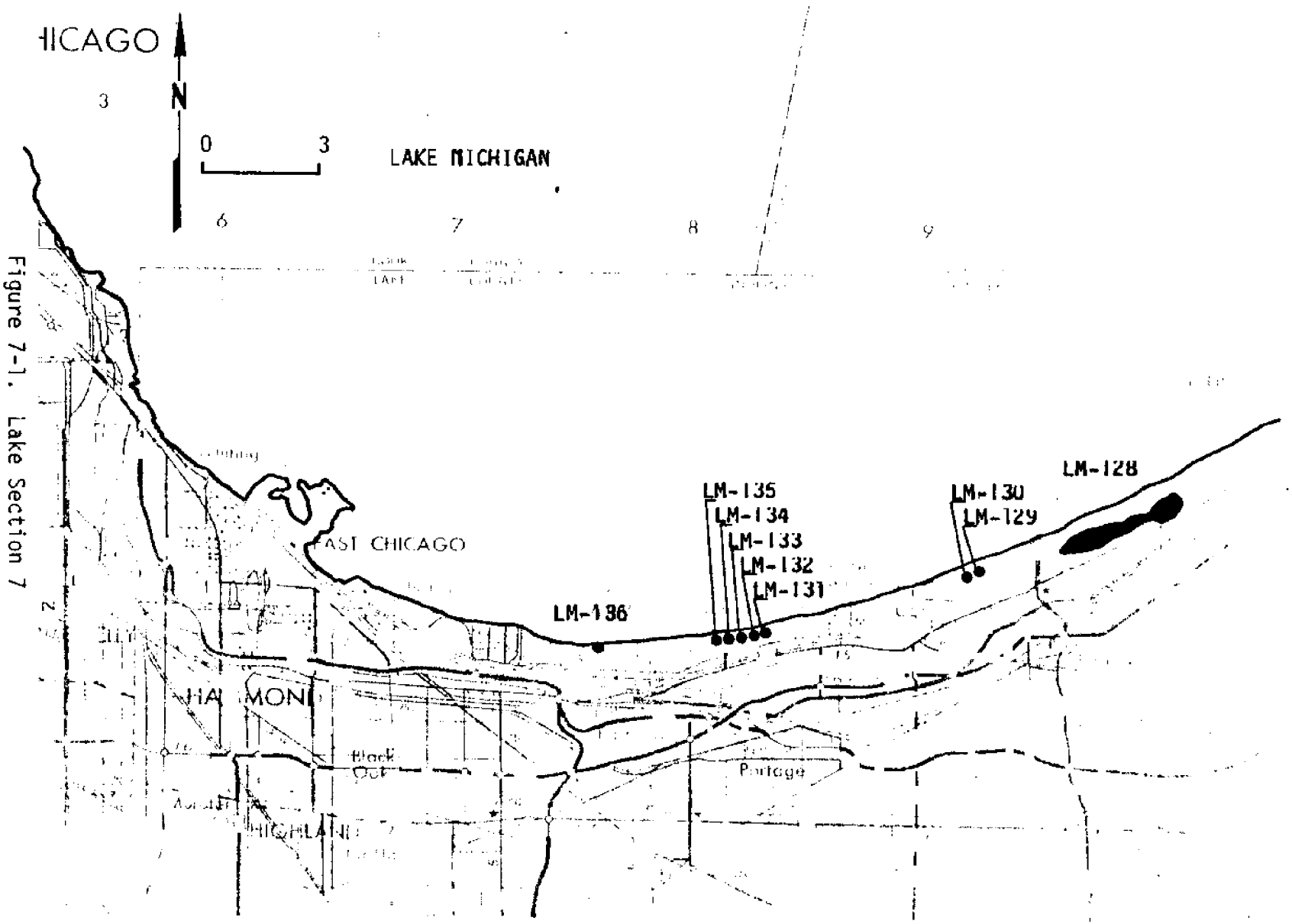

Figure 7-1. Lake Section 7

Table 7-1. Location, Acreage, and Classification of Wetlands in Lake Section 7

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
128	Indiana Dunes Wetland	41°37'30"	87°00'00"	404	P
	DUNE ACRES WETLAND COMPLEX				
129	Dune Acres Wetland #1	41°38'42"	87°06'30"	1	P
130	Dune Acres Wetland #2	40°38'39"	87°06'52"	4	P
	OGDEN DUNES WETLAND COMPLEX				
131	Ogden Dunes Wetland #1	41°37'36"	87°12'00"	2	P
132	Ogden Dunes Wetland #2	41°37'33"	87°12'13"	2	P
133	Ogden Dunes Wetland #3	41°37'30"	87°12'24"	4	P
134	Ogden Dunes Wetland #4	41°37'28"	87°12'39"	3	P
135	Ogden Dunes Wetland #5	41°37'24"	87°13'08"	8	P
136	Marquette Park Area Wetland	41°36'59"	87°16'45"	6	P

[a]P=palustrine
L=lacustrine
R=riverine

INDIANA DUNES WETLAND

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Setting

Indiana Dunes Wetland is located along the southern shore of Lake Michigan in Porter County, Indiana, 0.4 mile from the Lake Michigan shoreline and 4.0 miles from Michigan City, Indiana. The western portion of this wetland is situated within the Indiana Dunes State Park. A residential development named Beverly Shores lies to the north of the wetland.

Indiana Dunes Wetland is separated from Lake Michigan by a series of coastal beach ridges or dunes, and several blowouts are located along these ridgelines. The extreme eastern portion of the wetland has been partially filled and modified for residential development.

Indiana Dunes Wetland is a low, Palustrine System and includes both wooded and non-wooded areas. Several intermittent streams and a perennial stream are present within the wetland. Portions of the perennial stream have been channelized (U.S.G.S. quadrangle maps, Michigan City West, Indiana, 1969, and Dune Acres, Indiana, 1968).

Topography

The total relief of Indiana Dunes Wetland is less than 10 feet. Wetland elevations range from roughly 590 to 600 feet above sea level (10 to 20 feet above the approximate mean elevation of Lake Michigan). The wetland is located in the Calumet lacustrine Plain, an area of generally low relief occupying the bed of glacial Lake Chicago (Reshkin et al., 1975). The area is characterized by three shorelines of high sand dunes representing fluctuating stages of the glacial lake. The high dunes of the present shoreline range to 40 feet above the surrounding plain and occur in an east-west arc through the area.

Surficial Geology

The surficial geology of Indiana Dunes Wetland consists of silt, sand, and clay, as well as muck, peat, and marl. The silt, sand, and clay are the residue of former glacial lake areas and are generally less than 50 feet thick. The muck, peat, and marl were formed from lake and swamp deposits. These range in thickness from a few inches to 25 feet and are characterized by poorly drained, depressional areas (Hartke et al., 1975). Muck, peat, and marl are found in occasional deposits along the Indiana shore of Lake Michigan. Dune deposits of sand and silt are found in a narrow band along the Indiana shore of Lake Michigan. For additional information on these unconsolidated deposits see Hartke et al. (1975) and Reshkin et al. (1975).

Soils

The soil association for Indiana Dunes Wetland is Oakville-Plainfield-Adrian (Agricultural Experiment Station/Cooperative Extension Service, Purdue University, 1976). Oakville soils are deep, excessively drained, coarse-textured soils, which occupy sand dunes and beach ridges and were formed from coarse-textured glacial drift reworked by wind.

Plainfield soils are also deep, excessively drained, coarse-textured soils. These soils are nearly level to moderately sloping and occupy sand dunes and ridges on outwash plains and moraines. Plainfield soils were formed in strongly acid material derived from sandy glacial drift reworked by wind.

Adrian soils are poorly drained, organic soils that developed from sedge and grass remains. These soils are underlain by sandy material at a depth of less than 42 inches. Adrian soils are nearly level and are found on flats and in depressions.

Hydrology

There are five streams located in Indiana Dunes Wetland. Markowitz Ditch and two unnamed streams flow laterally through the eastern end of the wetland; an additional unnamed stream, which may be part of Dunes Creek during periods of high flow, runs through the northern portion of the wetland south of Beverly Shores. Dunes Creek is located in the western end of the wetland. The elevation of each of these streams is 600 feet with little gradient (U.S.G.S. quadrangle maps, Dune Acres, Indiana, 1968; Michigan City West, Indiana, 1969).

A water quality assessment of the Indiana Dunes National Lakeshore, which includes Indiana Dunes Wetland, is being conducted. (Arihood, 1975). This study analyzes the quality of the groundwater, surface water, and precipitation, as well as the geohydrology of the area. Numerous sampling sites are used for the water quality assessment.

Dunes Creek and its tributaries have water that is considered to be characteristic of a wetland drainage area containing wildlife. The water of the five streams in Indiana Dunes Wetland is colored and contains animal bacteria. Markowitz Ditch has a higher incidence of organic contamination than any of the other streams in the Indiana Dunes National Lakeshore. Chlordane, DDD, DDT, and dieldrin, as well as polychlorinated biphenyls, have been found in significant quantities in Markowitz Ditch, which also contains a higher amount of mineralized water than is usually associated with a wetland area (Arihood, 1975).

In a water sample taken in August, 1974, from Indiana Dunes Wetland, the water quality was found to be characteristic of water with high organic growth. The dissolved oxygen levels were also high, at 10.0 milligrams per liter (Arihood, 1975). Table 7-2 presents water quality information on Indiana Dunes Wetland.

Table 7-2. Hydrologic Data for Markowitz Ditch and Indiana Dunes Wetland[a]

Site	Date	Temperature (°C)	Dissolved Oxygen[b]	pH	Alkalinity[b]
Markowitz Ditch	10/17/73	13.0	--	6.5	--
	4/25/74	6.0	12.8	7.4	140.0
Indiana Dunes Wetland	10/17/73	11.0	1.8	6.4	--
	4/23/74	12.5	10.0	6.7	66.0

[a] Arihood (1975)
[b] milligrams per liter

Metallic ion measurements (e.g., iron, lead, and copper) were taken in a wetland area located in the Indiana Dunes State Park and are reported by National Parks Service (1977).. These measurements may be representative of the water quality conditions in Indiana Dunes Wetland.

The literature search yielded no site-specific data pertaining to water level influences, water depth, or seasonal changes in Indiana Dunes Wetland.

Climate

The closest weather station providing climatic data for Indiana Dunes Wetland is located in Ogden Dunes, Indiana. The average annual temperature was 51°F; the average daily low for January was 21.1°F and the average daily high in July was 85.0°F. The average annual precipitation is 40.20 inches, with a mean monthly precipitation of 3.80 inches in January and 2.59 inches in July based on the normal period from 1941-1970. The growing season is approximately five and a half months long, with the last killing frost (28°F) in 1975 occurring On May 7 and the first killing frost (28°F) on October 21 (National Oceanic and Atmospheric administration, 1975).

Special Features

Three dunes of exceptional height (750 feet above sea level or higher) lie to the northwest of the wetland (U.S.G.S. quadrangle maps, Michigan City West, Indiana, 1969; Dune Acres, Indiana, 1968).

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Vegetation

In terms of vegetational composition, the Indiana Dunes Wetland may be divided into western and eastern sections, using the state park boundary as an

approximate line of demarcation. Major species in the western portion of this wetland include, in descending order of abundance, reed grass (Phragmites communis), common cattail (Typha latifolia), touch-me-not (Impatiens biflora), hardhack (Spirea tomentosa), meadow sweet (Spirea alba), tall goldenrod (Solidago canadensis var. scabra), small white aster (Aster yimineus) and swamp rose (Rosa palustris). Other less abundant species occurring in the western portion of this wetland include willow (Salix spp.), quaking aspen (Populus tremuloides), buttonbush (Cephalanthus occidentalis), common elder (Sambucus canadensis), winterberry (Ilex verticillata), swamp loosestrife (Decodon verticillatus), red osier dogwood (Cornus stolonifera), gray dogwood (Cornus racemosa), swamp milkweed (Asclepias incarnata), nodding smartweed (Polygonum lapathifolium), arrowleaved tearthumb (Polygonum sagittatum), dark-green bulrush (Scirpus atrovirens), common arrowhead (Sagittaria latifolia), spotted joe-pye-weed (Eupatorium maculatum), American bur-reed (Sparganium americanum), dock (Rumex sp.) wool grass (Scirpus cyperinus), vervain (Verbena sp.), tickseed-sunflower (Bidens coronata), lesser duckweed (Lemna minor), and wild grape (Vitis sp.) (Krekeler, 1975).

For the eastern portion of this wetland, Krekeler (1975) does not provide any information on relative abundance, but includes a list of species occurring in the site, which follows:

Trees	quaking aspen Populus tremuloides bigtooth aspen Populus grandidentata cottonwood Populus deltoides willow Salix American elm Ulmus americana red maple Acer rubrum silver maple Acer saccharinum black cherry Prunus serotina white ash Fraxinus americana tuliptree Liriodendron tulipifera sassafras Sassafras albidum pincherry Prunus pensylvanica	Herbs	reed grass Phragmites communis virgin's-bower Clematis virginiana water-hemlock Cicuta maculata evening-primrose Oenothera biennis pokeweed Phytolacca americana moth mullein Verbascum blattaria purple loosestrife Lythrum salicaria sweet joe-pye-weed Eupatorium perfoliatum American bugle-weed Lycopus americanus tall nettle Urtica procera wild cucumber Echinocystis lobata slender mountain-mint Pycnanthemum flexuosum

Shrubs	common elder	Herbs	touch-me-not
	Sambucus canadensis		*Impatiens biflora*
	swamp rose		thistle
	Rosa palustris		*Cirsium* sp.
	meadow-sweet		goldenrod
	Spirea alba		*Solidago* sp.
	red-osier dogwood		horse-nettle
	Cornus stolonifera		*Solanum carolinense*

The literature search yielded no site-specific data concerning density, productivity, or relationship to water levels of the vegetation of the Indiana Dunes Wetland.

Fish

The ponds and wetlands in northwestern Indiana were discussed by Downing (1922), Texas Instruments Incorporated (1975, 1976, 1977), Carline (1977), and the northern Indiana Public Service Company (1977). These six studies are discussed in connection with the Dune Acres Wetlands Complex. The literature search provided no site-specific data pertaining to species composition, seasonal distribution and abundance, spawning and hatching areas, life histories, food sources, or recreational and commercial use of the fish populations in Indiana Dunes Wetland.

Invertebrates

General information applicable to Indiana Dunes Wetland may be found in Reshkin (1975). The mosquitoes in Appendix B-1 (Siverly, 1972) may occur in suitable habitat in the Indiana Dunes Wetland. However, the literature search produced no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in Indiana Dunes Wetland.

Reptiles and Amphibians

Documentation on the presence and abundance of species present in the immediate vicinity of Indiana Dunes Wetland is available in Schmidt and Necker (1935), Necker (1939), Minton (1972), and Reshkin et al. (1975). The first two references concern museum specimens collected prior to 1940; the third reference probably refers to these old records but includes new records as well. The fourth reference includes an educated opinion on the current abundance of all species recorded from the vicinity. The localities represented by the museum records are Beverly Shores, on the northern border of the wetland, and in Tremont, which is about 0.5 mile south.

Based on these references there may be 17 species of amphibians, all having wetland affinities, utilizing Indiana Dunes Wetland. There may be 21 species of reptiles in the vicinity, but only 13 species may be expected to frequent the

wetland on more than an incidental basis. Of 10 species of amphibians listed as common to abundant in Reshkin et al. (1975), all have small body size except the green frog (Rana clamitans, bullfrog (R. catesbeiana) and northern leopard frog (R. pipiens). There are six common to abundant reptiles, of which the midland painted turtle (Chrysemys picta marginata), northern water snake (Nerodia sipedon sipedon), Chicago garter snake (Thamnophis sirtalis semifasciata), eastern plains garter snake (T. r. radix), and eastern hognose snake (Heterodon platyrhinos) are relatively conspicuous. Species in danger of being extirpated locally include the spotted turtle (Clemmys guttata) and Blanding's turtle (Emydoidea blandingi). The bullfrog, leopard frog, snapping turtle (Chelydra serpentina), Blanding's turtle, and midland painted turtle have commercial value in some portions of their overall geographic ranges.

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the amphibians and reptiles inhabiting Indiana Dunes Wetland.

Avifauna

Two sources of information which may be regarded as highly relevant to bird populations in Indiana Dunes Wetland are Reshkin et al. (1975) and the Christmas Bird Counts published annually by Arbib. Reshkin et al. (1975) include a list of locally breeding avifauna, annotated by Dr. Russell E. Mumford so as to apply to the Indiana Dunes National Lakeshore. The list includes 114 species of breeding birds, plus 22 additional species which summer on the Indiana Dunes National Lakeshore property but lack breeding records there. Ninety species associate with wetlands for some sort of activity; 50 of these are passerine birds. Table 7-3 provides a selected list of 45 common breeding birds which associate with wetlands. From this list the key species typifying Indiana Dunes Wetland may be selected.

The key species are defined here as those species which are abundant, breeding in the wetland or locally, feeding in or over the wetland, and in sum spending much of their time at the wetland. These species include the piedbilled grebe (Podilymbus podiceps), green heron (Butorides striatus), mallard (Anas platyrhynchos), various rails, American coot (Fulica americana), downy woodpecker (Picoides pubescens), and red-winged blackbird (Agelaius phoeniceus). General summaries of the life histories of these species provided in Bull and Farrand (1977) may be used as a tentative guide to their activities.

Recent sources of data on the tentative presence and abundance of early winter avifauna include the annual Christmas Bird counts conducted in the Indiana Dunes National Lakeshore census area (Table 7-4). The 7.5-mile radius census area includes all of Indiana Dunes Wetland. However, the census area also includes several miles of Lake Michigan shoreline as well as the interior wetland, Pinhook Bog. Therefore, Table 7-4 probably represents the avifauna of the local region as opposed to the wetland exclusively. Birds of open water (e.g., common goldeneye (Bucephala clangula), and bufflehead (Bucephala albeola), and open lakeshore (e.g., herring gull, Larus argentatus, and Bonaparte's gull, L. philadelphia) are numerous. Mallards are numerous, but may not be using the wetland as a winter staging area. Red-winged black birds are also sporadically abundant and may rest in wetlands during migration.

Table 7-3. Common to Abundant Birds Associating with Wetlands and with Recent Breeding Records from the Indiana Dunes National Lakeshore[a]

pied-billed grebe	eastern phoebe
green heron	Traill's flycatcher
American bittern	tree swallow
mallard	bank swallow
blue-winged teal	rough-winged swallow
wood duck	purple martin
red-shouldered hawk	Carolina wren
marsh hawk	long-billed marsh wren
ring-necked pheasant	American robin
king rail	red-eyed vireo
Virginia rail	warbling vireo
sora	yellow warbler
common gallinule	ovenbird
American coot	yellowthroat
American woodcock	American redstart
black tern	bobolink
yellow-billed cuckoo	eastern meadowlark
screech owl	red-winged blackbird
belted kingfisher	savannah sparrow
red-headed woodpecker	Henslow's sparrow
downy woodpecker	swamp sparrow
eastern kingbird	
great crested flycatcher	

[a]Adapted from Reshkin et al. (1975)

Table 7-4. Christmas Bird Counts from the Indiana Dunes National Lakeshore Census Area[a]

	1976	1975	1974	1973	1972
common loon		1			
red-necked grebe			2		
horned grebe	1	2	3		
pied-billed grebe		1		3	
whistling swan				2	
Canada goose	80	32	82	37	
mallard	498	317	231	155	37
black duck	58	29	56	7	
gadwall	1	7			
pintail		1			
American wigeon		1		5	
wood duck		1			
redhead	5		2		
ring-necked duck		6	--b		
canvasback	2				
greaterscaup	12				
scaup sp.	100	12		1	30
lesser scaup	21				1
common goldeneye	374	35	65	27	300
bufflehead	330	117	123	88	50
oldsquaw		6	1		
white-winged scoter	2	26	3		
ruddy duck	1				
hooded merganser	5				1
common merganser	28	86	13	1	15
red-breasterd merganser	14	10	86	2	
Cooper's hawk		1	1		
red-shouldered hawk	1	1	1		
bald eagle	--b				
eagle, sp.			1		
marsh hawk		1	9	1	
Virginia rail	2	1			
American coot	10	15			
killdeer	1	5	2	2	
American woodcock		1			
common snipe	3	1	2		
great black-backed gull			1		
herring gull	275	608	320	140	1500
ring-billed gull	38	340	197	49	700
Bonaparte's gull		5			
little gull		--b			
great horned owl	3	3	1	1	1
barred owl	4	1	2		
long-eared owl			1		
belted kingfisher	5	6	2	4	

(Continued)

Table 7-4. (Concluded)

	1976	1975	1974	1973	1972
winter wren	1		2		
starling	812	619	770	450	55
yellow-headed blackbird	2		3	1	
red-winged blackbird	21	4	860	3000	1
Brewer's blackbird	1				
cardinal	205	270	180	215	167
purple finch	37	48	19	64	28
white-throated sparrow	21	7	3		
swamp sparrow	8	26	5	5	

[a]Arbib (1973, 1974, 1975, 1976, 1977)
[b]Observed in area during the count week, but not seen on the count day

General information pertaining to waterfowl breeding, migration, and harvest is included in Appendix D-16. Care should be taken in the interpretation of the relevance of these studies to Indiana Dunes Wetland.

The literature search yielded no site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Indiana Dunes Wetland.

Mammals

Studies of the general area provide information which may apply to Indiana Dunes Wetland. Lyon (1923) conducted a mammal survey of the Indiana Dunes region and recorded the relative abundance of 14 mammalian species (Table 7-5). The present relative abundance has been determined for 23 mammalian species of the Indiana Dunes National Lakeshore (Krekeler, 1975) and may apply to Indiana Dunes Wetland (Appendix E-3). The species from this list which have commercial value are the beaver (Castor canadensis), muskrat (Ondatra zibethicus), red fox (Vulpes vulpes), raccoon (Procyon lotor), mink (Mustela vison) and striped skunk (Mephitis mephitis). However, hunting and trapping is restricted since a large portion of this wetland lies within the boundaries of Indiana Dunes State Park.

The literature search provided no site-specific information pertaining to species composition, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, major food sources, or relationship to water levels of the mammals inhabiting Indiana Dunes Wetland.

Endangered Species

No endangered or threatened plants and animals were found through the literature search to occur in Indiana Dunes Wetland (U.S. Fish and Wildlife Service, 1977; Indiana Department of Natural Resources, undated). There are, however, several species of endangered or threatened birds and mammals historically or currently present in the vicinity of the wetland.

The peregrine falcon (Falco peregrinus), present on the federal endangered list, is not included in Eifrig's (1919) list of birds of the dunes region. It is currently, and may always have been, rare in the area. The bald eagle (Haliaeetus leucocephalus), which is endangered in Indiana (U.S. Fish and Wildlife Service, 1978), nested regularly in the vicinity of the Indiana Dunes up to about 1900 and then ceased (Eifrig, 1919).

The river otter (Lutra canadensis) and the bobcat (Lynx rufus), both endangered species in Indiana, were once common in the Indiana wetlands region (Brennan, 1923), but neither species has been recorded there since the middle to late 1800's (Brennan, 1923; Lyon, 1936). The Indiana myotis (Myotis sodalis), an endangered species, on the federal list, was recorded by Reshkin et al. (1975) as being rare in the Indiana Dunes National Lakeshore. It is unlikely that Indiana Dunes Wetland provides suitable habitat for this species.

Table 7-5. Relative Abundance of Wetland Mammal Species of the Indiana Dunes Region[a]

Common name	Relative abundance
Virginia oppossum	P
short-tailed shrew	U
red bat	P
eastern cottontail	C
woodchuck	C
red squirrel	C
deer mouse	U
white-footed mouse	C
muskrat	P
red fox	U
raccoon	U
long-tailed weasel	C
mink	C
striped skunk	C

[a]Lyon (1923)
[b]C=common, U=uncommon, P=present, relative abundance was not determined

The Indiana Department of Natural Resources has not designated any native amphibians or reptiles as endangered or threatened. It is considering the following amphibians and reptiles for possible state endangered status: spotted turtle (Clemmys guttata), smooth green snake (Opheodrys vernalis), and eastern massasauga (Sisturus c. catenatus). These species have been collected in the vicinity of Indiana Dunes Wetland.

Health

The available information is not sufficient to allow an evalutation of the environmental quality of this wetland. However, fly ash ponds in the vicinity of the wetland probably have some effect on its health.

CULTURAL SETTING

LM 128

Population

Indiana Dunes Wetland is situated adjacent to the Village of Beverly Shores in Pine and Westchester Townships of Porter County. The county is moderately urban, with a population density of 205 persons per square mile. Table 7-6 indicates that Porter County and the Village of Beverly Shores experienced rapid increases in population between 1970 and 1975. Pine Township declined slightly in population, while Westchester Township experienced a small population increase during the same time period. Population projections for 1990 indicate that rapid population growth is expected to continue in Porter County.

Table 7-6. Population Data for the Vicinity of Indiana Dunes Wetland

	Estimated Population 1975[a]	Estimated % Δ 1970-1975[a]	Projected 1990 Population[b]
Porter County	93,327	10.6	130,450
Westchester Township	14,017	2.7	--
Pine Township	3,016	-2.6	--
Village of Beverly Shores	1,050	11.0	--

[a] U.S. Bureau of Census (1977)
[b] Northwestern Indiana Regional Planning Commission (1976)

Land Use and Ownership

The primary land use in Indiana Dunes Wetland is rural open space, although the extreme eastern portion of the wetland is in residential development. Several access roads lie within and around the wetland, and primary highways and rail lines are also close by. The surrounding area is characterized by rural open space uses interspersed with areas of low density residential development,

represented by the communities of Porter, Tremont, and Beverly Shores (U.S.G.S. quadrangle maps, Michigan City West, Indiana, 1968; Dune Acres, Indiana, 1968). The wetland area is planned to retain its primarily open space character (Northwestern Indiana Regional Planning Commission, 1976).

The western portion of Indiana Dunes Wetland lies within the Indiana Dunes State Park and is under state ownership. That portion of the wetland east of the state park boundary is within the Indiana Dunes National Lakeshore and is primarily under federal ownership with enclaves of private inholdings (U.S. Department of the Interior, National Park Service, 1977).

Since most of the wetland is under either state or federal protective ownership, developmental pressure is minimal. Pressures do, however, exist on the private inholdings within the wetland, and the removal of the requirement of zoning compatibility to lakeshore management through the 1976 amendments to the Lakeshore Act has served to increase these pressures. However, pending legislation would allow accelerated purchase of private inholdings, after which current uses would be phased out. The wetland would then be allowed to return to its natural state (Office of the National Lakeshore, personal communication).

Recreation

Recreational opportunities in the vicinity of the wetland are provided by the Indiana Dunes State Park, into which the western portion of the wetland extends, and the Indiana Dunes National Lakeshore, in which the bulk of the eastern portion of the wetland lies. Recreational activities in the Indiana Dunes State Park include hiking, camping, swimming, and picnicking (Indiana Dunes State Park Office, personal communication). When fully operational, the Indiana Dunes National Lakeshore will offer facilities for both active and passive recreational activities (Northwestern Indiana Regional Planning Commission, 1976). The presence of private inholdings in this portion of the National Lakeshore has hindered the development of recreational facilities. While the entire beach east to Michigan City is public, it is relatively little used for swimming owing to access problems caused by limited parking. A short hiking trail runs through the area and is used for interpretive programs as well as by individual hikers (Office of the National Lakeshore, personal communication).

Mineral, Energy, and Forest Resources

The sand deposits within Indiana Dunes Wetland are too shallow and scattered to make their extraction economically viable. The area between the wetland and Lake Michigan, however, contains deposits between 10 and 50 feet thick, with scattered deposits greater than 50 feet in thickness (Bieber and Smith, 1952). These deposits typically contain 95% sand and 5% gravel (Rooney and Ault, undated).

The major portion of the wetland is forested and extensive forested areas surround the wetland area (U.S.G.S. quadrangle maps, Michigan City West, Indiana, 1969; Dune Acres, Indiana, 1968). The location of these areas within the Indiana Dunes State Park and the Indiana Dunes National Lakeshore, however, precludes their commercial exploitation. There are no known oil, gas, or coal deposits present within Indiana Dunes Wetland (Spencer, 1953; Carpenter and Keller, 1977).

Public Utilities and Facilities

Power lines are located south of Indiana Dunes Wetland (U.S.G.S. quadrangle maps: Michigan City West, Indiana, 1969; and Dune Acres, Indiana, 1968).

Pollution Sources

There are five fly ash settling ponds located at the Bailly Power Plant near Dune Acres (Northwestern Indiana Regional Planning Commission, 1977). It has been estimated that one million gallons of water daily infiltrates the ground through these ash ponds. The U.S. Geological Survey indicates that the water is possibly moving in an eastward direction (U.S. Department of the Interior, National Parks Service, 1977). This polluted water is seeping into the Indiana Dunes National Lakeshore (Louisville Courier-Journal, 1978). It is not certain, however, that the polluted water is affecting Indiana Dunes Wetland.

Historical and Archaeological Features

An historical marker for La Petite Forte is located within the Indiana Dunes State Park. The fort was a French military compound built around 1750 and abandoned in 1780 (Cattman, 1930).

No known archaeological sites exist in the vicinity of Indiana Dunes Wetland. However, the area has not been systematically surveyed by a professional archaeologist (U.S. Department of the Interior, National Park Service, 1977).

RESEARCH PROJECTS LM 128

An evaluation of water quality problems in the Indiana Dunes National Lakeshore is being conducted by the U.S. Geological Survey, Water Resources Division, Indiana District. Indiana Dunes Wetland is situated within the National Lakeshore area. The objectives of this study are to assess the extent of seepage from fly ash ponds into the Indiana Dunes and to investigate the effects on lakeshore water levels associated with dewatering for construction of a proposed power plant. This investigation will analyze water samples to determine the movement of pollutants from the industrialized area northwest of the Indiana Dunes. The hydrogeologic characteristics of the area are also under study (U.S. Geological Survey, 1978).

DUNE ACRES WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 129-130

Setting

Dune Acres Wetland Complex, comprised of Dune Acres Wetlands #1 and #2, is located along the southern shore of Lake Michigan in Porter County, Indiana. The two wetlands are situated very close to one another in a low depression which is surrounded by sand dunes. Both of the wetlands are approximately 0.2 mile from the Lake Michigan shoreline, six miles east-northeast of Gary, Indiana. Cowles Bog, a National Natural Landmark, is located one mile to the east of the wetlands. Dune Acres Wetlands #1 and #2 are low, wooded, and Palustrine Systems (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968).

The area in which Dune Acres Wetlands #1 and #2 are located is being considered by the National Park Service for inclusion in the Indiana Dunes National Lakeshore. The shoreline in the vicinity of the wetlands features coastal beach ridges. The wetlands are situated in the interdunal area, between the foredunal and backdunal complexes. Four blowouts are located along the coastal ridgeline in the area. Beach development is seen on the east side of breakwalls located offshore of the wetlands, indicating that the littoral current is moving westward (U.S. Department of the Interior, National Park Service, 1977).

Dune Acres Wetlands #1 and #2 are in a buffer zone which separates the heavily industrialized area to the west from the relatively undeveloped area to the east. Bethlehem Steel Mill and the Northern Indiana Public Service Company's Bailly Power Plant are located to the west of the wetlands (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968).

Topography

Dune Acres Wetlands #1 and #2 have a relief of less than 10 feet, and the elevation of both wetlands is approximately 610 feet above sea level (30 feet above the approximate mean elevation of Lake Michigan). The wetlands are located in the Calumet lacustrine Plain, an area of generally low relief that occupies the bed of glacial Lake Chicago (Reshkin et al., 1975). The area is characterized by three shorelines of high sand dunes representing fluctuating stages of the glacial lake. The high dunes of the present shoreline range to 40 feet above the surrounding plain and occur in an east-west arc through the area.

Surficial Geology

The surficial geology of Dune Acres Wetlands #1 and #2 consists of muck, peat, and marl formed in lake and swamp deposits. The deposits are thin, ranging from a few inches to 25 feet, and are characterized by poorly drained

depressional areas (Hartke et al., 1975). Muck, peat, and marl are found in occasional deposits along the Indiana shore of Lake Michigan. For additional information on the unconsolidated deposits of this area see Hartke et al. (1975) and Reshkin et al. (1975).

Soils

The soil association for Dune Acres Wetlands #1 and #2 is Oakville-Plainfield-Adrian (Agricultural Experiment Station/Cooperative Extension Service, Purdue University, 1976). Oakville soils are deep, excessively drained, coarse-textured soils. These soils occupy sand dunes and beach ridges and were formed from coarse-textured glacial drift reworked by wind.

Plainfield soils are also deep, excessively drained, and coarse-textured. These soils are nearly level to moderately sloping and generally occupy sand dunes and ridges on outwash plains and moraines. Plainfield soils were formed in strongly acid material derived from sandy glacial drift that has been reworked by wind.

Adrian soils are poorly drained, organic soils that developed from sedge and grass remains. These soils are underlain by sandy material at a depth of less than 42 inches. Adrian soils are nearly level and are found on flats and in depressions.

Hydrology

There are no streams flowing through Dune Acres Wetlands #1 and #2 (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968). However, a water quality assessment of the Indiana Dunes National Lakeshore has been done which includes Dune Acres Wetlands #1 and #2 (Arihood, 1975). This study analyzes the ground, surface, and rain waters, as well as the geohydrology of the area. Numerous sampling sites were used for the water quality assessment.

The movement of water from fly ash ponds owned by Northern Indiana Public Service Company has been investigated. The water level difference between the ash ponds and wetlands to the north of the ash ponds (not in the study area) is sufficient to cause continual water movement below the surface. Water has been observed flowing northward from the interdunal wetlands below Dune Acres Wetlands #1 and #2. The degree of water movement and seepage from the fly ash ponds is not known and is still under investigation. However, the water quality of the wetlands directly above the ash ponds and that of the ash ponds is identical. It is not known whether Dune Acres Wetlands #1 and #2 are also affected by this northward water movement, but they are located less than 300 feet away from the contaminated area. Water quality data and additional information is available in Arihood (1975). In addition, metallic ion measurements (e.g., iron, lead, and copper) were taken in a wetland area located in the Indiana Dunes State Park (U.S. Department of the Interior, National Parks Service, 1977). These measurements may be representative of the water quality conditions that exist in Dune Acres Wetlands #1 and #2.

The literature search yielded no site-specific data pertaining to water level influences, depth, and seasonal changes in Dune Acres Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for Dune Acres Wetlands #1 and #2 is located in Ogden Dunes. In 1975, the average monthly temperature was 51.1°F; the average daily low for January was 21.1°F and the average daily high in July was 85.0°F. The average annual precipitation is 40.20 inches, with a mean monthly precipitation of 3.80 inches in January and 2.59 inches in July based on the normal period from 1941-1970. The growing season is approximately five and a half months long, with the last killing frost (28°F) in 1975 occurring on may 7 and the first killing frost on october 21 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Dune Acres Wetlands #1 and #2 (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968).

BIOTIC SETTING LM 129-130

Vegetation

Krekeler (1975) provides information on major species composition and distribution of vegetation in nearby wetland areas. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels for the vegetation of Dune Acres Wetlands #1 and #2.

Fish

If fish communities are present in Dune Acres Wetlands #1 and #2, their characteristics may be similar to those in three nearby intradunal wetland ponds adjacent to the Bailly Generating Plant (Northern Indiana Public Service Company). Fish species composition of the three ponds near the Bailly Plant consisted of central mudminnow (Umbra limi), spottail shiner (Notropis hudsonius), goldenshiner (Notemigonus crysoleucas), bluegill (Lepomis macrochirus), green sunfish (Lepomis cyanellus), black bullhead (Ictalurus melas), and yellow perch (Perca flavescens) (Texas Instruments Incorporated, 1975, 1976, 1977; Carline, 1977; Northern Indiana Public Service Company, 1977). These three ponds were wooded wetlands without open water prior to 1966, and the origin of the fishes in them since their flooding by seepage from adjacent fly-ash ponds has been attributed both to human introduction and immigration during intermittent inundation of old drainage ditches to nearby streams (Carline, 1977). Presence of young-of-the-year of all species except the yellow perch has indicated successful reproduction in the ponds (Carline, 1977). Although winterkill of fishes in such shallow, heavily vegetated northern ponds is common, owing to dissolved oxygen depletion under the ice, winterkill in these three ponds was evidently minimal, because of a high dissolved oxygen content of the ground water (Carline, 1977). The ponds are apparently not used for recreational fishing (Carline, 1977).

Observations by Downing (1922) regarding fish communities in small intradunal wetland ponds in the Lake Michigan drainage of Indiana are of a very general nature but may apply to Dune Acres Wetlands #1 and #2. Such ponds provide habitat and spawning areas for northern pike (Esox lucius), central mudminnow, redhorse (Moxostoma spp.), lake chubsucker (Erimyzon sucetta), minnow (Notropis sp.), emerald shiner (Notropis atherinoides), river shiner (Notropis blennius), bluntnose minnow (Pimephales notatus), goldenshiner, brown bullhead (Ictalurus nebulosus), black bullhead, tadpole madtom (Noturus gyrinus), bluegill, pumpkinseed (Lepomis gibbosus), largemouth bass, crappie (Pomoxis spp.) yellow perch, johnny darter (Etheostoma nigrum), and sculpin (Cottus sp.). Most of these fishes enter from Lake Michigan through surface water connections, which are often transitory, and spawn on the sandy bottoms or vegetated margins of the ponds (Downing, 1922).

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Dune Acres Wetland Complex.

Invertebrates

Shelford (1912) and Park (1930) provide general and historical information for the southeastern shoreline of Lake Michigan. Information on the Indiana Dunes (Reshkin, 1975) may be applicable to the wetlands in the Dune Acres complex due to the proximity of the areas. The mosquitoes in Appendix B-1 (Siverly, 1972) may occur in suitable habitat in the Dune Acres Complex. However, the literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Dune Acres Wetlands #1 and #2.

Reptiles and Amphibians

Documentation on the presence of reptile and amphibian species in the immediate vicinity of Dune Acres Wetlands #1 and #2 is available in Schmidt and Necker (1935), Necker (1939), and Minton (1972). The first two references concern museum records but includes new records as well. The locality represented by the older museum records is Dune Acres, a residential development about a mile east of Dune Acres Wetlands #1 and #2. Dune Acres borders on a large wetland area which is not included in this study. In evaluating the museum records, one must recognize that many of the species may have been collected in this large wetland rather than in Dune Acres Wetlands #1 and #2.

There are 13 species of amphibians and 16 species of reptiles listed from the vicinity of Dune Acres. All of the amphibians and ten of the reptiles have wetland affinities. Locally documented species with commercial value in some portions of their geographic ranges include the northern leopard frog (Rana pipiens), eastern box turtle (Terrapene c. carolina), Blanding's turtle (Emydoidea blandingi), and midland painted turtle (Chrysemys picta marginata). The Chicago garter snake (Thamnophis sirtalis semifasciata) is a unique subspecies of local distribution.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the amphibians and reptiles inhabiting Dune Acres Wetlands #1 and #2.

Avifauna

Inasmuch as Dune Acres Wetlands #1 and #2 are located within the Indiana Dunes National Lakeshore, the bird list in Reshkin et al. (1975) applies to these wetlands in a general sense. However, because the wetlands are very small relative to the overall wetland acreage of the Indiana Dunes National Lakeshore, the bird list should be viewed with caution.

Several critical land areas adjacent to the Indiana Dunes National Lakeshore have been studied in detail (U.S. Department of the Interior, National Park Service, 1977). The documentation of Area II-A, which contains wetlands and occurs within a few hundred feet of Dune Acres Wetlands #1 and #2, includes a brief treatment of birds. Common birds include mallard (Anas platyrhynchos), greater scaup (Aytha marila), bufflehead (Bucephala albeola), common merganser (Mergus merganser), American coot (Fulica americana), long-billed marsh wren (Cistothorus palustris), and red-winged blackbird (Agelaius phoeniceus). The mallard is known to breed locally; the other waterfowl are seasonal migrants. The long-billed marsh wren and red-winged blackbird probably breed locally (Reshkin et al., 1975).

General information on waterfowl breeding, migration, and harvest is included in Appendix D-16. Care should be exercised in the interpretation of the relevance of these studies to Dune Acres Wetland Complex.

The literature search yielded no site-specific data pertaining to presence, seasonal abundance, density and productivity, recreation and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Dune Acres Wetlands #1 and #2.

Mammals

Several general studies provide information which may apply to Dune Acres Wetlands #1 and #2. Texas Instruments (1975, 1976, 1977) has been monitoring similar interdunal areas just south of Dunes Acres Wetland Complex for several years and has recorded the presence of 15 mammalian species which also may be found in the two wetlands of the complex (Table 7-7). The relative abundance has been determined for 23 mammalian species of the Indiana Dunes National Lakeshore (Krekeler, 1975) and this information also may apply to the two wetlands of Dune Acres Wetland Complex (Appendix E-3).

The literature search yielded no site-specific information pertaining to species composition, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, major food sources, or relationship to water levels for the mammals inhabiting the two wetlands comprising Dune Acres Wetland Complex.

Table 7-7. Key and Major Wetland Mammal Species Present on the Bailly Nuclear-1 Study Site near Dune Acres Wetland Complex[a]

Common name	1974	1975	1976
Virginia oppossum	x	x	x
masked shrew			x
short-tailed shrew	x	x	x
eastern cottontail	x	x	x
woodchuck	x	x	x
red squirrel	x	x	x
white-footed mouse	x	x	x
meadow vole	x	x	x
muskrat	x	x	x
meadow jumping mouse	x	x	x
red fox	x	x	x
raccoon	x	x	x
mink	x		x
striped skunk	x		
white-tailed deer			

[a]Texas Instruments (1975, 1976, 1977)

Endangered Species

No endangered or threatened plants and animals were found through the literature search to occur in Dune Acres Wetlands #1 and #2 (U.S. Fish and Wildlife Service, 1977; Indiana Department of Natural Resources, undated). There are, however, several species of endangered or threatened birds and mammals historically or currently present in the vicinity of the wetland.

The peregrine falcon (Falco peregrinus), present on the federal endangered list, is not included in Eifrig's (1919) list of birds of the dunes region. It is currently, and may always have been, rare in the area. The bald eagle (Haliaeetus leucocephalus), which is endangered in Indiana (U.S. Fish and Wildlife Service, 1978), nested regularly in the vicinity of the Indiana Dunes up to about 1900 and then ceased (Eifrig, 1919).

The river otter (Lutra canadensis) and the bobcat (Lynx rufus), both endangered species in Indiana, were common in the Indiana Dunes region (Brennan, 1923), but neither species has been recorded there since the middle to late 1800's (Brennan, 1923; Lyon, 1936). The Indiana myotis (Myotis sodalis), an endangered species, on the federal list, was recorded by Reshkin et al. (1975) as being rare in the Indiana Dunes National Lakeshore. It is unlikely that Dune Acres Wetlands #1 and #2 provides suitable habitat for this species.

The Indiana Department of Natural Resources has not designated any native amphibians or reptiles as endangered or threatened. It is considering the following amphibians and reptiles for possible state endangered status: spotted turtle (Clemmys guttata), smooth green snake (Opheodrys vernalis), and eastern massasauga (Sisturus c. catenatus). These species have been collected in the vicinity of Dune Acres Wetlands #1 and #2.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, fly ash ponds in the vicinity of the wetland probably have some effect on its health.

CULTURAL SETTING

LM 129-130

Population

Dune Acres Wetlands #1 and #2 are located in Westchester Township of Porter County. The county is moderately urban, with a population density of 205 persons per square mile. Table 7-8 indicates that Porter County grew rapidly between 1970 and 1975, while Westchester Township experienced only a small increase in population. Population projections for 1990 indicate that rapid population growth is expected to continue in Porter County.

Table 7-8. Population Data for the Vicinity of the Dune Acres Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Porter County	96,237	10.6	130,450
Westchester Township	14,017	2.7	--

[a] U.S. Bureau of Census (1977)
[b] Northwestern Indiana Regional Planning Commission (1976)

Land Use and Ownership

Land use within Dune Acres Wetlands #1 and #2 is rural open space (Northwestern Indiana Regional Planning Commission, 1976). Areas of intensive industrial development characterize the land to the west and south of the wetlands, while land use to the east is a mixture of rural open space and low density residential development, represented by the community of Dune Acres. An ash disposal field, ash settling ponds, electrical substation, transmission lines, and a dike are located near Dune Acres Wetlands #1 and #2. Breakwalls lie offshore of these wetlands (Northwestern Indiana Regional Planning Commission, 1976; U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968).

Dune Acres Wetlands #1 and #2 are under federal ownership and, as part of the Indiana Dunes National Lakeshore, are under National Park Service management (Northwestern Indiana Regional Planning Commission, 1976). Threats to the wetlands from actual development of the wetland area are therefore minimal. The ongoing concern for the wetlands within the National Lakeshore is over the effects of activities carried on by neighboring land owners (Dr. William Hendrickson, Office of the National Lakeshore, personal communication).

Recreation

Dune Acres Wetlands #1 and #2 are located within the Indiana Dunes National Lakeshore. When fully operational, this urban national park will offer facilities for both active and passive recreational activities (Northwestern Indiana Regional Planning Commission, 1976). A trail system is situated in close proximity to the wetlands, and one of the trails passes through Dune Acres Wetland #1 and #2. Access to the trail system may be improved with the addition of new areas to the National Lakeshore, thereby allowing the establishment of a trailhead (U.S. Department of the Interior, National Park Service, 1977).

Mineral, Energy, and Forest Resources

Sand deposits in the vicinity of Dune Acres Wetlands #1 and #2 are more than 50 feet thick over the major part of the area not in moraines (Bieber and Smith, 1952). These deposits typically contain 95% sand and 5% gravel (Rooney and Ault, undated).

Dune Acres Wetlands #1 and #2 are forested, and extensive forested areas lie to the east of the wetlands (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968). Although the wood is of commercial value, the location of the forested area within the National Lakeshore precludes its commercial exploitation.

There are no known oil, gas, or coal deposits present within Dune Acres Wetlands #1 and #2 (Spencer, 1953; Carpenter and Keller, 1977).

Public Utilities and Facilities

The Bailly Power Plant substation is located west of Dune Acres Wetlands #1 and #2. The plant is owned by Northern Indiana Public Service Company and burns chiefly coal, as well as Number 2 fuel oil. The Bailly plant is rated at 650 megawatts and obtains its condensing water from Lake Michigan. Transmission lines from the substation run to the south and west of the wetlands (U.S.G.S. quadrangle map, Dune Acres, Indiana, 1968; U.S. Department of the Interior, National Park Service, 1977; Federal Energy Administration, 1977; Federal Power Commission, 1974).

Pollution Sources

There are five fly ash settling ponds located at the Bailly Power Plant near Dune Acres Wetlands #1 and #2 (Northwestern Indiana Regional Planning Commission, 1977). It has been estimated that one million gallons of water daily infiltrate the ground through these ash ponds. The U.S. Geological Survey indicates that the water is possibly moving in an eastward direction (U.S. Department of the Interior, National Parks Service, 1977). This polluted water is seeping into the Indiana Dunes National Lakeshore (Louisville Courier-Journal, 1978). It is not certain, however, that the polluted water is affecting Dune Acres Wetlands #1 and #2.

Bethlehem Steel holds several NPDES permits for deep wells near Dune Acres Wetlands #1 and #2 (Northwestern Indiana Regional Planning Commission, 1977). There is no documentation, however, that outmigration from the well shaft or receiving bedrock is occurring.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Dune Acres Wetlands #1 and #2, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (U.S. Department of the Interior, National Park Service, 1977).

An evaluation of water quality problems is being conducted in the Indiana Dunes National Lakeshore by the U.S. Geological Survey, Water Resources Division, Indiana District. Dune Acres Wetlands #1 and #2 are situated within this National Lakeshore area. The objectives of the study are to assess the extent of seepage from fly ash ponds into the Indiana Dunes and to investigate the effects on lakeshore water levels associated with dewatering for construction of a proposed power plant. This investigation will analyze water samples to determine the movement of pollutants from the industrialized area northwest of Indiana Dunes. The hydrogeologic characteristics of the area are also under study (U.S. Geological Survey, 1978).

OGDEN DUNES WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 131-135

Setting

Ogden Dunes Wetland Complex, comprised of Ogden Dunes Wetlands #1-#5, is situated along the southern shore of Lake Michigan, in Porter County, Indiana. These wetlands are included in a single complex because they are located close to one another in an area of coastal beach dunes. All of these wetlands lie approximately 0.2 mile from the Lake Michigan shoreline and less than one mile east of Gary, Indiana.

The shoreline in the vicinity of the wetlands features coastal beach ridges. Ogden Dunes Wetlands #1-#5 are located in interdunal depressions between the foredunal and backdunal complexes; Ogden Dunes Wetland #3 lies within a blowout along this coastal ridgeline. A large wetland area lies 0.75 mile inland from the wetland complex, and there is urban and suburban development to the west and east. All of the wetlands in this complex are low, non-wooded, and palustrine (U.S.G.S. quadrangle map, Portage, Indiana, 1968).

Topography

Ogden Dunes Wetlands #1-#5 have slight relief. Ogden Dunes wetlands #1-#3 are less than 590 feet above sea level 10 feet above the approximate mean lake elevation level, while Ogden Dunes Wetlands #4 and #5 lie above the 590-foot contour line. The wetland complex is located in the Calumet Lacustrine Plain, an area of generally low relief occupying the bed of glacial Lake Chicago (Reshkin et al., 1975). The area is characterized by three shorelines of high sand dunes representing fluctuating stages of the glacial lake. The high dunes of the present shoreline range to 40 feet above the surrounding plain and occur in an east-west arc through the area.

Surficial Geology

The surficial geology of Ogden Dunes Wetlands #1-#5 consists of sand and some fine silt deposited by wind, mainly in dune form (Hartke et al., 1975). Dune deposits of sand and silt are found in a narrow band along the Indiana shore of Lake Michigan. For additional information on the unconsolidated deposits of this area see Hartke et al. (1975) and Reshkin et al. (1975).

Soils

The soil association for Ogden Dunes Wetlands #1-#5 is Oakville-Plainfield-Adrian (Agricultural Experiment Station/Cooperative Extension Service, Purdue University, 1976). Oakville soils are deep, excessively drained, and coarse-textured. These soils occupy sand dunes and beach ridges and were formed from coarse-textured glacial drift reworked by wind.

Plainfield soils are also deep, excessively drained, and coarse-textured. These nearly level to moderately sloping soils occupy sand dunes and ridges on outwash plains and moraines. Plainfield soils were formed in strongly acid material derived from sandy glacial drift reworked by wind.

Adrian soils are poorly drained, organic soils that developed from sedge and grass remains. They are underlain by sandy material at a depth of less than 42 inches. Adrian soils are nearly level and are found on flats and in depressions.

Hydrology

There are no streams flowing through any of the wetlands in Ogden Dunes Wetland Complex (U.S.G.S. quadrangle map, Portage, Indiana, 1968). However, a water quality assessment of the Indiana Dunes National Lakeshore is being conducted which includes Ogden Dunes Wetlands #1-#5 (Arihood, 1975). This study analyzes the quality of the groundwater, surface water, and rain waters, as well as the geohydrology of the area. Numerous sampling sites are used for this water quality assessment.

Five interdunal ponds have been studied (Arihood, 1975) which correspond to the locations of Ogden Dunes Wetlands #1 and #5. These wetland areas are similar in water quality to Lake Michigan, which may indicate lake influence. The pH of these interdunal, wet areas ranges from 7.4 to 8.3, which is common for surface water. Dissolved oxygen levels range from just below to just above the saturation point (Arihood, 1975). Water quality data for Ogden Dunes Wetlands #1-#5 are presented in Table 7-9 and additional information is available in Arihood (1975).

The literature search provided no site-specific data pertaining to water level influences, water depth, or seasonal changes in Ogden Dunes Wetlands #1-#5.

Climate

The closest weather station providing climatic data for Ogden Dunes Wetland Complex is located in Ogden Dunes, Indiana. In 1975, the average monthly temperature was 51.1^{o}F; the average daily low for January was 21.1^{o}F and the average daily high in July was 85.0^{o}F. The average annual precipitation is 40.20 inches, with a mean monthly precipitation of 3.80 inches in January and 2.59 inches in July based on the normal period from 1941-1970. The growing season is approximately five and a half months long, with the last killing frost (28^{o}F) in 1975 occurring on May 7 and the first killing frost on October 21 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Ogden Dunes Wetland Complex (U.S.G.S. quadrangle map, Portage, Indiana, 1968).

Table 7-9. Water Quality Data for Ogden Dunes Wetlands #1-#5[a]

Wetland	Date	Temperature (°C)	Dissolved Oxygen	pH	Alkalinity ($CaCO_3$) (mg/l)	Organic Nitrogen (mg/l)	Phosphorous (mg/l)
Ogden Dunes Wetland #1	10/18/73	14.0	11.3	7.4	--	--	--
	4/25/74	10.5	13.5	8.1	--	--	--
Ogden Dunes Wetland #2	10/18/73	14.5	12.5	7.6	133	--	--
	1/24/74	--	--	--	--	.10	.00
	4/25/74	11.0	12.3	8.1	--	--	--
Ogden Dunes Wetland #3	7/31/73	23.0	8.8	8.0	--	--	--
Ogden Dunes Wetland #4	7/31/73	23.0	9.5	--	--	--	--
Ogden Dunes Wetland #5	10/18/73	14.5	11.4	7.3	--	--	--
	1/24/74	6.5	10.2	--	--	.28	.00
	4/25/74	23.0	18.3	7.7	211	--	--

[a]Arihood (1975)

Vegetation

Major species composing the vegetation of the margin of Ogden Dunes Wetland #1 include, in descending order of abundance, heart-leaved willow (Salix cordata), Kalm's St. John's-wort (Hypericum kalmianum), Kalm's lobelia (Lobelia kalmii), rose-pink (Sabatia angularis), upland white aster (Aster ptarmicoides), and lance-leaved coreopsis (Coreopsis lanceolata). Major species composing the emergent vegetation of Ogden Dunes Wetland #1 include, in descending order of abundance, needle spikerush (Eleocharis acicularis), hair-like beakrush (Rhynchospora capillacea), short-tailed rush (Juncus brevicaudatus), horned bladderwort (Utricularis cornuta), greenish sedge (Carex viridula), willow (Salix sp.) baltic rush (Juncus balticus var. littoralis), common cattail (Typha latifolia), and soft-stem bulrush (Scirpus validus). Vascular aquatic species comprising the vegetation of the open water of Ogden Dunes Wetland #1 are limited only to variable pondweed (Potamogeton gramineus). The stonewort Chara contraria is the only non-vascular planktonic species occurring in the open water of Ogden Dunes Wetland #1 include diatoms, filamentous green algae, unicellular desmids and colonial blue-green algae (Krekeler, 1975).

Major species composing the vegetation of the margin of Ogden Dunes Wetland #2 include, in descending order of abundance, horned bladderwort (Utriclaris cornuta), Kalm's St. John's-wort, Kalm's lobelia, rose-pink, upland white aster, and bog twayblade (Liparis loeselii). Major species composing the emergent vegetation of Ogden Dunes Wetland #2 include, in descending order of abundance, hair-like beakrush, baltic rush, willow, needle spikerush, short-tailed rush, greenish sedge, and common cattail. Vascular aquatic species comprising the vegetation of the open water of Ogden Dunes Wetland #2 include floating-leaved pondweed (Potamogeton natans), large-leaved pondweed (Potamogeton amplifolius), variable pondweed, naiad (Najas flexilis), and other pondweeds, all being of nearly equal abundance. Non-vascular planktonic forms present in the open water habitat include diatoms, unicellular green algae (Ankistrodesmus), filamentous green algae, unicellular desmids, and dinoflagellates (Krekeler, 1975).

Major species composing the emergent vegetation of Ogden Dunes Wetland #3 include, in descending order of abundance, short-tailed rush, needle spikerush, soft-stem bulrush, baltic rush, and common cattail. Vascular aquatic species comprising the vegetation of the open water of Ogden Dunes Wetland #3 include variable pondweed and other pondweeds. Non-vascular aquatic macrophytes present in the open water habitat include the stoneworts Chara contraria and C. keukensis, the former being most abundant. Non-vascular planktonic forms occurring in this wetland include diatoms (Navicula, Amphora), filamentous green algae (Spirogyra, Zygnema), colonial blue-green algae (Ankistrodesmus), and unicellular desmids (Staurastrum) (Krekeler, 1975).

Major species composing the emergent vegetation of Ogden Dunes Wetland #4 include baltic rush, short-tailed rush, hair-like beak rush, greenish sedge, willow, and needle spikerush. Also occurring in this vegetation zone and of

lesser abundance is arrow-grass (Triglochin maritima). Non-vascular aquatic macrophytes present in the open water habitat include the stoneworts Chara contraria and C. keukensis, the former being only slightly more abundant than the latter. Diatoms are the most abundant non-vascular planktonic forms present in the open water of Ogden Dunes Wetland #4. Other non-vascular planktonic forms occurring there include filamentous green algae, unicellular desmids, unicellular green algae (Ankistrodesmus), colonial blue-green algae, and dinoflagellates (Krekeler, 1975).

Major species composing the vegetation of the margin of Ogden Dunes Wetland #5 include, in descending order of abundance, Kalm's lobelia, Kalm's St. John's-wort, strawberry (Fragaria virginiana), rose-pink, daisy fleabane (Erigeron annuus), centaury (Centaurium pulchellum), evening-primrose (Oenothera biennis), American bugle-weed (Lycopus americanus), silverweed (Potentilla anserina), swamp milkweed (Asclepias incarnata), purple-leaved willow-herb (Epilobium coloratum), whorled milkweed (Asclepias incarnata), and monkey-flower (Mimulus ringens). Major species composing the emergent vegetation of Ogden Dunes Wetland #5 include, in descending order of abundance, willow, common cattail, and baltic rush. Emergent species of lesser abundance include, in descending order of abundance, short-tailed rush, hard-stem bulrush (Scirpus acutus), sword-grass (Scirpus americanus), needle spikerush, hair-like beakrush, arrow-grass, slender bulrush (Scirpus heterochaetus), and twig rush (Cladium mariscoides). Vascular aquatic species comprising the vegetation of the open water of Ogden Dunes Wetland #5 include thin-leaved pondweed (Potamogeton alpinus var. tenuifolius), horned pondweed (Zannichellia palustris), lesser duckweed (Lemna minor), horned bladderwort, and pondweed (Potamogeton sp.). Non-vascular aquatic macrophytes present in the open water habitat include the stoneworts Chara contraria and C. keukensis, the former being abundant in this wetland. Non-vascular planktonic species present in the open water of Ogden Dunes Wetland #5 include diatoms (Navicula, Amphora), unicellular desmids (Cosmarium, Staurastrum) colonial blue-green algae (Merismopedia), colonial green algae (Actinastrum), and filamentous desmids (Krekeler, 1975).

The literature search provided no site-specific data pertaining to density, productivity, or relationship to water levels of the vegetation in the five wetlands of the complex.

Fish

If fish communities are present in these wetlands, they are probably similar to the fish populations of other intradunal ponds and wetlands in northwestern Indiana as discussed by Downing (1922), Texas Instruments Incorporated (1975, 1976, 1977), Northern Indiana Public Service Company (1977), and Carline (1977). These six studies are discussed in connection with the Dune Acres Wetland Complex. However, the literature search provided no site-specific information pertaining to species composition, seasonal distribution and abundance, spawning and hatching areas, life histories, food sources, or recreational and commercial use of the fish populations in Ogden Dunes Wetlands #1-#5.

Invertebrates

Shelford (1912) and Park (1930) provide general and historical information for the southeastern shoreline of Lake Michigan. Information on the Indiana Dunes (Reshkin, 1975) may be applicable to the wetlands in the Ogden Dunes Complex owing to the proximity of the areas. The mosquitoes in Appendix B-1 (Siverly, 1972) may occur in suitable habitat in the Ogden Dunes Wetland Complex. However, the literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, major food sources, or relationship to water levels of the invertebrates present in the Ogden Dunes Wetland Complex.

Reptiles and Amphibians

Documentation on the presence of reptile and amphibian species in the immediate vicinity of these wetlands is available in Schmidt and Necker (1935), Necker (1939), and Minton (1972). The first two references concern museum specimens collected prior to 1940; the third reference probably refers to these old records but includes new records as well. The locality represented by the older museum records is Ogden Dunes, a residential development bordering Ogden Dunes Wetland #5. Ogden Dunes also borders on a large wetland area which is not included in this study. In evaluating the museum records, one must recognize that many of the species may have been collected from the large wetland as opposed to Ogden Dunes Wetlands #1-#5.

There are four species of amphibians and seven species of reptiles from the vicinity of Ogden Dunes. All of the amphibians and four of the reptiles have wetland affinities. Locally documented species with commercial value in some portions of their geographic ranges include the bullfrog (Rana catesbeiana), northern leopard frog (R. pipiens), Blanding's turtle (Emydoidea blandingi), and midland painted turtle (Chrysemys picta marginata).

The literature search yielded no site-specific information pertaining to the presence, seasonal distribution and abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the amphibians and retiles inhabiting Ogden Dunes Wetlands #1-#5.

Avifauna

Information on avian species is available only for Ogden Dunes Wetland #1. The avifauna of this wetland include blue-winged teal (Anas discors), semi-palmated plover (Calidris pusillus), piping plover (Charadrius melodus), killdeer (C. vociferus) and starling (Sturnus vulgaris) (Kenneth J. Brock, personal communication).

Brock (unpublished) studied the fall migration at the West Beach unit of the Indiana Dunes National Lakeshore (Table 7-10). His study area included Ogden Dunes Wetlands #1-#5 and a large wetland, not included in the study, which extends from 0.5 mile south of Ogden Dunes Wetland #1 for 2.5 miles, west-southwest. The data reflect observations on this interior wetland most heavily and should be viewed with caution in evaluating the avifauna of Ogden Dunes Wetlands #1-#5.

Table 7-10. 1977 Fall Migration at the West Beach Unit of the Indiana Dunes National Lakeshore[a]

Species	Peak numbers of individuals observed	Date(s) when peak numbers were observed	General peak period(s)	Number of dates observed
common loon	25	24 Oct., 11 Nov.	late Oct.-mid Nov.	13
horned grebe	5	24 Oct.	mid Oct.-late Nov.	5
pied-billed grebe	36	5 Sept.	late Aug.-early Sept.	35
great blue heron	6	30 Aug.	late Aug.	7
green heron	2	30 Aug.	late Aug.-early Sept.	8
whistling swan	1	23 Nov.		1
Canada goose	22	9 Nov.	mid. Aug. & mid. Nov.	4
snow goose	25	11 Nov.	mid. Nov.	2
mallard	150	2 Sept.	late Aug.-early Sept. and early Nov.	37
black duck	13	11 Nov.	early Nov.	13
gadwall	18	21 Nov.	late Nov.	11
pintail	7	12 Sept., 24 Sept.	early Nov.	16
green-winged teal	30	14 Oct., 31 Oct.	mid Oct.-late Nov.	30
blue-winged teal	150	2 Sept.	mid Sept.-mid Oct.	18
wigeon	14	16 Sept.	mid Sept.	16
shoveler	3	16 Sept.	mid Sept.	6
wood duck	21	5 Sept.	late Aug.-early Sept.	18
redhead	43	11 Nov.	early Nov.	12
ring-necked duck	18	5 Nov.	early Nov.	15
canvasback	2	5 Nov.	early Nov.	5
greater scaup	6	12 Nov.	mid Nov.	3
lesser scaup	435	11 Nov.	mid Nov.	11
common goldeneye	6	14 Nov.	late Nov.	3
bufflehead	23	11 Nov.	mid Nov.	12
black scoter	5	11 Nov.	mid Nov.	3
ruddy duck	3	10 Oct.	mid Nov.	8
hooded merganser	17	14 Nov.	mid Nov.	3
common merganser	185	11 Nov.	mid Nov.	3
red-breasted merganser	16	24 Nov.		1
American coot	580	5 Nov.	mid Sept.-mid Nov.	33

(Continued)

Table 7-10. (Continued)

Species	Peak numbers of individuals observed	Date(s) when peak numbers were observed	General peak period(s)	Number of dates observed[b]
marsh hawk	1	24 Oct., 11 Nov.		2
sora	1	25 Aug.		1
herring gull	37	28 Nov.	late Nov.	30
ring-billed gull	78	12 Nov.	none	35
Franklin's gull	24	11 Nov.		1
Bonaparte's gull	23	12 Nov.	mid Nov.	13
Forster's tern	1	23 Aug.		1
common tern	8	5 Sept.	early Sept.	6
Caspian tern	4	11 Aug.	mid Aug.-mid Sept.	10
kingfisher	2	5 Sept.	late Aug.-late Sept.	12
downy woodpecker	1		none	8
semipalmated plover	4	25 Aug.	late Sept.	5
piping plover	1	30 Aug.		1
killdeer	8	30 Aug.	late Aug.-mid Sept.	22
black-bellied plover	2	5 Nov.	none	5
turnstone	4	5 Sept.	early Sept.	3
woodcock	1	18 Aug.		1
common snipe	1	23, 25 Aug.		2
spotted sandpiper	2	11 Aug.	early Sept.	7
solitary sandpiper	1		late Aug.	7
greater yellowlegs	3	23 Aug.		2
lesser yellowlegs	11	30 Aug.	late Aug.	5
Baird's sandpiper	1	5 Sept.		1
dunlin	9	14 Sept.		2
semipalmated sandpiper	4	2 Sept.	late Aug.-early Sept.	5
sanderling	40	11 Aug.	Aug.-early Sept.	24
Wilson's phalarope	1	23 Aug.		1
eastern kingbird	1	11 Aug.		1
short-billed marsh wren	1	21 Sept., 3 Oct.		2
yellowthroat	1	19 Sept.	late Sept.	6

(Continued)

Table 7-10. (Concluded)

	Peak numbers of individuals observed	Date(s) when peak numbers were observed	General peak period(s)	Number of dates observed[b]
red-winged blackbird	450	14 Oct.	late Oct.	20
swamp sparrow	17	14 Oct.	late Sept.-early Oct.	14

[a]Brock (unpublished)
[b]Observations were conducted on 37 dates commencing on August 11 and terminating on November 28

Appendix D-16 contains additional information on wetland birds. General studies on Lake Section 7 related to breeding, migration, and harvest of waterfowl are included. Care should be exercised in the interpretation of the relevance of these studies to Ogden Dunes Wetlands #1-#5.

The literature search yielded no site-specific information pertaining to seasonal abundance and distribution, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Ogden Dunes Wetlands #1-#5.

Mammals

General information discussed for Dune Acres Wetland Complex may apply to the five wetlands of Ogden Dunes Wetland Complex because of the similarity and proximity of the two complexes. The relative abundance has been determined for 23 mammalian species of the Indiana Dunes National Lakeshore (Appendix E-3) and this information also may apply to the five wetlands of Ogden Dunes Wetland Complex. However, the literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Ogden Dunes Wetlands #1-#5.

Endangered Species

No endangered or threatened plants and animals were found through the literature search to occur in Ogden Dunes Wetlands #1-#5 (U.S. Fish and Wildlife Service, 1977; Indiana Department of Natural Resources, undated. There are, however, several species of endangered or threatened birds and mammals historically or currently present in the vicinity of the wetland.

The peregrine falcon (Falco peregrinus), present on the federal endangered list, is not included in Eifrig's (1919) list of birds of the dunes region. It is currently, and may always have been, rare in the area. The bald eagle (Haliaeetus leucocephalus), which is endangered in Indiana (U.S. Fish and Wildlife Service, 1978), nested regularly in the vicinity of the Indiana Dunes up to about 1900 and then ceased (Eifrig, 1919).

The river otter (Lutra canadensis) and the bobcat (Lynx rufus), both endangered species in Indiana were once common in the Indiana Dunes region (Brennan, 1923), but neither species has been recorded there since the middle to late 1800's (Brennan, 1923; Lyon, 1936). The Indiana myotis (Myotis sodalis), an endangered species on the federal list, was recorded by Reshkin et al. (1975) as being rare in the Indiana Dunes National Lakeshore. It is unlikely that Ogden Dunes Wetlands #1-#5 provide suitable habitat for this species.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

Population

Ogden Dunes Wetlands #1-#5 are located in Portage Township of Porter County, Indiana. The county is moderately urban, with a population density of 205 persons per square mile. Table 7-11 indicates that both Porter County and Portage Township experienced a rapid increase in population between 1970 and 1975. Projections for 1990 indicate that rapid population growth is expected to continue in Porter County.

Table 7-11. Population Data for the Vicinity of Ogden Dunes Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Porter County	96,327	10.6	130,450
Portage Township	34,028	19.9	--

[a] U.S. Bureau of Census (1977)
[b] Northwestern Indiana Regional Planning Commission (1976)

Land Use and Ownership

Land use within Ogden Dunes Wetland Complex is primarily open space. Ogden Dunes Wetlands #1 and #5 are semi-urban open space, while Ogden Dunes Wetlands #2-#4 are rural open space. A sand pit, a filtration plant, a rail line, and a primary highway lie to the south of these wetlands (U.S.G.S. quadrangle map, Portage, Indiana, 1968). All of the wetlands in the complex are owned by the National Park Service (Northwestern Indiana Regional Planning Commission, 1976).

Residential development characterizes much of the area surrounding Ogden Dunes Wetlands #1-#5. The city of Gary is located immediately to the west of the wetlands, and Ogden Dunes is situated immediately to the east. The area to the south of the wetland complex is primarily in rural open space uses (U.S.G.S. quadrangle map, Portage, Indiana, 1968; Northwestern Indiana Regional Planning Commission, 1976).

Developmental pressures for Ogden Dunes Wetlands #1-#5 have been mitigated by the protective ownership and management of the wetlands by the National Park Service. The ongoing concern for the wetlands within the National Lakeshore is over the effects of activities carried on by neighboring land owners (Dr. William Hendrickson, Office of the National Lakeshore, personal communication).

Recreation

Ogden Dunes Wetlands #1-#5 are located within the Indiana Dunes National Lakeshore. When fully operational, this urban national park will offer facilities for both active and passive recreational activities (Northwestern Indiana Regional Planning Commission, 1976). The portion of the National Lakeshore between Gary and Ogden Dunes, known as the West Beach area, has facilities for swimming, picnicking, and hiking. Portions of the hiking trails pass through the wetlands. The area is heavily used by the public during holidays and the summer months (Office of the National Lakeshore, personal communication).

Mineral, Energy, and Forest Resources

Sand deposits in the vicinity of Ogden Dunes Wetlands #1-#5 range between 10 and 50 feet in thickness over much of the area (Bieber and Smith, 1952). Although the wetlands themselves have not been used for sand production, the area immediately inland of the wetlands has been sand mined in the past (Office of the National Lakeshore, personal communication).

There are no forest resources within any of the wetlands in this complex. However, forested areas do exist to the south of the wetlands (U.S.G.S. quadrangle map, Portage, Indiana, 1968). There are no known oil, gas, or coal deposits present within Ogden Dunes Wetlands #1-#5 (Spencer, 1953; Carpenter and Keller, 1977).

Public Utilities and Facilities

No public utilities are located within 0.5 mile of Ogden Dunes Wetlands #1-#5 (U.S.G.S. quadrangle map, Portage, Indiana, 1968).

Pollution Sources

There are no NPDES permit holders discharging in the vicinity of Ogden Dunes Wetlands #1-#5 (Indiana State Board of Health, Water Pollution Control Division, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Ogden Dunes Wetland #1-#5, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (U.S. Department of the Interior, National Park Service, 1977).

RESEARCH PROJECTS LM 131-135

An evaluation of water quality problems is being conducted in the Indiana Dunes National Lakeshore by the U.S. Geological Survey, Water Resources Division, Indiana District. Ogden Dunes Wetlands #1-#5 are situated within this National Lakeshore area. The objectives of the study are to assess the extent

of seepage from fly ash ponds into the Indiana Dunes and to investigate the effects on lakeshore water levels associated with dewatering for construction of a proposed power plant. This investigation will analyze water samples to determine the movement of pollutants from the industrialized area northwest of the Indiana Dunes. The hydrogeologic characteristics of the area are also under study (U.S. Geological Survey, 1978).

PHYSIOGRAPHIC SETTING LM 136

Setting

Marquette Park Area Wetland is located on the south shore of Lake Michigan in Lake County, Indiana, 0.2 mile from the Lake Michigan shoreline and less than one mile north of Miller, a suburb of Gary, Indiana. The shoreline in this area features coastal beach ridges; Marquette Park Area Wetland is located in the interdunal area, between the foredunal and backdunal complexes. A blowout in the coastal ridgeline lies to the east of the wetland, within Marquette Park. Areas of open water lie to the south of the wetland and Gary Harbor lies to the west. Marquette Park Area Wetland is a low, non-wooded, Palustrine wetland (U.S.G.S. quadrangle map, Gary, Indiana, 1968).

Topography

Marquette Park Area Wetland has a relief of less than 10 feet. The elevation of the wetland is 590 feet above sea level (10 feet above the approximate mean elevation of Lake Michigan). The wetland is located in the Calumet lacustrine plain, an area of generally low relief occupying the bed of glacial Lake Chicago (Reshkin et al., 1975). The area is characterized by three shorelines of high sand dunes representing fluctuating stages of the glacial lake. The high dunes of the present shoreline range to 40 feet above the surrounding plain and occur in an east-west arc through the area.

Surficial Geology

The surficial geology of Marquette Park Area Wetland consists of sand and some fine silt deposited by wind, mainly in dune form (Hartke et al., 1975). Dune deposits of sand and silt are found in a narrow band along the Indiana shore of Lake Michigan. For additional information on the unconsolidated deposits of this area see Hartke et al. (1975) and Reshkin et al. (1975).

Soils

The soil association for Marquette Park Area Wetland is Oakville-Tawas. This association consists of steep to nearly level and depressional, excessively drained and very poorly drained soils that are formed in coarse-textured and organic materials. The association is characterized by narrow, elongated, parallel ridges separated by sloughs. Oakville soils are on the ridges and are excessively drained. They have a black, coarse-textured surface layer about two inches thick. Tawas soils are in depressions between the ridges and are very poorly drained. Their surface layer is black friable muck about 30 inches thick (Persinger, 1972).

Hydrology

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Marquette Park Area Wetland. There are no streams flowing through the wetland.

Climate

The closest weather station providing climatic data for Marquette Park Area Wetland is located in Ogden Dunes, Indiana. In 1975, the average monthly temperature was 51.1°F; the average daily low for January was 21.1°F and the average daily high in July was 85.0°F. The average annual precipitation is 40.20 inches, with a mean monthly precipitation of 3.80 inches in January and 2.59 inches in July based on the normal period from 1941-1970. The growing season is approximately five and a half months long, with the last killing frost (28°F) in 1975 occurring on May 7 and the first killing frost on October 21 (National Oceanic and Atmospheric Administration, 1975).

Special Features

The original channel of the Grand Calumet River lies to the south of Marquette Pack Area Wetland. The wetland has been altered by dredging activity (U.S.G.S. quadrangle map, Gary, Indiana, 1968).

BIOTIC SETTING LM 136

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of vegetation in the Marquette Park Area Wetland.

Fish

A search of the literature provided no site-specific information pertaining to species composition, seasonal distribution and abundance, spawning and hatching areas, life histories, recreational and commercial use or food sources of the fish populations in Marquette Park Area Wetland.

Invertebrates

Shelford (1912) and Park (1930) provide general and historical information for the southeastern shoreline of Lake Michigan. Information on the Indiana Dunes (Reshkin, 1975) may be applicable to Marquette Park Area Wetland owing to the proximity of the areas. The mosquitoes in Appendix B-1 (Siverly, 1972) may occur in suitable habitat in Marquette Park Area Wetland. However, the literature search provided no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in the Marquette Park Area Wetland.

Reptiles and Amphibians

Documentation on the presence of reptile or amphibian species in the vicinity of this wetland is available in Schmidt and Necker (1935), Necker (1939), Pope (1944), Stille and Edgren (1948), Smith (1949), and Minton (1972). The first five references concern museum specimens collected prior to 1950 (most prior to 1940). The localities specified in the museum records are Miller, Miller Lagoon, and Gary. Miller is a residential area 1.5 miles southeast of Marquette Park Area Wetland. Miller Lagoon lies adjacent to the wetland and may support wetland vegetation, while Gary (few specimen records) lies southwest of the wetland. The probability of many species being collected in Marquette Park Area Wetland, as opposed to Miller Lagoon and marshy areas between the lagoon and Miller, is low.

There are eight species of amphibians and 14 species of reptiles recorded from the immediate vicinity of Marquette Park Area Wetland. All of the amphibians and eight of the reptiles have wetland affinities. Locally documented species with commercial value in some portions of their geographic ranges include central newt (Notophthalmus viridescens louisianensis), bullfrog (Rana catesbeiana), northern leopard frog (R. pipiens), snapping turtle (Chelydra serpentina), red-eared turtle (Pseudemys scripta), and midland painted turtle (Chrysemys picta marginata). The Chicago garter snake (Thamnophis sirtalis semifasciata) is a unique species of local distribution.

The literature search yielded no site-specific information pertaining to the presence, seasonal distribution and abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the amphibians and reptiles inhabiting Marquette Park Area Wetland.

Avifauna

Numerous old records of avian species at Miller and Long Lake are given by Eifrig (1919). Miller and Long Lake are situated about 1.5 miles and 500 feet, respectively, from Marquette Park Area Wetland. The woods and water, mentioned by Eifrig, are still associated with these areas (U.S.G.S. quadrangle map, Gary, Indiana, 1968).

Eifrig's bird list indicates 65 species at Miller and Long Lake. Common species with wetland affinities which also feed locally were the pied-billed grebe (Podilymbus podiceps), least bittern (Ixobrychus exilis), mallard (Anas platyrhynchos), black duck (A. rubripes), blue-winged teal (A. discors), American wigeon (A. americana), red-shouldered hawk (Buteo lineatus), marsh hawk (Circus cyaneus), common gallinule (Gallinula chloropus), American coot (Fulica americana), great horned owl (Bubo virginianus), eastern kingbird (T. tyrannus), great crested flycatcher (Myiarchus crinitus), bank swallow (R. riparia), and long-billed marsh wren (Cistothorus palustris). The decline of the piping plover (Charadrius melodus) as a locally breeding species was noted at that time. Common migrants and winter residents were greater scaup (Aythya marila), common goldeneye (Bucephala clangula), oldsquaw (Clangula hyemalis), common merganser (Mergus merganser), red-breasted merganser (M. serrator), rough-legged hawk (Buteo lagopus) and herring gull (Larus argentatus). These

data, published in 1919, should be applied to the current situation with caution. However, recent references pertaining to more easterly-located Indiana wetlands (e.g., Reshkin et al., 1975; Brock, 1977, unpublished; Arbib, 1975) indicate that all species are still present and most are still common in Lake Section 7 as a whole.

Appendix D-16 contains additional information on wetland birds. General studies on Lake Section 7 related to the breeding, migration, and hunter harvest of waterfowl are included. Care should be exercised in the interpretation of the relevance of these studies to Marquette Park Area Wetland.

The literature search yielded no site-specific information pertaining to presence, seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Marquette Park Area Wetland.

Mammals

Information regarding the mammals of the Indiana Dunes National Lakeshore (Appendix E-3) may apply to Marquette Park Area Wetland, but the mammalian fauna of this wetland probably has been influenced by the surrounding urbanization.

The literature search yielded no site-specific information pertaining to species composition, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, major food sources, or relationship to water levels of the mammals inhabiting Marquette Park Area Wetland.

Endangered Species

No endangered or threatened plants and animals were found through the literature search to occur in Marquette Park Area Wetland (U.S. Fish and Wildlife Service, 1977; Indiana Department of Natural Resources, undated). There are, however, several species of endangered or threatened birds and mammals historically or currently present in the vicinity of the wetland.

The peregrine falcon (Falco peregrinus), present on the federal endangered list, is not included in Eifrig's (1919) list of birds of the dunes region. It is currently, and may always have been, rare in the area. The bald eagle (Haliaeetus leucocephalus), which is endangered in Indiana (U.S. Fish and Wildlife Service, 1978), nested regularly in the vicinity of the Indiana Dunes up to about 1900 and then ceased (Eifrig, 1919).

The river otter (Lutra canadensis) and the bobcat (Lynx rufus), both endangered species in Indiana, were once common in the Indiana Dunes region (Brennan, 1923), but neither species has been recorded there since the middle to late 1800's (Brennan, 1923; Lyon, 1936). The Indiana myotis (Myotis sodalis), an endangered species, on the federal list, was recorded by Reshkin et al. (1975) as being rare in the Indiana Dunes National Lakeshore. It is unlikely that Marquette Park Area Wetland provides suitable habitat for this species.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING

LM 136

Population

Marquette Park Area Wetland is located on the west side of the city of Gary in Calumet Township of Lake County. The county is urban with a population density of 1,065 persons per square mile. Table 7-12 indicates that Lake County maintained a fairly stable population growth rate between 1970 and 1975, but Calumet Township and the city of Gary experienced a rapid decline in population during the same time period. Projections for 1990 indicate that Lake County is expected to experience a slow rate of population growth in the future.

Table 7-12. Population Data for the Vicinity of Marquette Park Area Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Lake County	546,757	0.1	609,836
Calumet Township	195,341	-9.5	--
City of Gary	167,546	-11.1	--

[a] U.S. Bureau of Census (1977)
[b] Northwestern Indiana Regional Planning Commission (1976)

Land Use and Ownership

Land use within Marquette Park Area Wetland is urban open space, and dredging activity has taken place. The surrounding area is characterized by industrial and residential development. The wetland is under private ownership (Northwestern Indiana Regional Planning Commission, 1976; U.S.G.S. quadrangle map, Gary, Indiana, 1968). The wetland lies within an area planned as an industrial park (Northwestern Indiana Regional Planning Commission, 1976). Developmental pressures are both severe and imminent.

Recreation

The Marquette Park Area Wetland is located immediately outside the western boundary of the city of Gary municipal Marquette Park. Recreational activities

within this park include swimming, fishing, picnicking, softball, and tennis. The park also has a boat ramp facility (City of Gary Park Department, personal communication).

Mineral, Energy, and Forest Resources

The wetland area is underlain by deposits of sand that, over a major part of the area, are more than 50 feet thick (Bieber and Smith, 1952). These deposits typically contain 95% sand and 5% gravel (Rooney and Ault, undated). Although the wetland area is underlain by limestone and dolomite deposits of significant size, the deposits are covered by unconsolidated materials of sufficient thickness to render their exploitation economically unfeasible (Rooney and Ault, undated).

There are no forest resources within the wetland itself. However, a large forested area exists to the south of the wetland (U.S.G.S. quadrangle map, Gary, Indiana, 1968). There are no known oil, gas, or coal deposits present within Marquette Park Area Wetland (Spencer, 1953; Carpenter and Keller, 1977).

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Marquette Park Area Wetland (U.S.G.S. quadrangle map, Gary, Indiana, 1968).

Pollution Sources

There are no NPDES permit holders discharging in the vicinity of Marquette Park Area Wetland (Indiana State Board of Health, Water Pollution Control Division, 1978). The literature search provided no site-specific data pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Marquette Park Area Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Indiana Historical Bureau, personal communication).

RESEARCH PROJECTS LM 136

The literature search identified no ongoing-or impending research projects pertaining to Marquette Park Area Wetland.

Table 7-13. Data Gaps - Lake Section 7

Data Gap*		Wetland Number	128	129-130	131-135	136
Physiographic Setting		Setting				
		Topography				
		Surficial Geology				
		Soils				
	Hydrology	Water Level Fluctuations				*
		Groundwater				*
		Water Quality	*	*	*	*
		Depth	*	*	*	*
		Seasonal Changes	*	*	*	*
		Climate				
		Special Features				
Biotic Setting	Vegetation	Major Species Distribution		*		
		Major Species Composition	*	*	*	*
		Density/Productivity	*	*	*	*
		Relationship to Water Levels	*	*	*	*
	Fish	Major species		*	*	*
		Species Composition	*	*	*	*
		Seasonal Distribution	*	*	*	*
		Spawning and Hatching Areas	*	*	*	*
		Commercial/Recreational Use	*	*	*	*
		Life Histories	*	*	*	*
		Food Sources	*	*	*	*
	Invertebrates	Species Composition	*	*	*	*
		Seasonal Distribution	*	*	*	*
		Density/Productivity	*	*	*	*
		Food Sources	*	*	*	*
		Relationship to Water Levels	*	*	*	*
	Amphibians/Reptiles	Major Species	*	*	*	*
		Seasonal Distribution	*	*	*	*
		Density/Productivity	*	*	*	*
		Recreational/Commercial Use	*	*	*	*
		Life Histories	*	*	*	*
		Food Sources	*	*	*	*
		Relationship to Water Levels	*	*	*	*
	Avifauna	Major Species	*	*	*	*
		Seasonal Distribution	*	*	*	*
		Density/Productivity	*	*	*	*
		Recreational/Commercial Use	*	*	*	*
		Life Histories	*	*	*	*
		Food Sources	*	*	*	*
		Relationship to Water Levels	*	*	*	*
	Mammals	Major Species	*	*	*	*
		Seasonal Distribution	*	*	*	*
		Density/Productivity	*	*	*	*
		Recreational/Commercial Use	*	*	*	*
		Life Histories	*	*	*	*
		Food Sources	*	*	*	*
		Relationship to Water Levels	*	*	*	*
		Endangered Species				
		Health	*	*	*	*
Cultural Setting		Population				
		Land Use and Ownership				
		Recreation				
		Mineral, Energy, Forest Resource				
		Public Utilities/Facilities				
		Point Pollution Sources				
		Non-Point Pollution Sources	*	*	*	*
		Historic Features				
		Archaeologic Features				

LAKE SECTION 8

INTRODUCTION

Lake Section 8 extends along the shore of Lake Michigan from East Chicago, Indiana, to just north of the Illinois-Wisconsin border. The Chicago metropolitan area comprises a major portion of this lake section. Residential, commercial, and industrial development are prevalent.

Lake Section 8 is part of the Lake Border Moraine, an area of low, undulating ridges of ground moraine (Fenneman, 1938). Predominant land types along this 55-mile stretch of shoreline include artificial fill, erodible high bluff, and erodible low plain (Great Lakes Basin Commission, 1975).

Figures 8-1 and 8-2 show the approximate location of the 38 wetlands in Lake Section 8. All but two of these wetlands are situated in the Lake Calumet region and are associated with lake-level water bodies such as Lake George Canal, Little Calumet River, Calumet River, and Lake Calumet. The remaining two wetlands are situated within or adjacent to Illinois Beach State Park near the cities of Waukegan and Zion, Illinois.

Table 8-1 presents the latitude and longitude, acreage, and classification for each of the wetlands in Lake Section 8. Elevations of these wetlands range from 585 to 600 feet above sea level (5 to 20 feet above the approximate mean elevation of Lake Michigan). Most of the wetlands in Lake Section 8 are Lacustrine Systems. Riverine and Palustrine Systems are also present.

Information related to the physiographic and cultural features of the wetlands in Lake Section 8 is summarized in the individual wetland narratives presented in this chapter. With the exception of Illinois Beach State Park Wetland, no site-specific information on the biotic characteristics of these wetlands was found in published sources. However, extensive biotic information is available for areas in the vicinity of the wetlands.

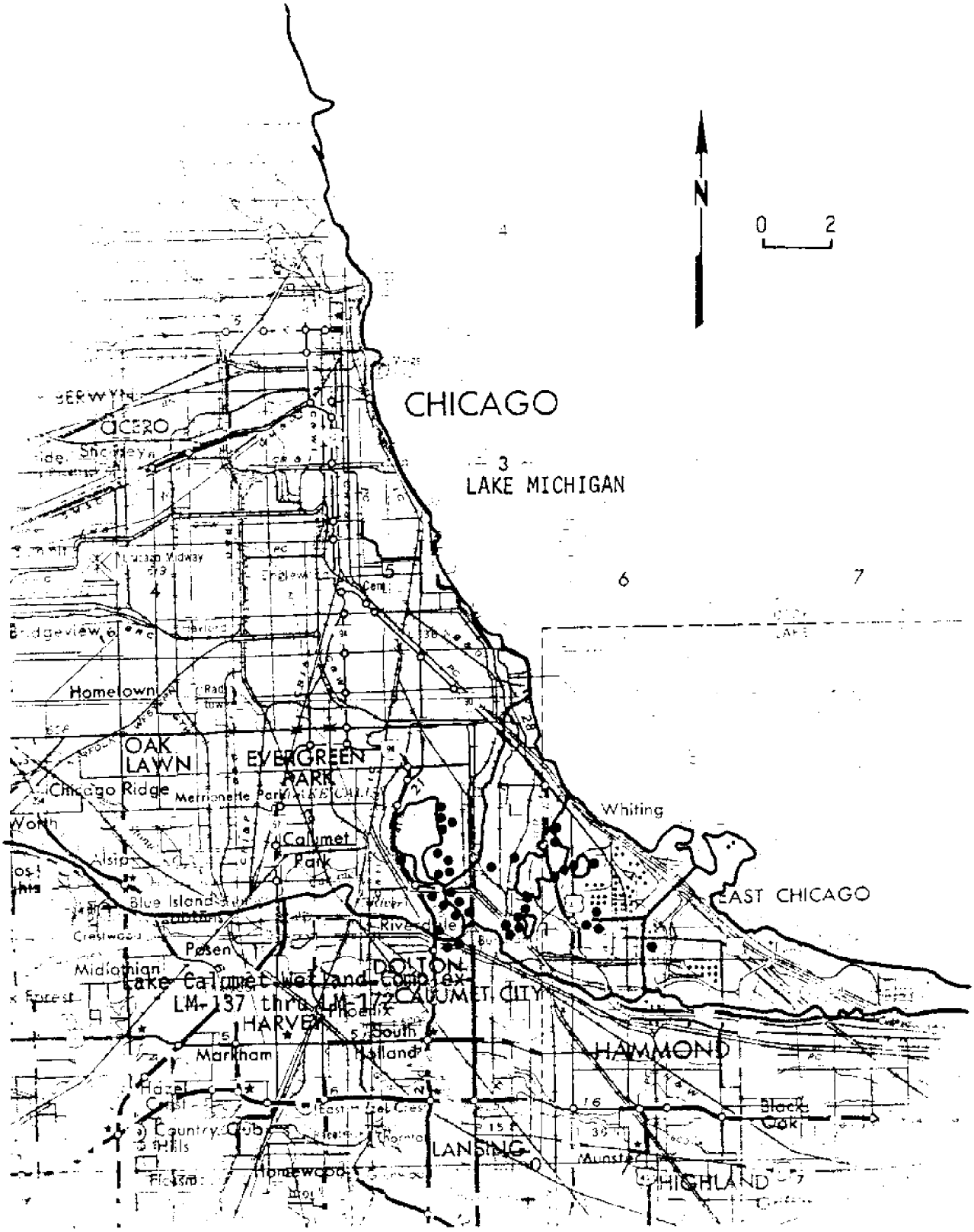

Figure 8-1. Southern portion of Lake Section 8.

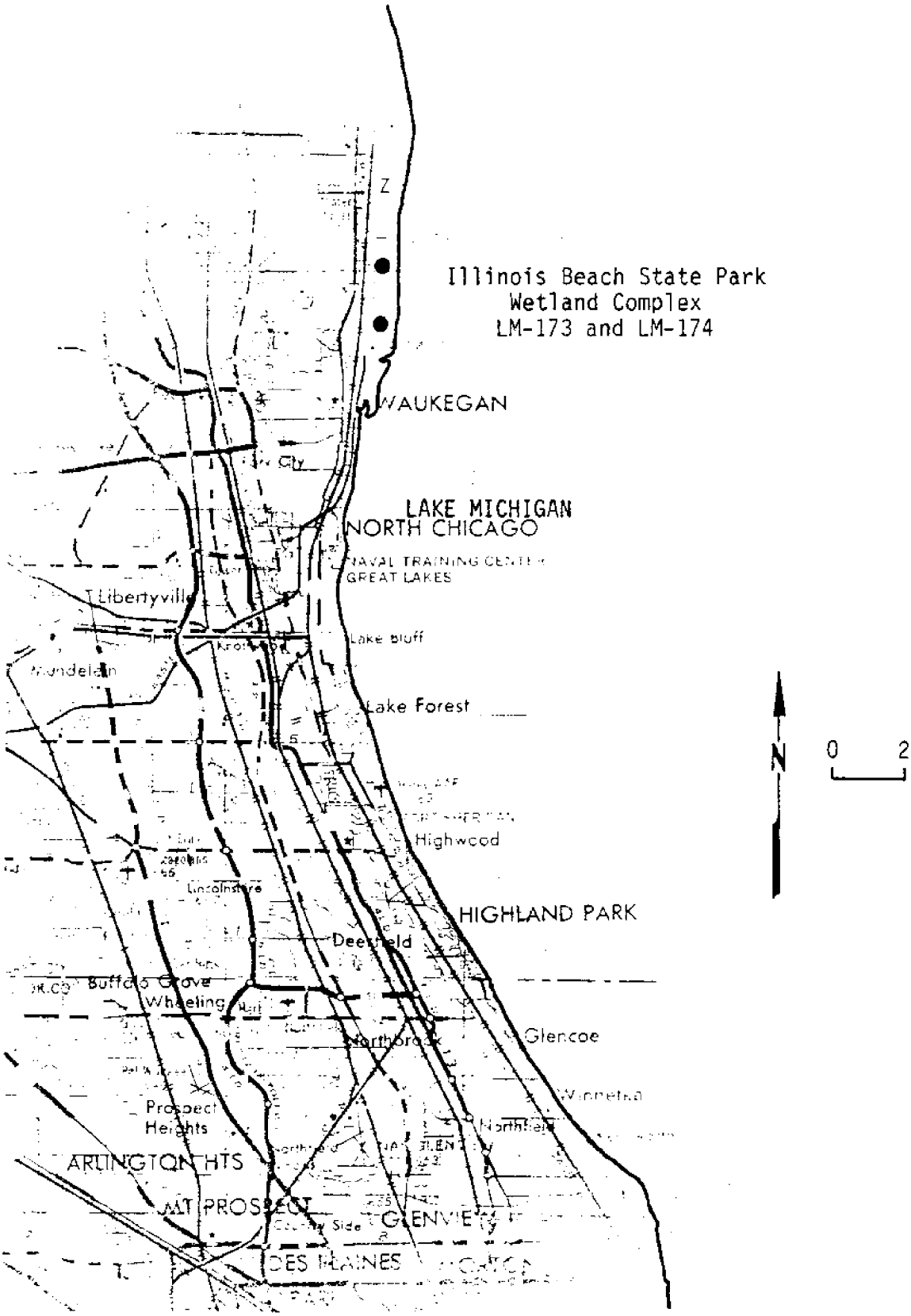

Figure 8-2. Northern portion of Lake Section 8

Table 8-1. Location, Acreage, and Classification of Wetlands in Lake Section 8

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
	LAKE CALUMET WETLAND COMPLEX				
137	East Chicago Wetland	41°37'58"	87°28'03"	17	R
138	Lake George Wetland #1	41°40'12"	87°29'54"	55	L
139	Lake George Canal Wetland #1	41°39'00"	87°29'40"	52	R
140	Lake George Canal Wetland #2	41°38'34"	87°29'44"	13	L
141	Lake George Wetland #2	41°40'00"	87°30'30"	8	L
142	Lake George Canal Wetland #3	41°38'40"	87°30'20"	43	L
143	Wolf Lake Park Wetland #1	41°40'58"	87°31'04"	17	L
144	Wolf Lake Park Wetland #2	41°40'40"	87°30'54"	13	L
145	Wolf Lake Park Wetland #3	41°40'00"	87°30'46"	24	L
146	Wolf Lake Park Wetland #4	41°39'54"	87°31'00"	4	L
147	William W. Powers Conservation Area Wetland #1	41°40'18"	87°32'15"	15	L
148	William W. Powers Conservation Area Wetland #2	41°39'52"	87°32'50"	7	P
149	William W. Powers Conservation Area Wetland #3	41°39'26"	87°32'00"	17	L
150	Powder Horn Lake Wetland #1	41°38'36"	87°32'18"	13	L
151	Powder Horn Lake Wetland #2	41°38'36"	87°32'00"	17	L
152	Powder Horn Lake Wetland #3	41°38'48"	87°32'00"	53	L
153	Lake Calumet Wetland #1	41°40'10"	87°34'18"	59	L
154	Lake Calumet Wetland #2	41°40'14"	87°33'50"	42	L
155	Lake Calumet Wetland #3	41°40'40"	87°34'24"	3	L
156	Lake Calumet Wetland #4	41°40'48"	87°34'24"	6	L
157	Lake Calumet Wetland #5	41°40'45"	87°33'58"	134	L
158	Lake Calumet Wetland #6	41°41'30"	87°34'10"	134	L
159	Lake Calumet Wetland #7	41°40'20"	87°35'47"	25	L
160	Calumet River Turning Basin #5 Wetland #1	41°39'51"	87°34'20"	3	L
161	Calumet River Turning Basin #5 Wetland #2	41°39'50"	87°34'10"	7	L
162	O'Brien Lock and Dam Area Wetland #1	41°39'14"	87°34'46"	84	P
163	O'Brien Lock and Dam Area Wetland #2	41°39'25"	87°33'46"	56	R
164	O'Brien Lock and Dam Area Wetland #3	41°39'03"	87°34'10"	14	P
165	O'Brien Lock and Dam Area Wetland #4	41°39'02"	87°33'44"	22	R
166	O'Brien Lock and Dam Area Wetland #5	41°38'46"	87°33'56"	32	R
167	Grand Calumet River Mouth Wetland #1	41°38'50"	87°33'30"	7	R
168	Grand Calumet River Mouth Wetland #2	41°38'25"	87°32'52"	27	P
169	Grand Calumet River Mouth Wetland #3	41°38'18"	87°32'42"	3	P
170	Little Calumet River Wetland #1	41°38'36"	87°34'37"	13	P
171	Little Calumet River Wetland #2	41°38'14"	87°33'49"	4	P
172	Little Calumet River Wetland #3	41°38'05"	87°34'02"	14	P
	ILLINOIS BEACH STATE PARK WETLAND COMPLEX				
173	Waukegan Wetland	42°23'30"	87°48'21"	4	L
174	Illinois Beach State Park Wetland	42°26'47"	87°48'40"	2902	L

[a] P=palustrine
L=lacustrine
R=riverine

PHYSIOGRAPHIC SETTING LM 137-172

Setting

The Lake Calumet Wetland Complex is comprised of 36 wetlands located in Lake County, Indiana and Cook County, Illinois. Although these wetlands are situated as a distance of more than 1,000 feet from the Lake Michigan shoreline, they are included in this study because they are contiguous with lake-level water bodies such as Lake George Canal, Little Calumet River, Calumet River, and Lake Calumet. Figures 8-3 through 8-6 show the location of the wetlands in relation to these water bodies.

All of the wetlands in the Lake Calumet Wetland Complex occupy low non-wooded sites (U.S.G.S. quadrangle maps, Lake Calumet, Illinois-Indiana, 1973; Whiting, Indiana, 1968). The wetlands have been grouped as a complex because it appears that the entire Lake Calumet region may have been a single wetland at one time. Extensive urbanization, however, has radically altered surface drainage, soils, vegetation, and topography and has resulted in the loss of a large portion of the wetland area. Storage tanks, shipping facilities, railroad lines, slag dumps, dredge and fill areas, and other industrial-related developments are now prevalent throughout the Lake Calumet region. Residential development is also extensive with the cities of East Chicago, Hammond, Whiting, Thorton, and Chicago surrounding the wetlands.

The locations of the 36 wetlands relative to the Lake Michigan shoreline and nearby cities are indicated in Table 8-2.

Topography

All of the wetlands in this complex have very slight relief. Wetland elevations are at or near 585 feet above sea level, which is only five feet above the approximate mean elevation of Lake Michigan (U.S.G.S. quadrangle maps, Lake Calumet, Illinois-Indiana, 1973; Whiting, Indiana, 1968). Bieber and Smith (1952) mapped this area as a beach ridge complex consisting primarily of low beach ridges, dunes, and wetlands. However, the beach ridges and dunes are now almost completely gone, owing to urban development. The landscape surrounding the wetland complex is very flat. The Great Lakes Basin Commission (1975) describes this portion of the Lake Michigan shoreline as a generally protected artificial fill area.

Surficial Geology

There are four types of surficial geology present in the Lake Calumet Wetland Complex: Carmi Member of the Equality Formation, Dolton Member of the Equality Formation, made land, and sand and fine gravel. Table 8-3 identifies which of these surficial deposits are present in the individual wetlands of the Lake Calumet Wetland Complex.

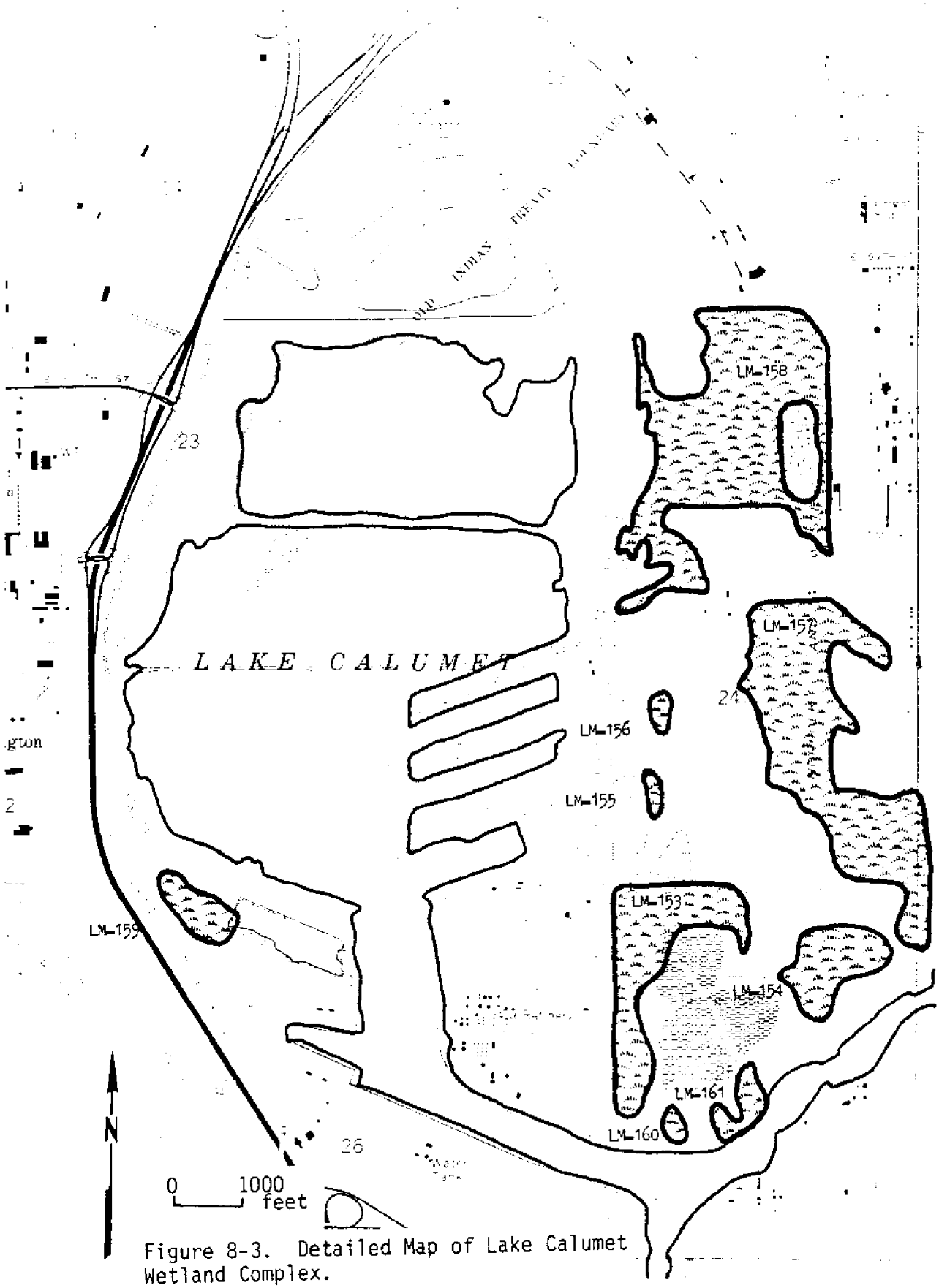

Figure 8-3. Detailed Map of Lake Calumet Wetland Complex.

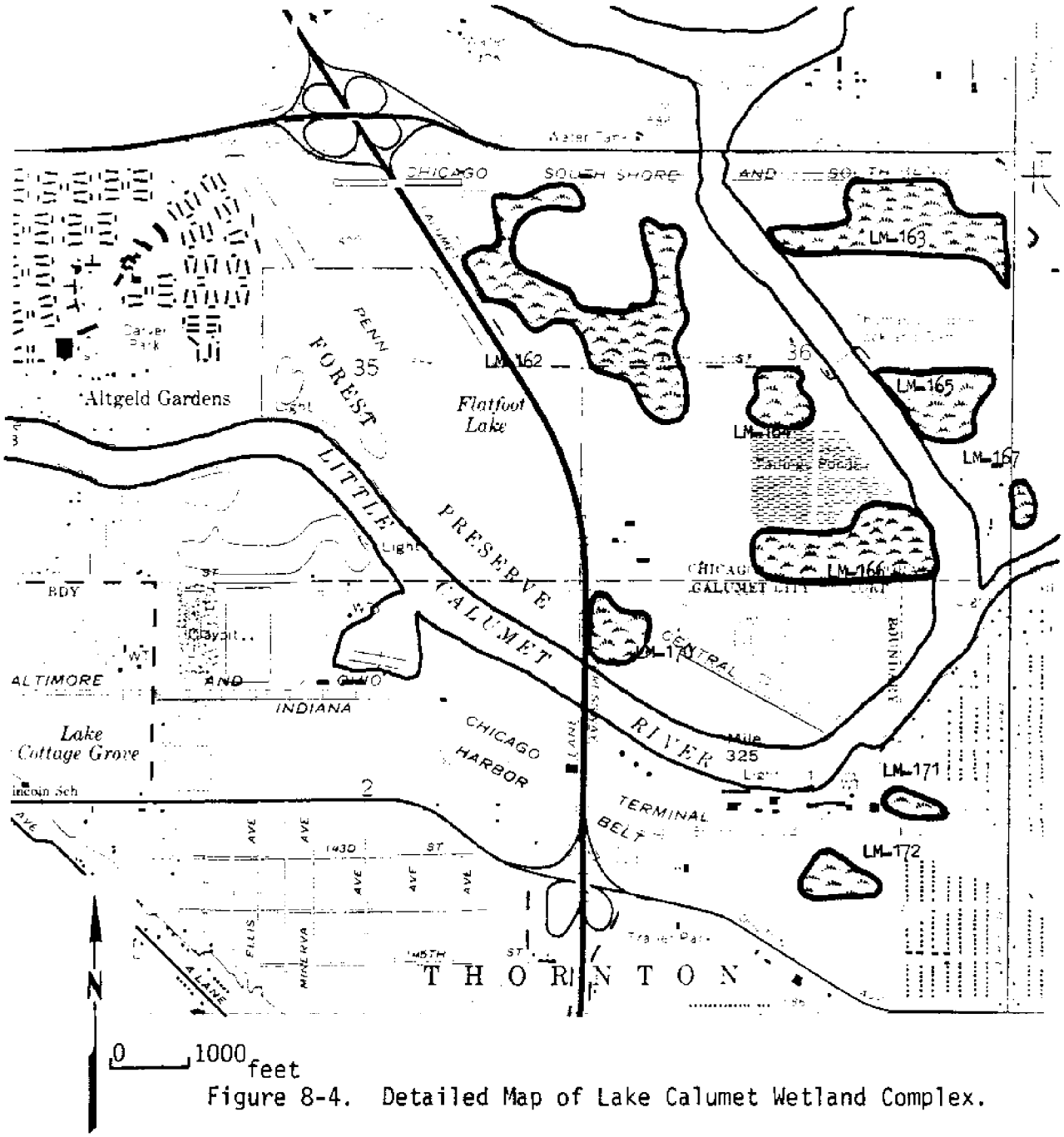

Figure 8-4. Detailed Map of Lake Calumet Wetland Complex.

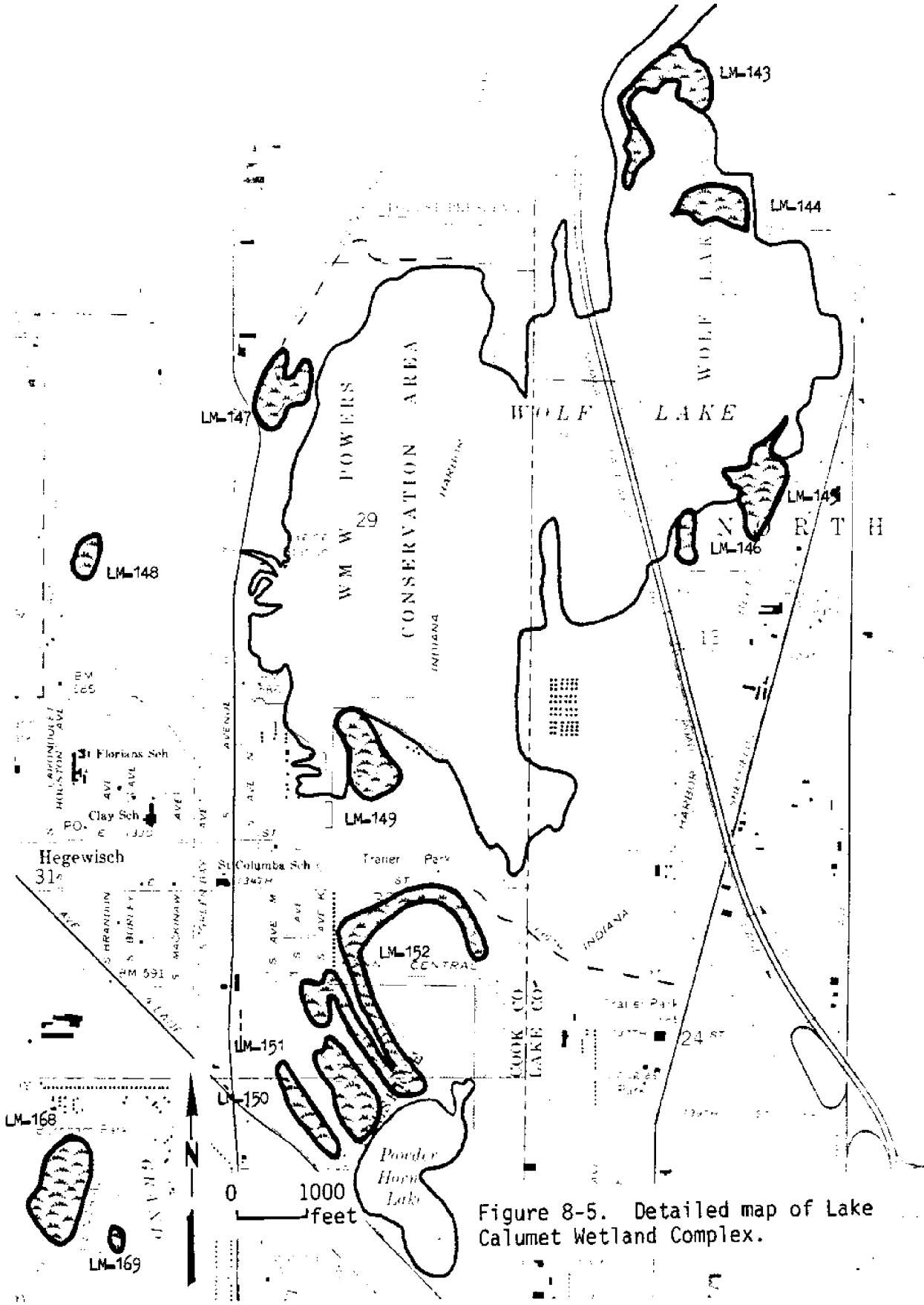

Figure 8-5. Detailed map of Lake Calumet Wetland Complex.

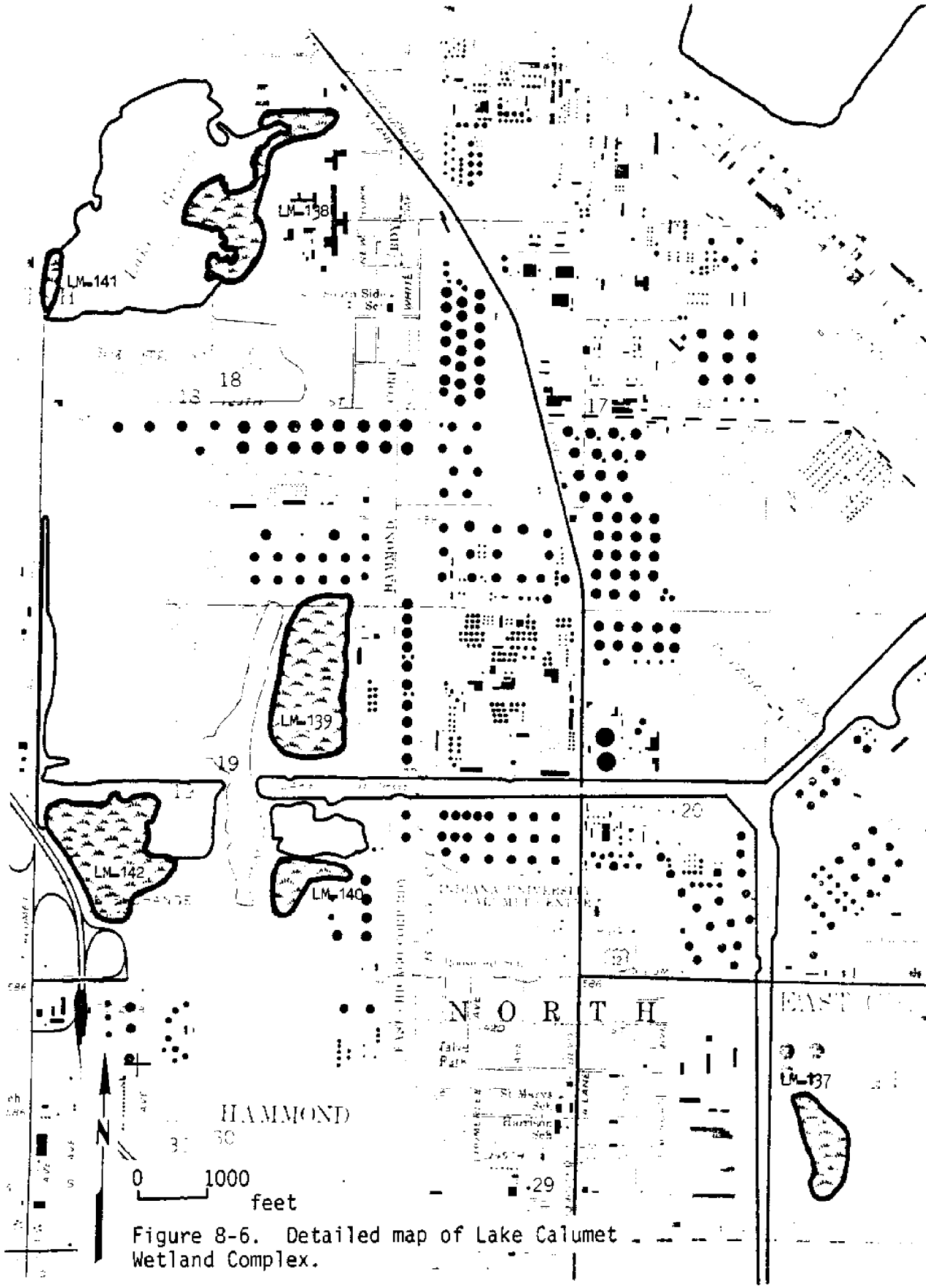

Figure 8-6. Detailed map of Lake Calumet Wetland Complex.

Table 8-2. Locations of Lake Calumet Wetlands

Wetland	Distance to shoreline (miles)	Distance to nearest city
East Chicago Wetland	1.5	adjacent to East Chicago, Indiana
Lake George Wetland #1	1.0	adjacent to Whiting, Indiana
Lake George Canal Wetland #1-#2	1.5	1.0 mile north of Hammond, Indiana
Lake George Wetland #2	1.0	adjacent to Whiting, Indiana
Lake Geroge Wetland #3	1.5	1.0 mile north of Hammond, Indiana
Wolf Lake Park Wetlands #1-#4	1.0	adjacent to Whiting, Indiana
William W. Powers Conservation Area Wetland #1-#3	3.0	1.0 mile northwest of Hammond, Indiana
Powder Horn Lake Wetlands #1-#3	3.0	0.75 mile northwest of Hammond, Indiana
Lake Calumet Wetlands #1-#7	3.0	2.0 miles south of Chicago, Illinois
Calumet River Turning Basin #5 Wetlands #1-#2	3.0	2.0 miles south of Chicago, Illinois
O'Brien Lock and Dam Area Wetland #1	4.0	1.0 mile north of Thornton, Illinois
O'Brien Lock and Dam Area Wetland #2	4.0	1.5 miles north of Thornton, Illinois
O'Brien Lock and Dam Area Wetlands #3-#4	4.0	1.0 mile north of Thornton, Illinois
O'Brien Lock and Dam Area Wetland #5	4.0	0.8 mile north of Thornton, Illinois
Grand Calumet River Mouth Wetlands #1-#3	4.0	1.0 mile northeast of Thornton, Illinois
Little Calumet River Wetlands #1-#2	4.0	0.5 mile north of Thornton, Illinois
Little Calumet River Wetland #3	4.0	0.25 mile northeast of Thornton, Illinois

Table 8-3. Surficial Deposits and Soil Types for Lake Calumet Wetland Complex

Wetland	Surficial deposit[a]	Soil type[b]
East Chicago Wetland	sand and gravel	Urban land
Lake George Wetland #1	made land	Oakville-Tawas
Lake George Canal Wetland #1	made land	Oakville-Tawas
Lake George Canal Wetland #2	made land	Oakville-Tawas
Lake George Wetland #2	made land	Oakville-Tawas
Lake George Canal Wetland #3	made land	Oakville-Tawas
Wolf Lake Park Wetland #1	made land	Oakville-Tawas
Wolf Lake Park Wetland #2	made land	Oakville-Tawas
Wolf Lake Park Wetland #3	made land	Oakville-Tawas
Wolf Lake Park Wetland #4	made land	Oakville-Tawas
William W. Powers Conservation Area Wetland #1	Carmi Member	Oakville
William W. Powers Conservation Area Wetland #2	Carmi Member	Oakville
William W. Powers Conservation Area Wetland #3	Carmi Member	Oakville
Powder Horn Lake Wetland #1	Dolton Member	Oakville
Powder Horn Lake Wetland #2	Dolton Member	Oakville
Powder Horn Lake Wetland #3	Dolton Member	Oakville
Lake Calumet Wetland #1	Carmi Member	Selma-Wesley
Lake Calumet Wetland #2	Carmi Member	Selma-Wesley
Lake Calumet Wetland #3	Carmi Member	Selma-Wesley
Lake Calumet Wetland #4	Carmi Member	Selma-Wesley
Lake Calumet Wetland #5	Carmi Member	Selma-Wesley
Lake Calumet Wetland #6	Carmi Member	Selma-Wesley
Lake Calumet Wetland #7	made land	Milford
Calumet River Turning Basin #5 Wetland #1	Carmi Member	Selma-Wesley
Calumet River Turning Basin #5 Wetland #2	Carmi Member	Selma-Wesley
O'Brien Lock and Dam Area Wetland #1	Carmi Member and made land	Milford and Selma-Wesley
O'Brien Lock and Dam Area Wetland #2	Cami Member	Selma-Wesley
O'Brien Lock and Dam Area Wetland #3	Carmi Member	Selma-Wesley
O'Brien Lock and Dam Area Wetland #4	Carmi Member	Selma-Wesley
O'Brien Lock and Dam Area Wetland #5	Carmi Member	Selma-Wesley
Grand Calumet River Mouth Wetland #1	Carmi Member	Urban land
Grand Calumet River Mouth Wetland #2	Carmi Member	Urban land

(Continued)

Table 8-3. (Concluded)

Wetland	Surficial deposit[a]	Soil type[b]
Grand Calumet River Mouth Wetland #3	Carmi Member	Urban land
Little Calumet River Wetland #1	Dolton Member	Urban land
Little Calumet River Wetland #2	Carmi Member	Urban land
Little Calumet River Wetland #3	Dolton Member	Urban land

[a]Surficial deposits for each wetland are based upon Willman and Lineback (1970)
[b]Soil types are based upon Soil Conservation Service (1977)

The Equality Formation is composed of silt, sand, gravel, and clay deposits which accumulated in areas once covered by glacial lakes (Willman, 1971). The Carmi and Dolton Members of the Equality Formation are present throughout the Lake Calumet Wetland Complex and the Chicago area.

The Dolton Member of the Equality Formation is predominantly sand, but contains beds of silt, pebbly sand, and gravel. These deposits consist of shore and shallow-water lake deposits which commonly occur in low ridges that were previously beaches, bars, and spits. Pebbly sand and gravel are largely confined to narrow belts along the more prominent shorelines where waves eroded the till, washed away the silt and clay, and left a concentrate of sand and pebbles. The deposits are generally less than 10 feet thick but may be as much as 25 feet thick (Willman, 1971).

The Carmi Member of the Equality Formation is predominantly silt, either well bedded or laminated. Much of this formation is sandy and contains beds of fine sand and clay. Where these deposits occur in lake basins, they are only a few feet thick and are rarely as much as 20 feet thick (Willman, 1971).

Made land is characterized by man-made fill over areas formerly covered by Lake Michigan and Lake Calumet. The fill consists of sand and gravel in areas bordering Lake Michigan, and rubbish in the areas bordering Lake Calumet (Willman and Lineback, 1970).

Sand and gravel occur in ridged belts that are somewhat higher than the surrounding area. In many places these ridges have been obliterated by man. Narrow belts of muck occur between the ridges (Hill, 1975).

For more information on the surficial geology of the Lake Calumet Wetland Complex Area, see Willman (1971). Additional information on shoreline geology and bluff erosion including the characteristics that contribute to erosion may be found in the Illinois Division of Water Resources (1975).

Soils

The Lake Calumet Wetland Complex is located in a highly urbanized area. Because of this, no modern county soil survey is available. However, a general soil association map has been prepared for Cook and Du Page Counties (U.S. Soil Conservation Service, 1977).

Table 8-3 identifies the soil types for each wetland in the Lake Calumet Wetland Complex. As indicated in the table, there are four associations present: Oakville, Milford, Selma-Wesley, and Oakville-Tawas. In addition, all of the wetlands are surrounded by and may include urban land. Urban land consists of areas that have been filled with either earth, cinders, basic slag, trash, or a combination of these and then smoothed over. The surface layer and subsoil have been removed or disturbed to such a degree that the soil can no longer be identified. Urban land also includes those areas where sand dunes have been removed and the areas leveled (Persinger, 1972).

The Oakville association consists of deep, excessively drained, coarse-textured soils. These soils generally occupy sand dunes and beach ridges and

are stabilized by trees and grasses. Oakville soils are formed from coarse-textured glacial drift that has been reworked by wind. These soils are primarily made up of quartz sand, which is not mottled within the first 40 inches (Persinger, 1972).

The Milford association consists of deep, excessively drained, coarse-textured and moderately fine-textured soils. These soils are nearly level and occur in slack water or lacustrine areas. They are formed in stratified, moderately fine-textured and fine-textured lacustrine deposits. The underlying material is silty clay loam or sand and gravel at a depth of more than 40 inches (Persinger, 1972).

The Selma-Wesley association consists of a built-up area of deep, level, and nearly level, poorly drained sois that have a loamy subsoil. They were formed from glacial outwash and lake sediments (U.S. Department of Agriculture, Soil Conservation Service, 1977).

The Oakville-Tawas association ranges from steep to nearly level and depressional, excessively drained and very poorly drained soils that are formed from coarse-textured and organic materials. This association is characterized by narrow, elongated, parallel ridges separated by sloughs. Oakville soils are on the ridges, are excessively drained, and have a black coarse-textured surface layer about 2 inches thick. Tawas soils are found in depressions between the ridges and are very poorly drained. The surface layer is black friable muck about 30 inches thick.

Hydrology

No rivers or streams flow directly through the individual wetlands in the Lake Calumet Wetland Complex. However, there are two rivers and four lakes adjacent to many of the wetlands in this complex. These are the Little Calumet River, Calumet River, Lake Calumet, Wolf Lake, Lake George, and Powder Horn Lake. These surface waters are considered to be of poor quality (Great Lakes Basin Commission, 1975). Their influence on the Lake Calumet Wetland Complex is not known.

Hydrological information such as drainage area and discharge is available for the rivers in the vicinity of the Lake Calumet Wetland Complex (U.S. Geological Survey, 1976). Water quality data are available for Wolf Lake and the channel which connects the lake to the Calumet River. The wetlands that may be influenced by Wolf Lake waters are those that are adjacent to the lake: W. W. Powers Conservation Area Wetlands #2 and #3 and Wolf Lake Park Wetlands #1-#4. The following parameters for Wolf Lake are reported in Tables 8-4 and 8-5: temperature, dissolved oxygen, pH, nitrogen, phosphorous, and suspended solids.

Specific information on the hydrology of the wetlands in the Lake Calumet Wetland Complex such as water level influences, groundwater drainage patterns and runoff, water quality, depth, and seasonal changes is unavailable.

Table 8-4. Water Quality Data for Wolf Lake Measured at the Indiana-Illinois State Line from January to June 1969 (25 samples)[a]

Parameter	Maximum	Minimum	Mean
temperature (°C)	19.0	1.0	7.8
pH	9.0	6.8	8.0
dissolved oxygen (% saturation)	110.0	39.0	84.0
nitrogen (mg/l)	1.27	0.23	0.70
phosphorous (mg/l)	0.094	0.024	0.039
suspended solids (mg/l)	32.0	0.0	13.0

[a]Technical Committee on Water Quality (1970)

Table 8-5. Water Quality Data for Wolf Lake Outlet at Carondolet Avenue from January to June 1969 (25 samples)[a]

Parameter	Maximum	Minimum	Mean
temperature (°C)	19.0	0.0	7.7
pH	9.1	7.4	8.5
dissolved oxygen (% saturation)	103.0	66.0	84.0
nitrogen (mg/l)	1.0	0.07	0.6
phosphorous (mg/l)	0.07	0.012	0.025
suspended solids (mg/l)	46.0	2.0	20.0

[a]Technical Committee on Water Quality (1970)

Climate

The closest weather station providing climatic data for the Lake Calumet Wetland Complex is located in Chicago (O'Hare Airport), Illinois. In 1975, the average monthly temperature was 51.1°F; the average daily low for January was 20.1°F and the average daily high in July was 85.3°F. The average annual precipitation is 31.72 inches, with a mean monthly precipitation of 1.70 inches in January and 3.66 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 22 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Lake Calumet Wetland Complex.

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Vegetation

Repoon (1927) provides an historical account of the vegetation of the Lake Calumet Wetland Complex, which may not be applicable at the present time. Pepoon stated that though the area had no striking scenic features, it showed considerable diversity in its flora. Wetland habitats of this coastal zone included sloughs, shallow lakes, ponds, rivers, and marshes. This diversity of habitats coupled with proximity yielded a complex mixture of plant communities.

The vegetation of the wetlands was composed mostly of monocots. Species varied in abundance, some thriving in diverse communities. Some species colonized certain areas exclusively, forming nearly pure stands. Among these were species of bulrush (Scirpus), cattail (Typha), cotton grass (Eriophorum), twig rush (Cladium) grasses such as blue-joint (Calamagrostis canadensis), and wild rice (Zizania aquatica), and the sedges Carex aquatilis, C. crinita, C. filiformia, C. riparia, and C. stricta. Common along the shores of lakes, ponds, annd streams were bur-reeds (Sparganium americanum, S. androcladum, S. eurycarpum), and arrowheads (Sagitarria graminea, S. heterophylla, S. latifolia) (Pepoon 1927).

Historically, the open water habitat of lakes and streams in this region supported a highly productive and diverse flora. Most noteworthy among dicots of this habitat type were bladderwort (Utricularia vulgaris), coontail (Ceratophyllum demersum), mermaid-weed (Proserpinaca palustris), starwort (Callitriche heterophylla), water crowfood (Ranunculus flabellaris, R. trichophyllus), water heart's-ease (Polygonum amphibium), water milfoil (Myriophyllum exalbescens, M. heterophyllum, M. verticillatum var. pectinatum), water shield (Brasenia schreberi), white water-lily (Nymphaea tuberosa), and yellow water-lily (Nuphar advena). With the above species, Pepoon included American lotus (Nelumbo lutea), a species of restricted range then confined to the Calumet River and Lake Calumet. He stated that American lotus has always been less abundant than white water-lily and is less able to resist destruction

by despoliation. Further, Pepoon believed that unless protected, the lotus would probably be extirpated and that the use of the Calumet River for navigation would hasten the loss of the lotus. The Illinois Natural History Survey (1976) reports that the water quality of Lake Calumet and the Calumet River is poor. This, coupled with the intense use of the waters for navigation, has probably eliminated the lotus, as well as some of the other species reported by Pepoon.

The open waters of Lake Calumet, Wolf Lake, and Lake George, as late as 1927, were rich in pondweeds (Zosteraceae). Nearly all species of this family occurring in the region were reported from Wolf Lake, including Potamogeton ampifolius, P. crispus, P. foliosus, P. friesii, P. gramineus, P. illinoensis, P. natans, P. nodosus, P. pectinatus, P. pusillus, P. richardsonii, P. robbinsii, P. strictifolius, P. zosteriformis, and Zannichellia palustris. Equally abundant monocot species included eel grass (Vallisneria americana), elodea (Elodea canadensis), naiad (Najas flexilis), and water star-grass (Heteranthera dubia). However, Pepoon cautioned that the waters of Lakes Calumet, Wolf, and George were rapidly losing their pre-eminence as habitats of aquatic plant and animal life, due to the encroachment of factories and various sewage and drainage operations. Yet, in 1927 extensive marshes thrived on the south and east shores of each lake.

The dominant forest trees of the region were species of oak (Quercus), restricted to relatively dry areas. Associated trees included ash (Fraxinus), cottonwood (Populus deltoides), elm (Ulmus), and maple (Acer). The wetter soils, such as those along Wolf Lake, supported a highly diverse community of willows (Salix). Sloughs were commonly bordered by paper birch (Betula papyrifera) and white cedar (Thuja occidentalis). On the low sand ridges between sloughs, there was generally an open growth of trees freely admitting light. Here, the herbaceous vegetation was a mixture of prairie grasses and forbes (Pepoon 1927).

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels for the vegetation of the 36 wetlands comprising the Lake Calumet Wetland Complex.

Fish

Fish collections have been made in the Calumet River, Little Calumet River, and Lake Calumet by the Illinois Natural History Survey and the Illinois Division of Fisheries, and the unpublished records of these agencies may document collections from specific wetlands.

Current literature regarding the fish communities in Wolf Lake, Lake Calumet, and the Calumet River (Lopinot, 1970; U.S. Army Corps of Engineers, 1975) may be used to draw general conclusions about the fishes of Wolf Lake. It contains a diversity of game fish, including northern pike (Esox lucius), carp (Cyprinus carpio), bullheads (Ictalurus spp.) channel catfish (Ictalurus punctatus), largemouth bass (Micropterus salmoides), crappies (Pomoxis spp.), bluegill (Lepomis macrochirus), miscellaneous sunfishes (Lepomis spp.), and yellow perch (Perca flavescens) (Lopinot, 1970). Although the relationship of

the Wolf Lake Wetlands to these species has not been studied, the wetlands probably serve as spawning and hatching areas for northern pike, carp, and bullheads, all of which are known to utilize wetlands for spawning, and as cover and feeding areas for most of the fish species in Wolf Lake at some time during their life cycles.

In contrast, Lake Calumet and the Calumet River contain a much less abundant and diverse fish population (U.S. Army Corps of Engineers, 1975), although carp, bullheads, and yellow perch furnish a sport fishery in these two bodies of water (Lopinot, 1970). During the 1800's and early 1900's Lake Calumet and the Calumet River supported an abundant and diverse fish fauna, as listed in Table 8-6, and minor sport and commercial fisheries (Kennicott, 1855; Milner, 1874; Nelson, 1876, 1878; Jordan, 1878; Forbes, 1884; Large, 1903; Forbes and Richardson, 1908; Meek and Hildebrant, 1910; O'Donnell, 1935). Some of these fishes may still be present in these waters and may enter adjacent wetlands to feed or spawn. The filling of wetlands adjacent to Lake Calumet and the Calumet River for the construction of harbor facilities and industrial expansion in the greater Chicago area undoubtedly contributed to the decline of such marsh dependent species as the grass pickerel (Esox americanus) and the pirate perch (Aphredoderus sayanus). Currently, the wetlands adjacent to Lake Calumet and the Calumet River are probably of minimal importance as areas for feeding, cover, and reproduction of fishes owing to poor water quality, continued filling, and overall depletion of the fish fauna in the area.

Table 8-6. Fishes Present in Lake Calumet and the Calumet River during the 1800's and early 1900's, Currently Greatly Depleted or Extirpated.

Species	Species
silver lamprey	banded killifish
lake sturgeon	white bass
bowfin	largemouth bass
longnose gar	black crappie
grass pickerel	rock bass
redhorse (species unidentified)	green sunfish
buffalo (species unidentified)	pumpkinseed
blackchin shiner	bluegill
brown bullhead	yellow perch
bullheads (species unidentified)	logperch
burbot	johnny darter
pirate perch	ninespine stickleback

The literature search provided no site-specific information pertaining to species composition, seasonal distribution and abundance, spawning and hatching areas, life histories, food sources, or commercial and recreational use of the fish populations in the 36 wetlands comprising the Lake Calumet Wetland Complex.

Invertebrates

General information for Lake Section 8 may be found in Hebard (1934), Illinois Natural History Survey (1976), McDonald (1951), and Ross (1944). the content of these studies is discussed in Appendix B-2. The invertebrate species presented in the discussion may or may not occur in wetland habitat in the Lake Calumet Wetland Complex.

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in any of the 36 wetlands comprising the Lake Calumet Complex.

Reptiles and Amphibians

Information on the region which includes the Lake Calumet Wetland Complex is available in Schmidt and Necker (1935), Necker (1939), Pope (1944), Seibert and Hagen (1947), Smith (1949, 1961) and Minton (1972). There is no information that any of the amphibian and reptile specimens mentioned in these references were collected more recently than 1950. The list of amphibians and reptiles from the Lake Calumet vicinity includes only the American toad (Bufo americanus) and four snakes. Seibert and Hagen (1947) indicate that the Chicago garter snake (Thamnophis sirtalis semifasciata), a unique, locally distributed race of garter snake, was not common in their study area. Seibert and Hagen also provided estimates, limited reproductive information and evidence of avian predation on two more common species, the eastern plains garter snake (Thamnophis r. radix) and western smooth green snake (Opheodrys vernalis blanchardi).

There are seven records of amphibians and four records of reptiles in the Wolf Lake area. Minton (1972) lists the mudpuppy (Necturus maculosus) in the area; however, the Illinois Natural History Survey (1976) indicates that it has become extinct locally. The predominantly wetland species in the area are Blanchard's cricket frog (Acris crepitans blanchardi), stinkpot (Sternotherus odoratus), and midland painted turtle (Chrysemys picta marginata). The Chicago garter snake has been reported throughout the region.

The literature search provided no site-specific data pertaining to presence, seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the amphibians and reptiles inhabiting the 36 wetlands of this complex.

Avifauna

The Illinois Natural History Survey (1976), which draws extensively from records in Woodruff (1907) and Ford (1956), states that this area once supported a rich marsh and wet prairie avifauna including breeding populations of birds which normally breed further north or west. Smith and Parmalee (1955) list various wetland birds highly atypical of the Lake Michigan basin (e.g., glossy ibis, Plegadis flacinellus and ruff, Philomachus pugnax) that were observed in the region during the late 1940's and early 1950's. Bartel (1975) reports

banding 231 black-crowned night herons (Nycticorax nycticorax) from colonies at Lake Calumet between 1937 and 1952. The ruff and marbled godwit (Limosa fedora) were observed at Lake Calumet during the fall of 1976 (Kleen, 1977).

The Illinois Natural History Survey (1976) indicates that waterfowl formerly breeding in the area include the pintail (Anas americana), redheads (Aythya americana), lesser scaup (Aythya affinis), and ruddy ducks (Oxyura jamaicensis). These species are still common within the Illinois coastal zone but only as transients during migration. However, Kleen (1975, 1976, 1977) suggests that the American wigeon, redhead, pintail, and gadwall (Anas strepera) may breed at Lake Calumet, at least in token numbers.

High quality population data are lacking for the region and the only census data available are the Christmas Bird Counts of the Calumet City-Sandridge Census Area (Table 8-7). This census area includes all of the Lake Calumet Wetland Complex but, in addition, includes portions of open Lake Michigan and several interior wetlands lying outside of the project area. Thus, the data may not be representative of the Lake Calumet Wetland Complex itself. The most abundant waterfowl are mallards (Anas platyrhynchos), common goldeneyes (Bucephala clangula), scaup and mergansers. Herring gulls (Larus delawarensis) are very numerous. With respect to breeding season Kleen (1973, 1976, 1977) reports nesting ring-billed gulls (Larus delawarensis) at Lake Calumet.

Appendices D-17, D-18, D-19, and D-20 contain additional information on wetland birds. Both general studies on Lake Section 8 and site-specific studies in close geographic proximity to the Lake Calumet Wetland Complex are included. Care should be exercised in the interpretation of the relevance of these studies to the Lake Calumet Wetland Complex, since the literature search yielded no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds of the Lake Calumet Wetland Complex.

Mammals

Some general information concerning the Lake Calumet region is provided by Kennicott (1855), Gregory (1936), Hier (1968), and the Illinois Natural History Survey (1976). In the past, a diverse mammalian fauna existed in this region but was severely altered by the settlement and development of the area by man. The present relative abundance in the Illinois coastal zone of Lake Michigan has been determined for 16 species of wetland mammals and may apply to the wetlands of this complex (Appendix E-). Species from this list which have commercial value are the eastern cottontail (Sylvilagus floridanus), beaver (Castor canadensis), muskrat (Odatra zibethicus), red fox (Vulpes vulpes), raccoon (Procyon lator), mink (Mustela vison), striped skunk (Mephitis mephitis), and white-tailed deer (Odoroileus virginianus). Hunting and trapping of mammals may occur on some of the privately owned wetlands of this complex with the permission of the landowner but is restricted in the state owned wetlands and wetlands within the city limits.

The literature search yielded no site-specific information pertaining to species composition, seasonal distribution and abundance, density and

Table 8-7. Wetland Bird Species of the Calumet City - Sandridge Census Area in the 1972-1976 Christmas Bird Count[a]

	1976	1975	1974	1973	1972
horned grebe		2	2		
pied-billed grebe		2	1		1
double-crested cormorant		2			
Canada goose		--b			
blue-winged teal		1	1		
northern shoveler		3	5		2
snow goose			2		
mallard	892	934	472	112	138
black duck	11	13	7	2	
gadwall	1				
pintail			2	2	
redhead	1		5		
ring-necked duck			3		
canvasback		4	1		
greater scaup		1		24	
scaup sp.	150	23		1200	
lesser scaup	3	10	42	4	
common goldeneye	149	78	76	63	190
bufflehead	--b			3	
oldsquaw				1	
ruddy duck		3			
hooded merganser		1	1		
common merganser	190	15	11	7	12
merganser sp.				19	
red-breasted merganser	106	5	27	3	
Cooper's hawk				1	
red shouldered hawk			1	1	2
marsh hawk			1	1	
American coot	2	31	34	1	2
killdeer		3			
black-bellied plover				1	
glaucous gull	1				
Iceland gull	1				
great black-backed gull	1				
herring gull	2410	4624	831	2479	345
ring-billed gull	591	721	49	28	4
Bonaparte's gull		144	114	70	
white-winged gull, sp.		1		1	
greated horned owl	1		1	1	1
long-eared owl		4			--b
short-eared owl	6	5		--b	
saw-whet owl				1	
belted kingfisher	--b		1		
winter wren		2			
starling	3709	4052	1954	5007	637

-continued-

Table 8-7. (Concluded)

	1976	1975	1974	1973	1972
red-winged blackbird	37	12	1897	13	16
rusty blackbird			1	2	--b
cardinal	75	88	49	34	26
purple finch					1
white-throated sparrow	5	--b	7	4	9
swamp sparrow	24	23	10	2	3

[a]The Calumet City-Sandridge census area encompasses all of the Lake Calumet Wetland Complex as well as a portion of the Lake Michigan shoreline and many lakes and rivers not included in this study (Arbib, 1973, 1974, 1975, 1976, 1977)

[b]Observed in the area during the count week, but not seen on the count day

productivity, recreational and commercial use, life histories, major food sources, or relationship to water levels of the mammals inhabiting the 36 wetlands comprising the Lake Calumet Wetland Complex.

Endangered Species

Historical records indicate that the Federally listed endangered peregrine falcon (Falco peregrinus), northern bald eagle (Haliaecetus l. leucocephalus), and southern bald eagle (H. l. alascanus) were rare summer residents and that bald eagles nested in Cook County (U.S. Fish and Wildlife Service, 1978; Woodruff, 1907; and Ford, 1956). Apparently, these endangered species have always been uncommon in the region except during spring migration. The peregrine falcon is still observed locally during spring migration (e.g., in downtown Chicago during 1974 and 1975; Kleen, 1974, 1975). Although the Illinois Natural History Survey (1976) reports that the northern and southern bald eagles occur in small numbers as transients and winter residents of the Illinois shoreline, recent records of sightings in the Lake Calumet Wetland Complex appear to be lacking.

No other species of plants or animals currently appearing on the Federal endangered species list (U.S. Fish and Wildlife Service, 1977) are known to occur in this wetland complex.

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Population

East Chicago Wetland, Lake George Canal Wetlands #1-#3, Lake George Wetlands #1 and #2, and Wolf Lake Park Wetlands #1-#4 are situated in North Township of Lake County, Indiana. Wetlands located within Cook County in the City of Chicago include lake Calumet Wetlands #1-#7, Calumet River Turning Basin #5 Wetlands #1 and #2, O'Brien Lock and Dam Wetlands #1-#5, Powder Horn Lake Wetlands #1-#3, and William W. Powers Conservation Area Wetlands #1-#3. Little Calumet River Wetlands #1-#3 and Grand Calumet River Mouth Wetlands #1-#3 are situated in Thornton Township of Cook County.

Both Lake County, Indiana and Cook County, Illinois are highly urbanized areas with population densities per square mile of 1,064 and 5,757 respectively. The demographic characteristics of the two counties, as well as North Township, Thornton Township, and the city of Chicago are presented in Table 8-8. All areas with the exception of Lake County experienced some decline in population over the five year period 1970-1975. Lake County experienced slow or stable population growth during this same period. Projections for 1990 indicate that Lake County is expected to experience a slow rate of population growth in the future, while the population of Cook County is expected to remain stable.

Table 8-8. Population Data for the Vicinity of the Lake Calumet Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990
Lake County, Indiana	546,757	+0.1	578,800[b]
North Township	202,554	-0.5	--
Cook County, Illinois	5,493,766	-2.3	5,491,602[c]
Thornton Township	188,067	-4.5	--
City of Chicago	3,369,357	-8.0	--

[a] U.S. Bureau of Census (1977)
[b] Northwestern Indiana Regional Plan Commission (1976)
[c] State of Illinois, Bureau of the Budget (1976)

Land Use and Ownership

Land use within the wetlands of the Lake Calumet Wetland Complex is predominantly urban open space, while the surrounding area is characterized primarily by residential land uses interspersed with areas of intensive industrial development (U.S.G.S. quadrangle map Lake Calumet, Illinois-Indiana, 1973 and Illinois Coastal Zone Management Program, 1975). Table 8-9 indicates the predominant land use and ownership for each of the wetlands in the complex.

All of the wetlands in the Lake Calumet Complex lie in an area of intensive urban development. Every wetland in the complex is located in close proximity to an expressway, road, or railroad track. Dredge and fill areas and tailings ponds are also common in the vicinity of the wetland complex.

East Chicago Wetland is located next to the dredged channel of the Indiana Harbor Canal. Storage tanks are located just north of the wetland, and rail lines lie to the immediate east and south.

Lake George Wetlands #1 and #2 are located adjacent to Lake George, which has been considerably altered by dredge and fill activity. An access road, built on fill, crosses these wetlands. Rail lines lie to the north and east of the wetlands and an access road lies to the south.

Wolf Lake Park Wetlands #1-#4 are located adjacent to Wolf Lake, which also has been considerably altered by dredge and fill activity. The Indiana East-West Toll Road lies to the west of the wetlands and crosses directly through Wolf Lake. Railroad tracks are located to the north and south of the wetlands and roads are located to the east.

William W. Powers Conservation Area Wetlands #1-#3 are located on the west shoreline of Wolf Lake. A road and a rail line lie within William W. Powers

Table 8-9. Lake Calumet Wetland Complex Ownership[a]

Wetland	Ownership
East Chicago Wetland	
Lake George Wetland #1	--[b]
Lake George Wetland #2	--
Lake George Canal Wetland #1	--
Lake George Canal Wetland #2	--
Lake George Canal Wetland #3	--
Wolf Lake Park Wetland #1	Municipal Park
Wolf Lake Park Wetland #2	Municipal Park
Wolf Lake Park Wetland #3	Municipal Park
Wolf Lake Park Wetland #4	Municipal Park
William W. Powers Conservation Area Wetland #1	State
William W. Powers Conservation Area Wetland #2	--
William W. Powers Conservation Area Wetland #3	--
Powder Horn Lake Wetland #1	County Forest Preserve
Powder Horn Lake Wetland #2	County Forest Preserve
Powder Horn Lake Wetland #3	County Forest Preserve
Lake Calumet Wetland #1	--
Lake Calumet Wetland #2	--
Lake Calumet Wetland #3	--
Lake Calumet Wetland #4	--
Lake Calumet Wetland #5	--
Lake Calumet Wetland #6	--
Lake Calumet Wetland #7	--
Calumet River Turning Basin #5 Wetland #1	--
Calumet River Turning Basin #5 Wetland #2	--
O'Brien Lock and Dam Area Wetland #1	--
O'Brien Lock and Dam Area Wetland #2	--
O'Brien Lock and Dam Area Wetland #3	--
O'Brien Lock and Dam Area Wetland #4	--
O'Brien Lock and Dam Area Wetland #5	--
Grand Calumet River Mouth Wetland #1	--
Grand Calumet River Mouth Wetland #2	--
Grand Calumet River Mouth Wetland #3	--
Little Calumet River Wetland #1	--
Little Calumet River Wetland #2	--
Little Calumet River Wetland #3	--

[a]Information is taken from U.S.G.S. quadrangle maps, Lake Calumet, Illinois-Indiana (1973) and Whiting, Indiana (1968) unless otherwise stated

[b]Detailed ownership information for these wetlands is lacking. The Regional Port District owns segments of land in the immediate vicinity of Lake Calumet, as does the Metropolitan Sanitary District, which uses areas around the eastern shore of the lake as a depository for fill and dredge spoil (City of Chicago Planning Department, personal communication). It is therefore inferred that ownership in this area is mixed.

Conservation Area Wetland #1. William W. Powers Conservation Area Wetland #2 is located adjacent to a ditch which connects Wolf Lake and the Calumet River. William W. Powers Conservation Area Wetland #3 has been partially dredged and filled to accomodate residential development. Powder Horn Lake Wetlands #1-#3 lie to the northwest of Powder Horn Lake. Rail lines are located on all sides of these wetlands and a secondary highway lies to the south.

Lake Calumet Wetlands #1-#7 and Calumet River Turning Basin #5 Wetlands #1 and #2 are located adjacent to Lake Calumet and the Calumet River. An application has been filed by the Chicago Port Authority to dredge the Calumet River and Lake Calumet to accommodate deep draft vessels (Ed Hanses, U.S. Army Corps of Engineers, personal communication). Also, a harbor facility is proposed to be constructed at Lake Calumet (National Oceanic and Atmospheric Administration, Calumet and Indiana Harbors Navigation Chart, 1975). All of these wetlands are surrounded by roads and rail lines. Tailings ponds are located adjacent to Lake Calumet Wetlands #1 and #2 and Calumet River Turning Basin #5 Wetlands #1 and #2.

O'Brien Lock and Dam Area Wetlands #1-#5 and Grand Calumet River Mouth wetlands #1-#3 are located adjacent to the Little Calumet River and the Grand Calumet River. The Calumet Expressway lies to the west of all of these wetlands, and roads lie to the east and north. Tailing ponds are adjacent to O'Brien Lock and Dam Area Wetlands #3 and #4 and rail lines lie adjacent to or cross through these wetlands.

Little Calumet River Wetlands #1-#3 are located on either side of the Little Calumet River. A forest preserve lies to the west of these wetlands and a large fill are lies to the north. Rail lines, secondary highways, access roads and an expressway are all located nearby.

The highly urbanized nature of the Lake Calumet area suggests that strong development pressures exist on the Lake Calumet Wetland Complex with the exception of William W. Powers Conservation Area Wetland #1; Wolf Lake Park Wetlands #1-#4; and Powder Horn Lake Wetlands #1-#3, which are under government ownership.

Recreation

Powder Horn Lake Wetlands #1-#3 are located in one of the city of Chicago Forest Preserves. Major summer activities in these preserves include swimming, picnicking, bird watching, camping, fishing, hiking, horseback riding, boating, and bicycling. Winter activities include cross-country skiing, sledding, and ice skating. It is not known which of these recreational activities are permitted directly within the wetland areas (Cook County Park District, personal communication).

Wolf Lake Park Wetlands #1-#4 are situated in Wolf Lake Park. Recreational activities in the park include swimming, fishing, canoeing, and sailing, and a nature study area is located on a small island off the shore of the lake. The eastern portion of the park receives more intensive use than does the western side (City of Hammond Planning Department, personal communication).

Recreational opportunities in the William W. Powers conservation area include picnicking, fishing, boating, hiking, trails, and hunting in season. (Illinois Department of Conservation, personal communication).

Mineral, Energy, and Forest Resources

The Lake Calumet Wetland Complex is underlain by scattered deposits of sand and mixed sand and gravel; extensive stone resources, principally dolomite deposits; and thin lake clays and alluvial materials. The dolomite deposits are thick in numerous places and many are of high quality (Major, 1968). There are, however, no quarrying or sand and gravel operations present within the wetland complex area and only one operating clay pit exists in the vicinity (U.S.G.S. quadrangle map, Lake Calumet, Illinois-Indiana, 1973).

Significant forest stands in the area are located principally within municipal forest preserves. Powder Horn Lake Wetlands #1-#3 are located within one of these forest preserves (U.S.G.S. quadrangle map, Lake Calumet, Illinois-Indiana, 1973).

Public Utilities and Facilities

Power lines extend across many of the wetlands located in the Lake Calumet Wetland Complex. These lines are situated to the west of Lake George Canal Wetland #3; Lake George Wetland #2; Wolf Lake Park Wetlands #1-#3; William W. Powers Conservation Area Wetlands #1-#3; Powder Horn Lake Wetlands #1-#3; and Grand Calumet River Mouth Wetland #3. Power lines are located to the east of William W. Powers Conservation Area Wetland #2 and Grand Calumet River Mouth Wetland #2, and a power line passes directly through Wolf Lake Park Wetland #4. A filtration plant is situated northeast of Lake George Wetland #1 and a sewage disposal plant is located to the west of Lake Calumet Wetland #7 (U.S.G.S. quadrangle map, Lake Calumet, Illinois-Indiana, 1973). There are no public utilities situated within 0.5 mile of any of the remaining wetlands of the Lake Calumet Wetland Complex.

Pollution Sources

There are numerous disposal sites in the Lake Calumet Wetland Complex registered with the Illinois Environmental Protection Agency as point sources of pollution under the NPDES program. These areas are north of Wolf Lake, on the east and west sides of Lake Calumet, and in the vicinity of O'Brien Lock and Dam and Lake George Canal. The exact location of these disposal sites can be obtained from the Illinois Division of Water Pollution Control.

Several industrial dischargers are located in the vicinity of Powder Horn Lake Wetlands #1-#3 and O'Brien Lock and Dam Area Wetlands #1-#5. Although none of the industrial dischargers are located within the wetlands, they may have an impact on them. In addition to these point sources of pollution, it is probable that leaching, transient pollutants, and air-borne pollutants are present in the wetland complex, but their existence can not be verified through a literature search. On-site sampling would be necessary to identify the sources and extent of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of any of the 36 wetlands of the Lake Calumet Wetland Complex. No systematic survey of the archaeological resources of this area has been completed.

RESEARCH PROJECTS LM 137-172

There are no current or impending research projects in the Lake Calumet Wetland Complex.

PHYSIOGRAPHIC SETTING LM 173-174

Setting

Illinois Beach State Park Wetland Complex is comprised of Waukegan Wetland and Illinois Beach State Park Wetland. Waukegan Wetland is located in Lake County, Illinois, while Illinois Beach State Park Wetland is situated in Lake County, Illinois and Kenosha County, Wisconsin. Both wetlands are approximately 0.2 mile from the Lake Michigan shoreline and are in close proximity to the cities of Waukegan, Zion, and Winthrop Harbor, Illinois.

Waukegan Wetland and Illinois Beach State Park Wetland are grouped as a complex because they are located very close to one another and because they exhibit similar physiographic characteristics. The wetlands occupy low non-wooded sites within an area which extends approximately 1.0 mile inland from Lake Michigan for approximately 9.0 miles along the shoreline (U.S.G.S. quadrangle map, Zion, Illinois, 1972).

Portions of both wetlands lie within the Illinois Beach State Park. This park includes prairie and natural sand prairie, in addition to the wetland areas (U.S. Army Corps of Engineers, 1972). The northern portion of Illinois Beach State Park includes part of the Chiwaukee Prairie which is designated as a Wisconsin State Scientific Area (Germain, et al., 1977).

Topography

Elevations in the wetland complex range from 585 to 600 feet above sea level. Waukegan Wetland has a total relief of approximately five feet with elevations ranging froom 585 to 590 feet above sea level, which is five to ten feet above the approximate mean elevation of Lake Michigan. Illinois Beach State Park Wetland has a total relief of approximately 15 feet with elevations ranging from 585 to 600 feet above sea level (five to twenty feet above lake level).

The wetland area has been described by Hester and Fraser (1973) as a beach ridge complex consisting primarily of beach ridges, dunes, and wetlands. The area is transitory because of ongoing erosion and aggradation (Visoky, 1977). The Great Lakes Basin Commission (1975) has defined this area as an erodible low plain with critical erosion problems. The area inland from the wetland complex features gently rolling to flat moraine topography (U.S.G.S. quadrangle map, Zion, Illinois, 1972).

Surficial Geology

The surficial geology of the Illinois Beach State Park Wetland Complex consists of the Carmi and Dolton Members of the Equality Formation. The Equality Formation is composed of silt, sand, gravel and clay deposits which accumulated in areas that were once covered by glacial lakes (Willman, 1971).

The Carmi Member encompasses most of the Waukegan Wetland and is present inland in the Illinois Beach State Park Wetland. The Dolton Member is present along the shore of the Illinois Beach State Park Wetland (Willman and Lineback, 1970).

The Carmi Member of the Equality Formation is predominantly silt, either well bedded or laminated. Much of this formation is sandy and contains beds of fine sand and clay. Where these deposits occur in lake basins, they are only a few feet thick and rarely as much as 20 feet thick (Willman, 1971).

The Dolton Member of the Equality Formation is predominantly sand, but contains beds of silt, pebbly sand, and gravel. These deposits consist of shore and shallow water lake deposits which commonly occur in low ridges that were previously beaches, bars, and spits. Pebbly sand and gravel is largely confined to narrow belts along the more prominent shorelines where waves eroded the till, washed away the silt and clay, and left a concentrate of sand and pebble. The deposits are generally less than 10 feet thick but may be as much as 25 feet thick (Willman, 1971).

Additional information on the surficial geology of the Illinois Beach State Park Wetland complex can be found in Illinois State Geological Survey (1975) and Larsen (1973).

Soils

The soil association for both wetlands in the Illinois Beach State Park Wetland Complex is Marsh-Fox-Boyer. This soil is characterized by wet, marshy areas and level to rolling, well drained to moderately well drained soils that are moderately deep over sand and gravel and have rapid to moderate permeability. In addition to this soil association, there are some man-made areas and gravel pits present in the complex (Paschke and Alexander, 1970).

Hydrology

Specific information on the hydrology of Waukegan Wetland, such as water level influence, groundwater discharge patterns and runoff, water quality, depth, and seasonal changes is unavailable. No rivers or streams flow directly through the Waukegan Wetland.

Four streams drain into the Illinois Beach State Park Wetland: Lake Michigan Tributary at Winthrop Harbor, Kellogg Ravine between Winthrop Harbor and Zion, Bull Creek south of Zion, and Dead River at Farnum Point. Most of the year, the Dead River is a ponded stream, except during heavy storm periods when it picks up much of the flow from Bull Creek as it drains the wetland. A barrier bar (a continous wave-pounded beach deposit) blocks the drainage of Dead River into Lake Michigan (Visoky, 1977). The elevation of each of these streams as they enter the wetland is 600 feet. Their elevation as they leave the wetland is 585 feet (U.S.G.S. quadrangle map, Zion, Illinois, 1972).

Table 8-10 describes surface water characteristics for Lake Michigan Tributary, Kellogg Ravine, and Bull Creek. Data on Dead River are unavailable. Groundwater data, measured weekly, were recorded between January 1975 and April 1976. Table 8-11 presents the location of the piezometer, the depth of the water below the surface, the date of measurement, and the high and low readings.

Hydrologic data which may reflect conditions in Illinois Beach State Park Wetland are presented in Tables 8-12 and Table 8-13. No data are available for nitrogen, phosphorous, pH, dissolved oxygen, carbon, or salinity. Visoky (1977), however, discusses a number of other chemical parameters for the streams entering the wetland, such as cations and anions.

Specific information on water level influence, runoff, depth, and seasonal changes related to Illinois Beach State Park Wetland is unavailable.

Climate

The closest weather station providing climatic data for the Illinois Beach State Park Wetland Complex is located in Waukegan, Illinois. In 1975, the average monthly temperature was 47.5°F; the average daily low for January was 16.4°F and the average daily high in July was 81.4°F. Mean monthly precipitation is 1.96 inches in January and 3.33 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 14 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Illinois Beach State Park Wetland Complex.

BIOTIC SETTING LM 173-174

Vegetation

Literature useful in providing a characterization of major species composition and distribution by habitat type is provided by Evers (1963), Ross (1963), The Illinois Natural History Survey (1976), and Paulson (1977). Habitat types within the Illinois Beach State Park Wetland include marshes, the open water of the Dead River, prairies, conifer forest, deciduous forest, and dunes.

Marsh vegetation is variable, being characterized by grasses (*Calamogrostis*, *Pragmites*, *Spartina*, *Sphenopholis*), cattails (*Typha angustifolia*, *T.* x *glauca*, *T. latifolia*), rushes (*Juncus* spp.), carices (*Carex* spp.), and bulrushes (*Scirpus* spp.). Species associated with the above vegetation include sweet flag (*Acorus calamus*), arrowhead (*Sagittaria* spp.) mild water-pepper (*Polygonum hydropiperoides*), water-hemlock (*Cicuta bulbifera*), and water-parsnip (*Sium* sp.). Of special significance among marsh vegetation are the numerous orchids occurring along marsh margins. Orchids reported by Pepoon (1927) include *Calopogon pulchellus*, *Cypripedium candidum*,

Table 8-10. 1965-1975 Surface Water Data for Illinois Beach State Park Wetland[a]

	Drainage area (sq. mi.)	Channel slope (ft./mi.)	Maximum discharge cfs (1965-74)	Streamflow cfs (4/23/75)
Lake Michigan Tributary	1.5	47	355 (1969)	0.48
Kellogg Ravine	5.0	32	605 (1972)	10.30
Bull Creek	4.5	66	--	1.94

[a]Visoky (1977)

Table 8-11. 1975-1976 Ground Water Data for Illinois Beach State Park Wetland (feet below surface)[a]

Location	Low	Date	High	Date
46N 12E 10	5.43	10/8/75	1.86	3/10/76
46N 12E 237	5.00	10/8/75	2.34	4/30/75
46N 12E 27	6.12	10/8/75	2.38	2/26/75
46N 12E 34	2.81	8/12/75	0.80	3/19/75

[a]Visoky (1977)

Table 8-12. 1975 Water Quality Data for Streams Entering Illinois Beach State Park Wetland[a]

	Hardness (mg/l)	Dissolved solids (mg/l)	Temperature (°F)
Lake Michigan Tributary			
January 1975	344	478	32
July 1975	312	292	73
Kellogg Ravine			
January 1975	362	532	32
July 1975	204	277	78
Bull Creek			
January 1975	414	688	--
July 1975	372	472	77
Dead River			
January 1975	--	--	--
July 1975	--	--	82

[a]Visoky (1977)

Table 8-13. 1975 Water Quality Data for Streams Leaving Illinois Beach State Park Wetland[a]

	Hardness (mg/l)	Dissolved solids (mg/l)	Temperature (°F)
Lake Michigan Tributary			
January 1975	344	412	--
July 1975	264	292	83
Kellogg Ravine			
January 1975	348	514	35
July 1975	268	352	81
Bull Creek			
January 1975	138	164	34
July 1975	136	160	64
Dead River			
January 1975	--	--	--
July 1975	--	--	--

[a]Visoky (1977)

C. arietinum var. parviflorum, C. arietinum var. pubescens, Habenaria clavellata, H. dilatata, H. hyberborea, H. x media, Liparis loesilii, Pogonia ophioglossoides, and Spiranthes cernua. Dominant among woody vegetation of marsh areas are the willows (Salix candida, S. lucida, S. pedicellaris, S. serissima), among which Pepoon reported extensive hybridization. Aquatic species characteristic of the waters of the Dead River include duck weeds (Lemna spp.), water-meal (Wolffia columbiana), pond weeds (Potamogeton spp.), water milfoil (Myriophyllum sp.), white water-lily (Nymphaea tuberosa), yellow water-lily (Nuphar advena), and white buttercup (Ranunculua trichophyllus). Arrowgrass (Triglochin spp.) occurs along the margins of beach pools in which the algae Chlamydamonas and Oscillatoria predominate.

Prairies in the area are of two types, wet and dry sand. Dominant vegetation in wet prairies includes prairie cordgrass (Spartina pectinata), blue-joint grass (Calamagrostis canadensis) and carices (Carex spp.). Fringed gentians (Gentiana crinita) occur in some wet prairies. Dry sand prairie vegetation is compsed primarily of such grasses as little bluestem (Andropogon scoparius), switchgrass (Panicum virgatum), Indiana grass (Sorghastrum nutans), and beach reed (Calmovilfa longifolia var. magna). In the sand prairies, especially in blowouts, as well as in the forest, the creeping juniper (Juniperus horizontalis) and bearberry (Arctostaphylos uva-ursi) are abundant.

About a century ago Robert Douglass, a nurseryman, scattered seeds of a variety of coniferous species which germinated to produce a man-made conifer forest unique to this region of Illinois. Currently some species are thriving and reproducing naturally. Austrian pine (Pinus nigra) is most abundant, followed by scotch pine (Pinus sylvestris), white pine (Pinus strobus), pitch pin (Pinus rigida), and European larch (Larix decidua).

Deciduous forest is present on the lee slopes of dune ridges. Black oak (Quercus velutina) is dominant, with associates including white oak (Quercus alba), bur oak (Quercus macrocarpa), cottonwood (Populus deltoides), and quaking aspen (Populus tremuloides). Humus is not abundant in this forest.

Vegetation of the beach and dune area is scattered. Characteristic plants of the upper beach are beach pea (Lathyrus maritimus), sea rocket (Cakile edulenta), beach grass (Ammophila arenaria), and beach reed, the last two serving as sand binders in early dune formation. On the exposed fore dunes are sand cherry (Prunus pumila), bearberry, creeping juniper, shrubby juniper (Juniperus communis), summer grape (Vitis aestivalis), and poison ivy (Rhus radicans). Prickly pear (Opuntia sp.) occurs on higher dry ridges of pure sand.

Botanically and topographically the Illinois Beach State Park Wetland is highly diverse. The Illinois Natural History Survey (1976) reports 735 species of vascular plants for the area. This high degree of species diversity is a reflection of habitat diversity and the relatively unspoiled nature of the area; however, Gates (1912), Pepoon (1927), Atwell (1932) and later authors all warn of the potential for destruction of this natural area by the encroachment of man.

The literature search yielded no site-specific information pertaining to density and productivity or relationship to water levels of the vegetation of

the Illinois State Beach Park Wetland Complex, nor to species composition and distribution of vegetation in Waukegan Wetland.

Fish

Current literature regarding species composition, spawning and hatching areas, and recreational use of the fish fauna has been published for Illinois Beach State Park Wetland by Tichacek and Wight (1972), Illinois Beach Management Plan Task Force (1973), and Evers and Page (1977). Collections have also been made in this wetland by the Illinois Natural History Survey and the Illinois Division of Fisheries, and their unpublished records are a source of information on fishes of the wetland. Fifteen species of fishes have been reported specifically from the Dead River, including carp (Cyprinus carpio), goldfish (Carassius auratus), white sucker (Catostomus commersoni), brown bullhead (Ictalurus nebulosus), black bullhead (Ictalurus melas), central mudminnow (Umbra limi), bluegill (Lepomis macrochirus), pumpkinseed (Lepomis gibbosus), green sunfish (Lepomis cyanellus), largemouth bass (Micropterus salmoides), ninespine stickleback (Pungitius pungitius), and slimy sculpin (Cottus cognatus) (Tichacek and Wight, 1972). A more comprehensive list of fishes was compiled by the Illinois Beach Management Plan Task Force (1973) and is included in Table 8-14. Because of its clean waters and proximity to Lake Michigan, the Illinois Beach State Park Wetland provides habitats for fishes rare or absent elsewhere in Illinois, including rainbow smelt (Osmerus mordax), lake chub (Couesius plumbeus), longnose dace (Rhinichthys cataractae), spottail shiner (Notropis hudsonius), lake chubsucker (Erimyzon sucetta), nine-spine stickleback, and slimy sculpin (Evers and Page, 1977). Yearling northern pike occurred in Dead River, indicating probable use of this wetland for spawning by pike, and a recreational fishery for northern pike was noted in Dead River (Tichacek and Wight, 1972).

Table 8-14. Fishes of Bull Creek and Dead River, Lake County, Illinois[a]

Species	Species
skipjack herring	southern redbelly dace
central mudminnow	creek chub
grass pickerel	lake chubsucker
northern pike	white sucker
rainbow smelt	shorthead redhorse
golden shiner	yellow bullhead
fathead minnow	brown bullhead
bluntnose minnow	black bullhead
goldfish	tadpole madtom
carp	pumpkinseed
blacknose dace	green sunfish
longnose dace	bluegill
emerald shiner	largemouth bass
common shiner	white crappie
spottail shiner	least darter
blacknose shiner	johnny darter
red shiner	yellow perch
blackchin shiner	brook stickleback
lake chub	ninespine stickleback
stoneroller	

[a] Meek Hildebrand (1910), Illinois Beach Management Plan Task Force (1973), Tichacek and Wight (1972), Evers and Page (1977).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, life histories, food sources, or commercial use of the fish populations in the Illinois Beach State Park Wetland Complex, nor to species composition or spawning and hatching areas in the Waukegan Wetland.

Invertebrates

Information on the occurrence of selected species in the Illinois Beach State Park Wetland available in Ross (1944, 1963), Evers and Page (1963) and Illinois Natural History Survey (1976) is discussed below. The aquatic vegetation of the Dead River supported species found nowhere else in the state. Fabria inornata, Triaenodes baris and Polycentropus remotus were found only in this locality in Illinois (Evers and Page, 1963). The Phryganeidae were common, including Phryganea cinera and P. sayi, Banksiola selina and Agrypnia vestita. Of the Leptocerids, Triaenodes aba was common, as was Polycentropus remotus (Ross, 1944). Ross (1963) reported another northern species of caddisfly, Triaenodes tarda. The butterfly, Callophrys polios, was abundant only in this locality in Illinois (Evers and Page, 1963).

General information for Lake Section 8 may be found in Hebard (1934), Illinois Natural History Survey (1976), McDonald (1951) and Ross (1944). The content of these studies as it may apply to the two wetlands of the Illinois Beach State Park Wetland Complex is discussed in Appendix B-2. The species presented in the discussion may or may not occur in wetland habitat in this complex.

The literature search yielded no site-specific information pertaining to density and productivity, seasonal distribution and abundance, major food sources, or relationship to water levels for the invertebrates present in the Illinois Beach State Park Wetland Complex, nor to species composition in Waukegan Wetland.

Reptiles and Amphibians

Nine species of amphibians and 13 reptiles appear on a list of animals observed at Illinois Beach Nature Preserve (Illinois Beach State Park Task Force, 1973). This list departs slightly from older records (from Illinois Beach, Waukegan, and Waukegan Flats) of Schmidt and Necker (1935), Necker (1939), and Pope (1944). The pickerel frog (Rana palustris) and the Illinois (yellow) mud turtle(Kinosternon flavescens spooneri) have only recently been recorded in the area (Illinois Natural History Survey, 1976). It is clear that neither species is common locally. All of the amphibians and 11 of the 13 reptilian species that have been recently documented require wetlands or at least tend to associate with them.

Species found in the Illinois Beach State Park Wetland which have commercial value in some portions of their geographic ranges include the northern leopard frog (Rana pipiens), common snapping turtle (Chelydra serpentina), Blanding's turtle (Emydoidea blandingi), and midland painted turtle (Chrysemys picta marginata). The Illinois Natural History Survey (1976) indicates that the bullfrog (Rana catesbeiana) has been extirpated, but for reasons not stated. The Chicago garter snake (Thamnophis sirtalis semifasciata), unique to the Chicago region, occurs in the Illinois Beach Nature Preserve.

The literature search yielded no site-specific information pertaining to density and productivity, seasonal distribution and abundance, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the reptiles and amphibians of the Illinois Beach State Park Wetland Complex, nor to the species composition in Waukegan Wetland.

Avifauna

Census data is available from the Wakegan Christmas Bird Count (Table 8-15) and may be representative of the Waukegan Wetland. The Waukegan Christmas Bird Count encompasses the Waukegan as well as the southern portion of the Illinois Beach State Park Wetland and ten miles of Lake Michigan shoreline.

Avian research has been conducted in the Illinois Beach State Park Wetland. Gustafson identifies 160 species of birds on his checklist of animals observed at Illinois Beach Nature Preserve (Illinois Beach state Park Task Force, 1973).

Table 8-15. Waterfowl of the Waukegan Census Area in the 1972-1976 Christmas Bird Counts[a]

	1976	1975	1974	1973	1972
Canada goose	10	27		4	3
snow goose					1
mallard	838	1035	405	177	295
mallard x black duck	1				1
black duck	18	81	22	9	12
gadwall		1			
pintail	2				
green-winged teal	1				
wood duck	6	5	2	1	
redhead	1	1	4		3
ring-necked duck		2	3		
canvasback	14	21	86	26	11
greater scaup	25	39	25		3
scaup sp.	55	472	251	260	23
lesser scaup	13	133	206		1
common goldeneye	497	584	562	231	606
bufflehead	80	45	73	20	21
harlequin duck		3			
oldsquaw	55	394	57	7	37
dark-winged scoter sp.			1		
white-winged scoter			25		1
ruddy duck	1	4	21	1	1
hooded merganser	2	2	1	1	
common merganser	29	22	8	1	4
red-breasted merganser	5	8	6	4	5
American coot	6	19	3	3	2

[a]The Waukegan Census encompasses the southern portion of the Illinois Beach State Park Wetland, the Waukegan Wetland, and 10 miles of the Lake Michigan shoreline (Arbib, 1973, 1974, 1975, 1976, 1977)

This list includes 48 species of wetland birds designated as visitants to ponds, moist prairie, or marsh according to the Illinois Natural History Survey (1976). The list gives 21 species of waterfowl, some of which are restricted to open waters of Lake Michigan, and five additional migratory wetland game bird species.

Combined information from the two aforementioned references indicates that only the mallard (Anas platyrhynchos) and American coot (Fulica americana) may be expected to breed locally. The commonly observed nonbreeding waterfowl that visit ponds and marshes are the Canada goose (Branta canadensis), black duck (Anas rubripes), pintail (A. acuta), green-winged teal (A. checca), blue-winged teal (A. discors), northern shoveler (A. clypeata), American wigeon (A. americana), wood duck (Aix sponsa), ring-necked duck (Arthya collaris), lesser scaup (A. affinis), and ruddy duck (Oxyura jamaicensis). Common offshore transient or wintering waterfowl include the snow goose (Chen caerulescens), common goldeneye (Bucephala clangula), bufflehead (B. albeola) and oldsquaw (Clangula hyemalis). Other migratory game birds that are commonly observed and that may breed locally are the king rail (Rallus elegans), sora (Porzana carolina) and common gallinule (Gallinula chloropus). Common migratory game birds that visit wetlands, but do not breed there, are the American woodcock (Philohela minor) and common snipe (Capella gallinago). Common nongame species that associate with wetlands and have been observed breeding locally include the pied-billed grebe (Podilymbus podiceps), green heron (Butorides striatus), least bittern (Ixobrychus exilis), killdeer (Charadrius vociferus), common tern (Sterna hirundo), belted kingfisher (Megaceryle alcyon), barn swallow (Hirundo rustica), purple martin (Progne subis), short-billed marsh wren (Cistothorus platensis), eastern meadowlark (Sturnella magna), red-winged blackbird (Agelaius phoeniceus) and swamp sparrow (Melospiza georgiana).

Scharf et al. (1977) report that the southern section of the Illinois Beach State Park lies in the path of heavy hawk migration. A hawk census was conducted in the park in the fall of 1976 (Johnson, 1977); twelve species of hawks totalling 800 individuals were seen. This area is also the site where people trapped for falconry in the past. There has been a recent observation of the gyrfalcon (Falco rusticolus) at Illinois Beach State Park (Brooks and Current, 1975).

The northern tip of Illinois Beach State Park Wetland lies in Wisconsin. Part of this area is Chiwaukee Prairie, a state scientific area. Tessen (1976) reports that breeding birds of Chiwaukee Prairie innclude the mallard, blue-winged teal, sora and Virginia rails (Rallus limicola), upland sandpiper (Bartramia longicauda), long-billed marsh wren (Cistothorus palustris), and swamp sparrow. Other wetland birds observed as regular visitants of the Chiwaukee Prairie include the American bittern (Botaurus lentiginosus), three species of herons, common snipe, american woodcock, winter wren (Troglodytes troglodytes), six species of warblers and Le Conte's sparrow (Ammospiza leconteii).

The literature search provided no site-specific information pertaining to density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds of Illinois Beach State Park Wetland, nor to seasonal distribution and abundance in Waukegan Wetland.

Mammals

Sixteen mammalian species have been recorded at the Illinois Beach State Park Wetland (Table 8-16). The eastern cottontail (Sylvilagus floridanus), beaver (Castor canadensis), muskrat (Ondatra zibethicus), red fox (Vulpes vulpes), raccoon (Procyon lotor), long-tailed weasel (Mustela frenata), mink (Mustela vison), stripped skunk (Mephitis mephitis), and white-tailed deer (Odoroileus virginianus) are important commercially. However, hunting and trapping is limited since these activities are illegal on the portion of this wetland which lies within Illinois Beach State Park.

Some general information both historical and current, concerning the Illinois Beach State Park Wetland Complex is provided by Hier (1968) and the Illinois Natural History Survey (1976). The present relative abundance in the Illinois coastal zone of Lake Michigan has been determined for 16 species of wetland mammals and may apply to the wetlands of this complex (Appendix E-4).

The literature search yielded no site-specific information pertaining to seasonal distribution and abundance, density and productivity, life histories, major food sources, or relationship to water levels of the mammals inhabiting the Illinois Beach State Park Wetland Complex, nor to species composition or recreational and commercial uses in Waukegan Wetland. However, specific information concerning the Illinois Beach State Park Wetland may apply also to the Waukegan Wetland because of their proximity.

Table 8-16. Major and Key Mammalian Species of Illinois Beach State Park[a]

Common Name	Common Name
virginia opossum	muskrat
short-tailed shrew	coyote[b]
Franklin's ground squirrel	red fox
least shrew	raccoon
red bat	long-tailed weasel
eastern cottontail	mink
beaver[c]	striped skunk
deer mouse	white-tailed deer[c]
meadow vole	

[a] According to the Illinois Beach State Park Task Force (1972)
[b] Extirpated species
[c] Reintroduced species

Endangered Species

No species of vegetation, fish or invertebrates currently appearing on the Federal list (U.S. Fish and Wildlife Service, 1977) are known to occur in this wetland complex. However, the following threatened species on the list of endangered and threatened fishes for the State of Illinois occur or may once have occurred in the coastal wetlands (James Allen, Illinois Dept. of Conservation, personal communication).

lake sturgeon	Acipenser fulvescens
lake whitefish	Coregonus clupeaformis
cisco (lake herring)	Coregonus artedii
pugnose shiner	Notropis anogenus
blacknose shiner	Notropis heterolepis
longnose sucker	Catostomus catostomus

Of these, only the blacknose shiner has recently been recorded in the literature as occurring in the coastal wetlands (Illinois Beach Management Plan Task Force, 1973).

No amphibian or reptile species currently appearing on the Federal list (U.S. Fish and Wildlife service, 1977) are known to occur in this wetland complex. The Illinois (yellow)mud turtle is included in the proposed Illinois State List of Endangered Species (Donald L. Wills, personal communication). Two specimens have been collected in Illinois Beach State Park (Illinois National History Survey, 1976).

Gustafson includes the peregrine falcon (Falco peregrinus) and bald eagle (Haliaeetus leucocephalus) on his list of animals observed at Illinois Beach Nature Preserve (Illinois Beach state Park Task Force, 1973). These species are included on the Federal Endangered Species List. The peregrine falcon was observed at the Illinois Beach State Park on September 19 and 26, 1976 (Johnson, 1977) and at Waukegan on september 25 and October 10, 1977 (Kleen, 1977).

Gustafson reports the following birds at the Illinois Beach Nature Preserve which are on the Illinois Endangered Species List: great egret (Casmerodius albus), American bittern, Cooper's hawk (Accipiter cooperii), osprey (Pandion haliaetus), upland sandpiper common tern, black tern (Chidonias niger) and short-eared owl (Asio flammeus). None of these species are believed to have bred locally in recent years (Illinois Natural History Survey, 1976); however, all may utilize wetlands for feeding or refuge.

The river otter (Lutra canadensis), was abundant historically in the Illinois Beach State Park Wetland Complex but has not been recorded in this region since 1900 (Hier, 1968). No other mammalian species presently on the Federal or Illinois endangered and threatened species lists are found in the wetlands of this complex.

Population

Waukegan Wetland is located in Waukegan Township of Lake County, Illinois. Illinois Beach State Park Wetland extends from the Lake County townships of Zion and Benton to Pleasant Prairie Township in Kenosha County, Wisconsin.

Lake County and Kenosha County are urban areas with population densities per square mile of 837 persons and 433 persons respectively. The demographic characteristics of the two counties as well as the relevant townships are presented in Table 8-17. All of these areas, with the exception of Benton and Waukegan Townships, experienced small to moderate growth between 1970 to 1975. The population of Benton Township declined rapidly during the five year period and population was stable in Waukegan Township. The 1990 projections suggest that rapid growth is expected in both counties.

Table 8-17. Population Data for the Vicinity of the Illinois Beach State Park Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Lake County, Illinois	407,373	+6.5	609,836
Benton Township	13,598	-9.1	20,800
Waukegan Township	76,680	0	109,900
Zion Township	17,504	+1.4	27,200
Kenosha County, Wisconsin	122,621	+4.0	159,900
Pleasant Prairie Township	12,040	+0.2	--

[a] U.S. Bureau of the Census (1977a)
[b] Lake County Regional Planning Commission (1975) and Southeastern Wisconsin Regional Planning Commission (personal communication)

Land Use and Ownership

Land use within Waukegan Wetland and Illinois Beach State Park Wetland is primarily rural open space. The northern portion of Waukegan wetland and the southern portion of Illinois Beach State Park Wetland lie within the Illinois Beach State Park, and as such are subject to recreational use. Waukegan Wetland is located adjacent to a tailings pond and much of this wetland has been recently filled by tailings (U.S.G.S. quadrangle map, Zion, Illinois, 1972).

Illinois Beach State Park Wetland is crossed by several roads, and a rail line lies in the wetland near its western boundary. A small boat dock is located on the Lake Michigan shoreline next to the Illinois Beach State Park Wetland and a tailings pond is located to the south of the wetland. Part of the

southern end of this wetland has been filled to accommodate industrial development. The southern portion of Waukegan Wetland is under private ownership, as are scattered areas along the western boundary of Illinois Beach State Park Wetland. The northern section of Illinois Beach State Park Wetland is under mixed private and governmental (state and local) ownership (Lake County Regional Planning commission, personal communication, Illinois Division of Water Resources, 1975, and Rockford Map Publishers, Inc., 1977). The northern tip of the Illinois Beach State Park Wetland, extending into the state of Wisconsin, is within an area planned as a primary environmental corridor (Southeastern Wisconsin Regional Planning Commission, 1975). This corridor includes part of the Chiwaukee Prairie State Scientific Area. The 83 acre scientific area is owned by the University of Wisconsin (University of Wisconsin-Parkside, personal communication, and Germain et al., 1977).

Land use in the area surrounding the wetland complex is characterized by residential development, with the communities of Waukegan, Zion, Dunes Park, and Winthrop Harbor, Illinois situated to the west. The community of Carol Beach, Wisconsin is located to the north of the Illinois Beach State Park Wetland. Areas of intensive industrial development are located immediately south of the wetlands. A small subdivision and an area of industrial development are located along the eastern boundary of the Illinois Beach State Park Wetland (U.S.G.S. quadrangle map, Zion, Illinois, 1972, and Rockford Map Publishers, Inc., 1977).

The close proximity of the Waukegan Wetland and Illinois Beach State Park Wetland to urbanized areas suggests that portions of these wetlands may be subject to development pressures. However, because a large portion of the wetlands lies within the Illinois Beach State Park, large sections of the wetlands area likely to remain in their current state.

Recreation

Recreational opportunities within the vicinity of the wetland complex are primarily afforded by the Illinois Beach State Park, encompassing the southern portion of Illinois Beach State Park Wetland and the northern portion of Waukegan Wetland. The park has been designated as three areas: 1) a general recreation area in the northern portion of the park, 2) a nature study area between Beach Road and Dead River, and 3) a wildlife refuge area south of the Dead River. Primary recreational uses are fishing, bathing, boating, picnicking, camping, and use as a nature preserve (U.S.G.S. quadrangle map, Zion, Illinois, 1972; Illinois State Beach Management Plan Task Force, 1973).

As a state scientific area, Chiwaukee Prairie is not intended for intensive recreational uses such as picnicking or camping. In 1977, for example, the area received only 266 visitor contacts for recreational use. Chiwaukee Prairie, however, does receive wide-ranging educational and nature study use. Total use of the scientific area has been estimated as 2,400 visitor contacts yearly (Younkman, 1978, and Germain et al., 1977).

Mineral, Energy, and Forest Resources

The area adjacent to the Illinois Beach State Park Wetland Complex along the shore of Lake Michigan has several continuous deposits of clean sand with a little fine gravel (Larsen, 1973). No sand or gravel operations are present, however, in either Waukegan Wetland or Illinois Beach State Park Wetland (U.S.G.S. quadrangle map, Zion, Illinois, 1972).

Black oak woods and pine plantations are present within the Illinois Beach State Park Wetland (U.S. Army Corps of Engineers, 1972). No significant forest resources exist in Waukegan Wetland.

Public Utilities and Facilities

The Zion Nuclear Power Plant is located on the eastern edge of the Illinois Beach State Park Wetland. This plant is owned by the Commonwealth Edison Company and contains two units, each rated at 1085 megawatts. Power lines from the plant extend north and west through portions of the wetland. The Waukegan Electric Generating Plant is situated to the south of the Illinois Beach State Park Wetland and to the west of the Waukegan Wetland. The Waukegan plant is owned by the Commonwealth Edison Company and burns mostly coal, with some smaller units burning oil. A series of power lines from the Waukegan Power Plant are situated immediately south of the Illinois Beach State Park Wetland. Both generating plants utilize Lake Michigan as a source of condensing water (Federal Energy Administration, 1977, and U.S.G.S. quadrangle map, Zion, Illinois-Wisconsin, 1972).

Pollution Sources

An ash pond owned by Commonwealth Edison is situated adjacent to the southeast edge of the Illinois Beach State Park Wetland. This ash pond also borders the western edge of Waukegan Wetland (Illinois Environmental Protection Agency, 1976).

Historical and Archaeological Features

No historical sites, structures, or landmarks exist within 500 feet of the Illinois Beach State Park Wetland Complex (Elaine Holien, personal communication). An account of the early history of this area is given by the Illinois Beach State Park Task Force (1973).

The Illinois Beach State Park encompasses an area which contains 43 archaeological sites (Elain Holien, personal communication). Specific location and research documentation can be obtained from the Illinois Department of Conservation, Historic Sites and Program Division.

RESEARCH PROJECTS

LM 173-174

An environmental assessment is currently being prepared for the Illinois Department of Conservation for a proposed recreational facility and safe harbor in the vicinity of the Illinois Beach State Park. The completion date for this

ongoing study is May, 1978 (Applied Environmental Research, personal communication).

Table 8-18. Data Gaps - Lake Section 8

	Data Gap*	Wetland Number	137-172	173-174
Physiographic Setting		Setting		
		Topography		
		Surficial Geology		
		Soils		
	Hydrology	Water Level Fluctuations	*	*
		Groundwater	*	
		Water Quality	*	
		Depth	*	*
		Seasonal Changes	*	*
		Climate		
		Special Features		
Biotic Setting	Vegetation	Major Species Distribution	*	
		Major Species Composition	*	
		Density/Productivity	*	*
		Relationship to Water Levels	*	*
	Fish	Major species	*	
		Species Composition	*	
		Seasonal Distribution	*	*
		Spawning and Hatching Areas	*	
		Commercial/Recreational Use	*	
		Life Histories	*	*
		Food Sources	*	*
	Invertebrates	Species Composition	*	*
		Seasonal Distribution	*	*
		Density/Productivity	*	*
		Food Sources	*	*
		Relationship to Water Levels	*	*
	Amphibians/Reptiles	Major Species	*	
		Seasonal Distribution	*	*
		Density/Productivity	*	*
		Recreational/Commercial Use	*	
		Life Histories	*	*
		Food Sources	*	*
		Relationship to Water Levels	*	*
	Avifauna	Major Species	*	
		Seasonal Distribution	*	
		Density/Productivity	*	*
		Recreational/Commercial Use	*	*
		Life Histories	*	*
		Food Sources	*	*
		Relationship to Water Levels	*	*
	Mammals	Major Species	*	
		Seasonal Distribution	*	*
		Density/Productivity	*	*
		Recreational/Commercial Use	*	
		Life Histories	*	*
		Food Sources	*	*
		Relationship to Water Levels	*	*
		Endangered Species		
		Health	*	
Cultural Setting		Population		
		Land Use and Ownership		
		Recreation		
		Mineral,Energy,Forest Resource		
		Public Utilities/Facilities		
		Point Pollution Sources		
		Non-Point Pollution Sources	*	*
		Historic Features		
		Archaeologic Features	*	

LAKE SECTION 9

INTRODUCTION

Lake Section 9 extends along the western shore of Lake Michigan from just north of the Illinois-Wisconsin border to the Door County-Kewaunee County border in Wisconsin. The region features both lake-border morainal plain and subdued knob and kettle topography in the vicinity of the wetlands. Predominant shore types along this 165 mile stretch of shoreline are low plain and both low and high bluffs (Great Lakes Basin Commission, 1975).

Figures 9-1, 9-2, 9-3, and 9-4 show the approximate location of the nineteen coastal wetlands in Lake Section 9. Latitude, longitude, acreage, and classification for each of these wetlands is presented in Table 9-1. Many of the wetlands in Lake Section 9 lie at elevations greater than 650 feet above sea level, 70 feet above the approximate men elevation of Lake Michigan. Palustrine wetlands are most prevalent, although Riverine and Lacustrine Systems are also present.

Available information related to the physiographic and cultural features of the nineteen coastal wetlands is summarized in the individual wetland narratives presented in this chapter. Published sources lack site-specific information related to the biotic characteristics of these wetlands in many instances. However, site-specific biotic information is available for Oak Creek Wetland, Point Beach State Forest Wetland, Two Creeks Township Wetland #1-#3, and Kewaunee River Wetland #2.

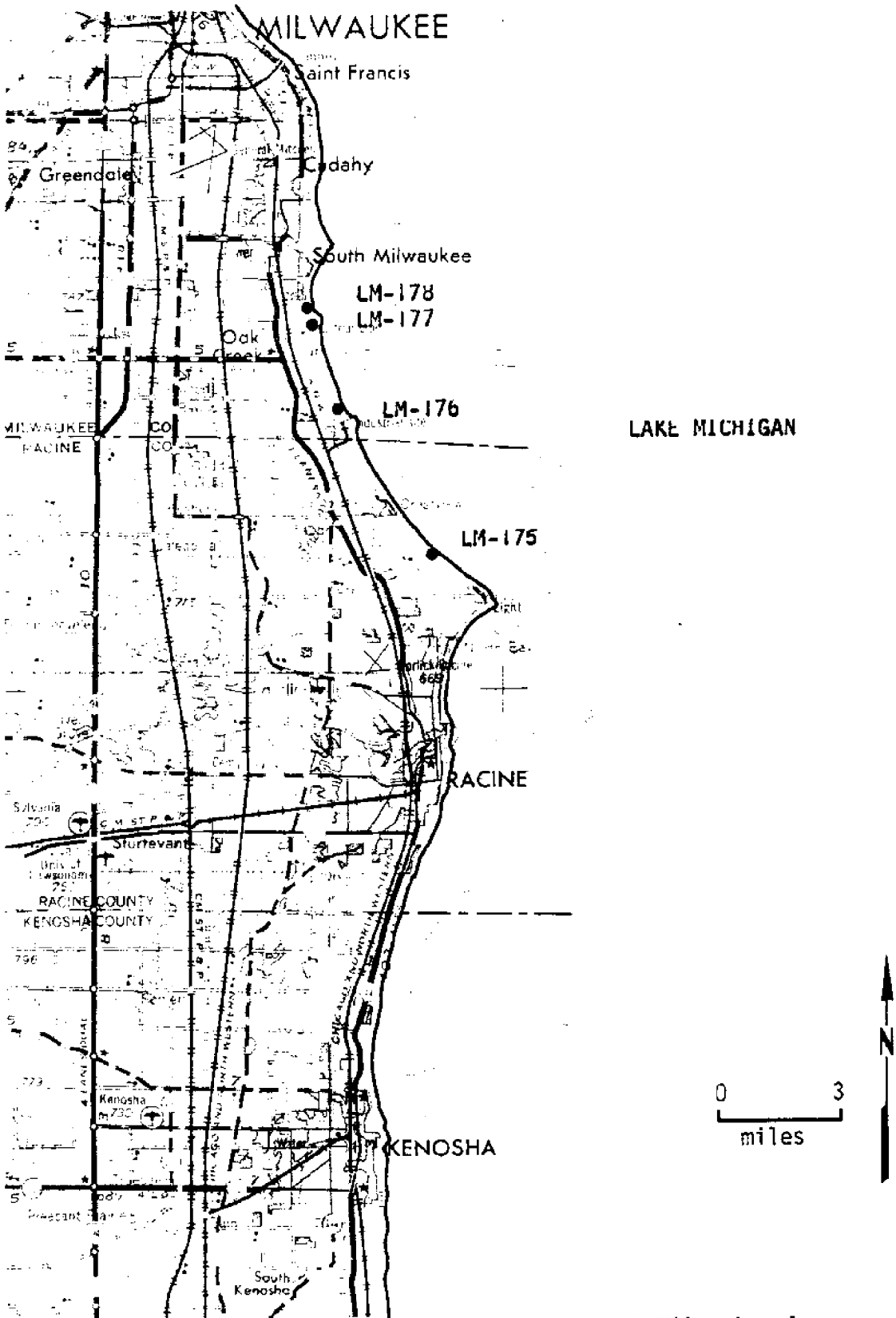

Figure 9-1. Lake Section 9 - South Milwaukee Area

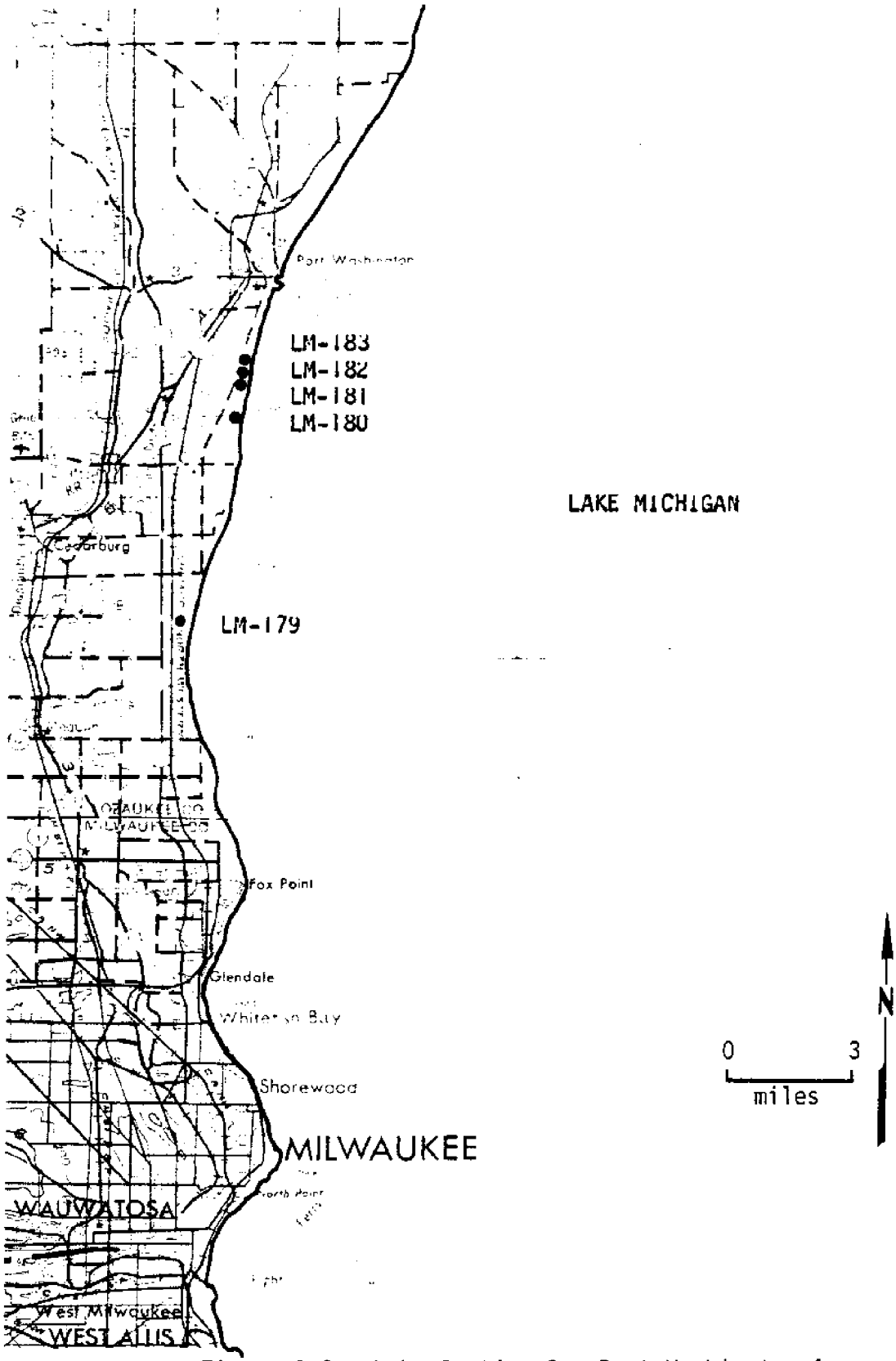

Figure 9-2. Lake Section 9 - Port Washington Area

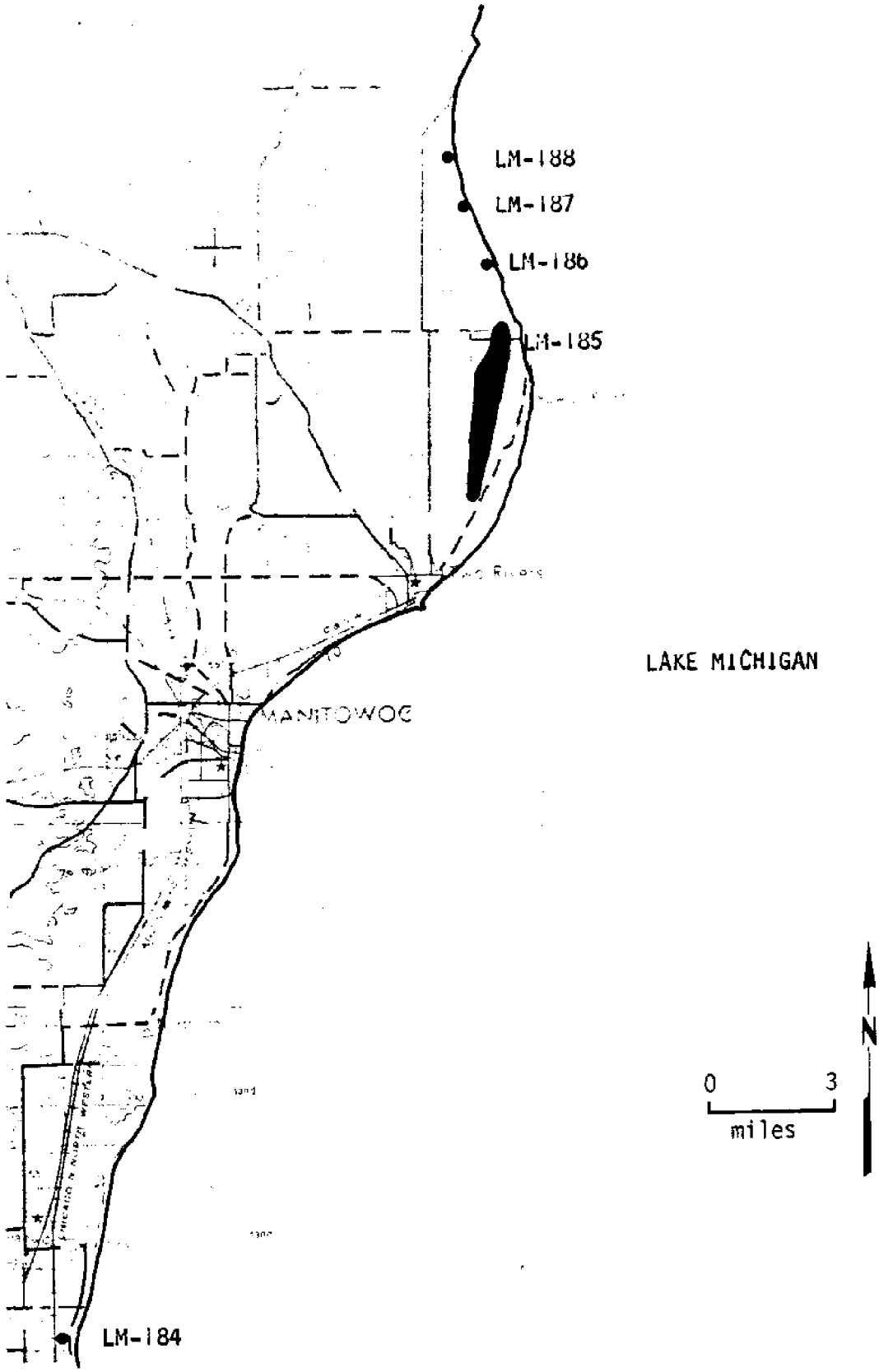

Figure 9-3. Lake Section 9 - Manitowoc Area

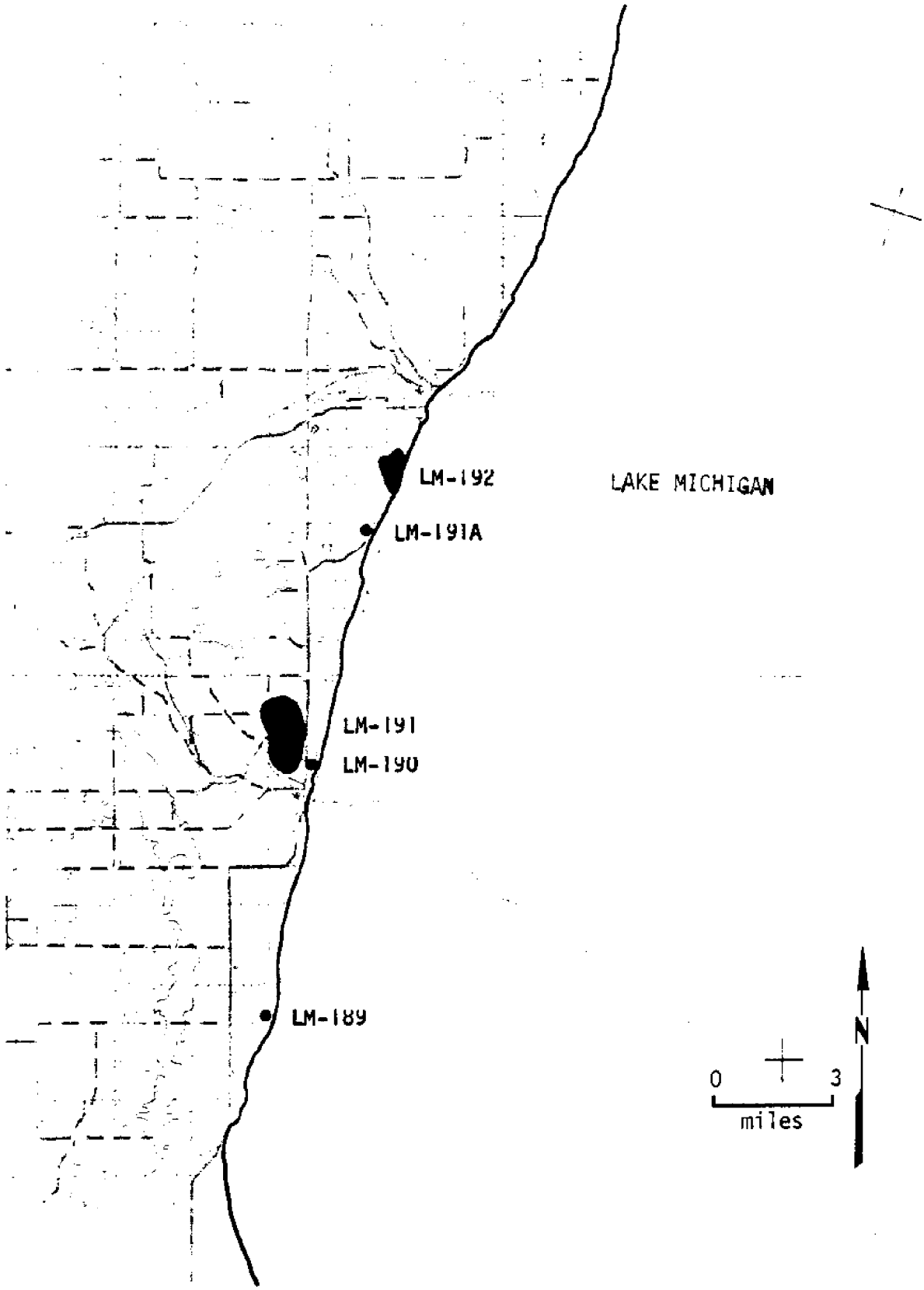

Figure 9-4. Lake Section 9 - Kewaunee Area

Table 9-1. Location, Acreage and Classification of Wetlands in Lake Section 9

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
175	Dominican College Wetland	42°47'00"	87°47'00"	1	P
176	Oak Creek Wetland	45°51'10"	87°50'10"	2	P
	CARROLLVILLE WETLAND COMPLEX				
177	Carrollville Wetland #1	42°53'10"	87°50'50"	1	P
178	Carrollville Wetland #2	42°53'30"	87°51'00"	Drained	P
179	Mequon Township Wetland	43°16'44"	87°54'12"	1	P
180	Grafton Township Wetland	43°20'25"	87°52'42"	4	P
	WASHINGTON SCHOOL WETLAND COMPLEX				
181	Washington School Wetland #1	43°21'05"	87°53'10"	1	P
182	Washington School Wetland #2	43°21'24"	87°52'54"	1	P
183	Washington School Wetland #3	43°21'30"	87°52'51"	1	P
184	Mosel Township Wetland	43°53'10"	87°44'10"	2	P
185	Point Beach State Forest Wetland	44°13'00"	87°31'40"	1490	P,R
186	Two Creeks Township Wetland #1	44°16'10"	87°30'40"	10	P
187	Two Creeks Township Wetland #2	44°17'20"	87°32'20"	15	P
188	Two Creeks Township Wetland #3	44°18'10"	87°32'40"	1	P
189	Carlton Township Wetland	44°22'30"	87°31'20"	40	P
	KEWAUNEE RIVER WETLAND COMPLEX				
190	Kewaunee River Wetland #1	44°28'00"	87°30'00"	Drained	P
191	Kewaunee River Wetland #2	44°28'30"	87°30'50"	360	R
191 A	Pierce Township Wetland	44°33'10"	87°28'10"	2	R
192	Threemile Creek Wetland	44°34'30"	87°27'20"	160	P,R

[a]P=palustrine
L=lacustrine
R=riverine

DOMINICAN COLLEGE WETLAND

PHYSIOGRAPHIC SETTING

LM 175

Setting

Dominican College Wetland is located in Racine County, Wisconsin, 350 feet from the Lake Michigan shoreline and 2.0 miles north of the city of Racine, Wisconsin. The wetland is situated in a small ravine which has been partially filled for construction of an access road. Dominican College Wetland is Palustrine and occupies a non-wooded, low site (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

Topography

Dominican College Wetland has very little relief and has an elevation of 595 feet above sea level, 15 feet above the approximate mean elevation of Lake Michigan (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971). The wetland is located near the base of a low bluff which has been described by the Great Lakes Basin Commission (1975) as an unprotected critical erosion area. The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Dominican College Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976) and are extensive along the Wisconsin shore of Lake Michigan.

Soils

The soil series for Dominican College Wetland is Colwood silt loam. The Colwood series consists of loamy, poorly-drained soils that developed from laminated lacustrine silt and fine sand. This soil, found in flats and small depressions, is underlain by layers of sand and gravel at a depth of 40 or more inches (Link and Demo, 1970).

Hydrology

There are no streams flowing through Dominican College Wetland, but there is an intermittent stream near the edge of the wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is

available for select deep well sites in Racine County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Dominican College Wetland.

Climate

The closest weather station providing climatic data for Dominican College Wetland is located in Milwaukee Airport, Wisconsin. In 1975, the average monthly temperature was 47.0°F, the average daily low for January was 17.1°F and the average daily high in July was 80.4°F. The average annual precipitation is 29.07 inches, with a mean monthly precipitation of 1.63 inches in January and 3.41 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 20 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Dominican College Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

BIOTIC SETTING LM 175

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Dominican College Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Dominican College Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Dominican College Wetland.

Reptiles and Amphibians

A list of reptile and amphibian species documented in Caledonia Township (Table 9-2) contains 11 species of amphibians and five species of reptiles, including two state endangered species, one state threatened species, and three species on the state watch list (Hine et al., 1975). All of the amphibians and seven of the reptiles have wetland affinities. However, because many of the

records are old and there is a considerable amount of suitable habitat in the township outside of this wetland (e.g., the Root River), these data have only limited relevance to Dominican College Wetland.

Appendix C-9 contains general information on amphibians and reptiles of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Dominican College Wetland.

Table 9-2. Amphibian and Reptile Records of Caledonia Township[a]

mudpuppy
central newt
blue-spotted salamander
eastern tiger salamander
bull frog
pickerel frog[c]
Blanding's turtle[b,e]
eastern milk snake
midland brown snake[e]
northern red-bellied snake
eastern smooth green snake
northern watersnake[e]
queen snake[d,e]
western fox snake
western ribbon snake[b,e]
eastern garter snake[e]
eastern massasauga[d,e]

[a] Vogt, Wisconsin Department of Natural Resources (unpublished)
[b] state watch status
[c] state threatened status
[d] state endangered status
[e] reptiles with wetland affinities

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Dominican College Wetland as Class I wildlife habitat, "most desirable" for songbirds (Thompson et al., 1976). The Hoye Nature Club of Racine is active in the area and may have specific information concerning this wetland.

Wind Point, located 1.5 miles southeast of Dominican College Wetland, is known for a wide variety of avian sightings (Tessen, 1976) and may provide an indication of the avifauna of Dominican College Wetland. Both usual and unusual documentations have occurred at Wind Point in recent years, including several species of waterfowl and other water birds which visit open waters of Lake Michigan, and several shore birds. Only some of the shore birds may be remotely expected to visit Dominican College Wetland. Potential species include sanderlings (Calidris alba), dunlins (C. alpina), plovers, and sandpipers. During April-early June and September-October, warblers, kinglets (Regulus spp.), vireos (Vireo spp.), thrushes (Catharus spp.), sparrows, scarlet tanagers (Piranga olivacea), and other migrating passerines are present.

Caledonia Wildlife Preserve, a 200-acre area, is located five miles west of Dominican College Wetland. Ducks, geese, swans, sandhill cranes (Grus canadensis), and other shorebirds utilize this site as a resting spot during spring migration (Tessen, 1976; Wisconsin Department of Natural Resources, unpublished). The influence of the birdlife of this area on that of Dominican College Wetland is unknown.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Dominican College Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Dominican College Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Dominican College Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Dominican College Wetland by the literature search.

The queen snake (Regina septemvittata) and eastern massasauga (Sistrurus c. catenatus), endangered in Wisconsin, the pickerel frog (Rana palustris), endangered in Wisconsin, and the state watch bullfrog (R. catesbeiana), Blanding's turtle (Emydoidea blandingi), and western ribbon snake (Thamnophis p. proximus) have been recorded historically in Caledonia Township (Vogt, 1978).

Although no sightings of endangered birds have been documented for the wetland, a narrow raptor migration corridor exists along the shoreline of Lake Section 9 and is regularly used by endangered raptorial species. For example, a

peregrine falcon (Falco peregrinus) was observed in May, 1974, in the Evans Park Region, which is about nine miles southwest of Dominican College Wetland (Tessen, 1976).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "most desirable" habitat for songbirds.

CULTURAL SETTING LM 175

Population

Dominican College Wetland is located in Caledonia Township of Racine County, Wisconsin. The county has a moderate population density of 506 persons per square mile. Table 9-3 indicates that Racine County experienced slow population growth between 1970 and 1975, while Caledonia Township experienced rapid population growth. Projections for 1990 indicate that Racine County may be subject to rapid growth in the future.

Table 9-3. Population Data for the Vicinity of Dominican College Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Racine County	175,781	2.9	203,860
Caledonia Township	18,452	10.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetland is rural open space. The surrounding area is characterized by residential, industrial, commercial, and industrial land use to the south and east of the wetland. Land use to the north and west of the wetland is primarily agricultural open space with scattered areas of residential usage. Several buildings of the Dominican College campus are adjacent to and in the vicinity of this wetland. An access road lies adjacent to the wetland to the south, and a secondary road lies 350 feet to the west (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Rockford Map Publishers, Inc., 1974), and is within an area planned for low density residential development of 0.7-2.2 dwelling units per net residential acre (Southeastern Wisconsin

Regional Planning Commission, 1975; U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971). The location of Dominican College Wetland suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Dominican College Wetland.

Mineral, Energy, and Forest Resources

Dominican College Wetland lies within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). There is one crushed limestone plant operating approximately 1.5 miles southwest of the wetland (Ostrom, 1970). Glaciolacustrine deposits are present in the area, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no clay or sand and gravel operations active within the vicinity of the wetland (Ostrom, 1970).

No significant forest resources are present in Dominican College Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Dominican College Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

Pollution Sources

There are no NPDES permit holders adjacent to Dominican College Wetland (Ruff et al., 1976). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Dominican College Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Division of Historic Preservation, unpublished).

RESEARCH PROJECTS LM 175

The literature search identified no on-going or impending research projects pertaining to Dominican College Wetland.

PHYSIOGRAPHIC SETTING LM 176

Setting

Oak Creek Wetland is located in Milwaukee County, Wisconsin, 0.3 mile from the Lake Michigan shoreline and 2.5 miles north of Crestview, Wisconsin. This Palustrine wetland occupies a raised, non-wooded site (U.S.G.S. quadrangle mpa, Racine North, Wisconsin, 1971).

Topography

Oak Creek Wetland has very little relief and has an elevation of 705 feet above sea level. The wetland lies on a high bluff 125 feet above the approximate mean elevation of Lake Michigan. The Great Lakes Basin Commission (1975) has described this portion of the Lake Michigan shoreline as high bluff with critical erosion problems. The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Oak Creek Wetland is characterized by end moraines, a band of discontinuous hills paralleling Lake Michigan (Skinner and Borman, 1973). These deposits consist of till and stratified sand and gravel on terminal, recessional, and interlobate moraines (Hadley and Pelham, 1976).

Soils

The soil type in Oak Creek Wetland is Marsh. Marsh is the term used by the Soil Conservation Service for a miscellaneous land type that is nearly level and very poorly drained, comprised of mineral and organic matter that is dark near the surface. The native vegetation of Marsh land is mainly sedges, rushes, and reeds (Steingraeber and Reynolds, 1971).

Hydrology

There are no streams flowing through Oak Creek Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Milwaukee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Oak Creek Wetland.

Climate

The closest weather station providing climatic data for Oak Creek Wetland is located in Milwaukee Airport, Wisconsin. In 1975, the average monthly temperature was 47.0°F, the average daily low for January was 17.1°F and the average daily high in July was 80.4°F. The average annual precipitation is 29.07 inches, with a mean monthly precipitation of 1.63 inches in January and 3.41 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 20 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Oak Creek Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

BIOTIC SETTING LM 176

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Oak Creek Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Oak Creek Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Oak Creek Wetland.

Reptiles and Amphibians

Vogt (1978) has documented reptile and amphibian species in Oak Creek Township. This list contains three species of amphibians: the northern leopard frog (Rana pipiens), eastern tiger salamander (Ambystoma tigrinum tigrinum), and American toad (Bufo americanus). The list also includes Butler's garter snake (Thamnophis butleri), which is on the state watch list (Hine et al., 1975). Only the three amphibians have wetland affinities.

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Oak Creek Wetland. The literature search yielded

no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Oak Creek Wetland as Class II wildlife habitat, "desirable" for songbirds (Thompson et al., 1976). Although high quality population data are lacking, Audubon Christmas Bird Counts of the Hales Corners Census Area (Table 9-4) are available. This census area includes all of Oak Creek Wetland but also includes portions of open Lake Michigan and several interior wetlands lying outside of the project area, so the data may not be representative of Oak Creek Wetland itself. The most abundant waterfowl are mallards (Anas platyrhynchos), greater scaup (Aythya marila), common goldeneyes (Bucephala clangula), buffleheads (B. albeola), and oldsquaw (Clangula hyemalis); black ducks (Anas rubripes) and mergansers are less abundant. Herring gulls (Larus argentatus), ring-billed gulls (L. delawarensis), and ring-necked pheasants (Phasianus colchicus) are common.

Various herons, including the yellow-crowned night heron (Nycticorax violacea), have nested along the Root River in the vicinity of Oak Creek Wetland (Tessen, 1976). Other wetland nesting birds of the area include coots (Fulica americana), long-billed marsh wrens (Cistothorus palustris), king rails (Rallus elegans), and possibly the common gallinule (Gallinula chloropus) and pied-billed grebe (Podilymbus podiceps). During the migratory period, double-crested cormorants (Phalacrocorax auritus), yellow-headed blackbirds (X. xanthocephalus), and numerous diving and dabbling ducks are often observed.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Oak Creek Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Oak Creek Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Oak Creek Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Oak Creek Wetland by the literature search.

Table 9-4. Wetland Bird Species of the Hales Corner Census Area in the 1972-1976 Christmas Bird Counts[a]

Species	1976	1975	1974	1973	1972
whistling swan		17			
mallard	29	67	571	166	155
black duck	11	28	56	38	30
gadwall	17				
American wigeon	1				
redhead				2	
canvasback	3				3
greater scaup	593	1900	244	70	33
common goldeneye	305	1003	209	355	158
bufflehead	106	70	300	141	82
oldsquaw	311	1311	776	511	201
common merganser	7		60		
red-breasted merganser	15	49	149	41	
ring-necked pheasant	57	46	84	122	20
American coot		16	6	2	
killdeer		1			
glaucous gull	1				
herring gull	343	301	602	239	586
ring-billed gull	26	2	157	13	15
Bonaparte's gull	1				
great horned owl	4	2			
long-eared owl	2	5	1		--[b]
short-eared owl		1		1	
winter wren					1
starling	1303	1064	980	833	387
red-winged blackbird	1	1	350		
rusty blackbird			10		
cardinal	44	35	35	43	30
purple finch	12		7	7	27
white-throated sparrow	1		2	4	1
swamp sparrow	3	4	6	8	

[a]The Hales Corner census area encompasses all of the Oak Creek Wetland as well as a portion of Lake Michigan shoreline and several wetlands not included in this study (Arbib, 1973, 1974, 1975, 1976, 1977).
[b]Observed in the area during the count week, but not seen on the count day.

However, Butler's garter snake, which is on the state watch list, has been recorded in Oak Creek Township. This species was removed from the state endangered list in 1975 and currently large populations exist in Milwaukee County.

Although no sightings of endangered birds have been documented for the wetland, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the endangered peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "desirable" habitat for songbirds. Two power plants are located in the vicinity of Oak Creek Wetland and may have some effect on its health.

CULTURAL SETTING LM 176

Population

Oak Creek Wetland is located in Oak Creek Township of Milwaukee county. The county is densely populated (4,447 persons per square mile). Table 9-5 indicates that the county experienced moderate population decline while the township experienced rapid growth over the years 1970-1975. Population projections for 1990 indicate that population in Milwaukee County may decline slowly in the future.

Table 9-5. Population Data for the Vicinity of Oak Creek Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Milwaukee County	1,054,063	-4.0	963,930
Oak Creek Township	15,879	14.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetland is rural open space. The surrounding area is primarily under agricultural open space uses, with an area of industrial use to the southeast (the Oak Creek Power Plants) and small areas of residential development inland. Oak Creek Wetland is located 0.5 mile northwest of the North and South Oak Creek Power Plants and a National Guard Rifle Range. A Chicago and North Western rail line lies 0.5 mile to the west (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under the ownership of the Wisconsin Electric Power Company, operator of the power plants to the southeast of the wetland (Southeastern Wisconsin Regional Planning Commission, personal communication), and is within an area planned as an environmental corridor (Southeastern Wisconsin Regional Planning Commission, 1975; U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971). The location of this wetland within an area planned as an environmental corridor suggests that it is subject to low development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Oak Creek Wetland.

Mineral, Energy, and Forest Resources

Although Oak Creek Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). End moraine deposits present in the wetland have a low potential for containing large deposits of commercial sand and gravel. However, the outwash fans and ice contact deposits often found in association with end moraines have a high potential to contain moderate to small deposits of sand and gravel (Hadley and Pelham, 1976). There are currently no sand and gravel or clay operations active within the wetland vicinity (Ostrom, 1970).

No significant forest resources are present in Oak Creek Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

The North Oak Creek and South Oak Creek Power Plants are located to the southeast of Oak Creek Wetland. These plants, owned by the Wisconsin Electric Power Company, burn coal and have a combined rating of 1712 megawatts. Both plants obtain their condensing water supply from Lake Michigan. Transmission lines from the plants run to the south and west of Oak Creek Wetland (U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971; Federal Power Commission, 1977).

Pollution Sources

There are no NPDES permit holders adjacent to Oak Creek Wetland (Ruff et al., 1976). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Oak Creek Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin, Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 176

The Wisconsin Electric Power Company's North and South Oak Creek Power Plants are currently investigating expansion into the wooded areas and wetlands west of the power plants. Should any development be proposed, an environmental report will be forthcoming (personal communication, 1978).

PHYSIOGRAPHIC SETTING LM 177-178

Setting

Carrollville Wetland #1 no longer exists and will receive no further consideration. Carrollville Wetland #2 will be referred to as Carrollville Wetland. Carrollville Wetland is located 0.2 mile from the Lake Michigan shoreline in Milwaukee County, Wisconsin, close to the city of South Milwaukee. The wetland is Palustrine and is situated in a raised, non-wooded site (U.S.G.S. quadrangle map, South Milwaukee, Wisconsin, 1971; Hadley and Pelham, 1976).

Topography

Carrollville Wetland has very little relief and an elevation of 670 feet above sea level. The wetland lies on a high bluff 90 feet above the approximate mean elevation of Lake Michigan. Bluff seepage problems occur along this portion of the shoreline (Great Lakes Basin Commission, 1975). The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Carrollville Wetland is characterized by end moraines, a band of discontinuous hills paralleling Lake Michigan (Skinner and Borman, 1973). These deposits consist of till and stratified sand and gravel on terminal, recessional, and interlobate moraines (Hadley and Pelham, 1976).

Soils

The soil series for Carrollville Wetland is Pistakee silt loam, a very poorly drained, dark grayish-brown silt loam. This soil receives runoff from the surrounding slopes and is subject to occasional flooding. Ponding may occur in the spring, especially during periods of heavy rainfall.

Hydrology

There are no streams flowing through Carrollville Wetland (U.S.G.S. quadrangle map, South Milwaukee, Wisconsin, 1971). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Milwaukee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Carrollville Wetland is located in Milwaukee Airport, Wisconsin. In 1975, the average monthly temperature was 47.0°F, the average daily low for January was 17.1°F and the average daily high in July was 80.4°F. The average annual precipitation is 29.07 inches, with a mean monthly precipitation of 1.63 inches in January and 3.41 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 20 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Carrollville Wetland (U.S.G.S. quadrangle map, South Milwaukee, Wisconsin, 1971).

BIOTIC SETTING LM 177-178

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Carrollville Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Carrollville Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Carrollville Wetland.

Reptiles and Amphibians

Vogt (1978) has documented reptile and amphibian species in Oak Creek Township. The list contains three species of amphibians: the northern leopard frog (*Rana pipiens*), eastern tiger salamander (*Ambystoma tigrinum tigrinum*), and American toad (*Bufo americanus*). The list also includes Butler's garter snake (*Thamnophis butleri*), which is on the state watch list (Hine et al., 1975). Only the three amphibians have wetland affinities.

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Carrollville Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Appendix D-21 contains additional information on wetland birds of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Carrollville Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Carrollville Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Carrollville Wetland by the literature search. However, Butler's garter snake (Thamnophis butleri), which is on the state watch list, has been recorded in Oak Creek Township. This snake was removed from the state endangered list in 1975, and currently large populations exist in Milwaukee County.

Although no sightings of endangered birds have been documented for the wetland, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus); both threatened in Wisconsin, and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, sewage waste settling ponds are located within the wetlands and may have some effect on its health.

Population

Carrollville Wetland is situated in Oak Creek Township of Milwaukee County. The county is densely populated (4,447 persons per square mile). Table 9-6 indicates that the county experienced moderate population decline while the township experienced rapid growth over the years 1970-1975. Population projections for 1990 indicate that population in Milwaukee County may decline slowly in the future.

Table 9-6. Population Data for the Vicinity of Carrollville Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Milwaukee County	1,054,063	-4.0	963,930
Oak Creek Township	15,879	14.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Carrollville Wetland is urban open space. The surrounding area contains a mixture of uses including urban open space and residential, commercial, and industrial development. Carrollville Wetland has been partially filled by construction of settling ponds for a sewage treatment plant. The shoreline to the east of the wetland has been extended into Lake Michigan by fill activity. A secondary road is located to the west of the wetland (U.S.G.S. quadrangle map, South Milwaukee, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is within an area planned for high density residential development of 7.0-17.9 dwelling units per net residential acre (Southeastern Wisconsin Regional Planning Commission, 1975; U.S.G.S. quadrangle map, Racine North, Wisconsin, 1971).

The location of this wetland within an area planned for high density residential development, combined with the rapid population growth of Oak Creek Township, suggests that this wetland is subject to high development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Carrollville Wetland.

Mineral, Energy, and Forest Resources

Although Carrollville Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity (Ostrom, 1970). End moraine deposits present in the wetland have a low potential for containing large deposits of commercial sand and gravel. The outwash fans and ice contact deposits often found in association with end moraines have a high potential of containing moderate to small deposits of sand and gravel (Hadley and Pelham, 1976), but there are currently no sand and gravel or clay operations active within the wetland vicinity (Ostrom, 1970).

No significant forest resources are present in the wetland (U.S.G.S. quadrangle map, South Milwaukee, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

Settling ponds have been constructed within Carrollville Wetland. These ponds handle waste discharges from sewage disposal plants located to the south of the wetland (Wisconsin Division of Environmental Protection, 1969).

Pollution Sources

The extent of degradation of Carrollville Wetland from the sewage disposal plant settling ponds is not known. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Carrollville Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin, Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 177-178

The literature search identified no on-going or impending research projects pertaining to Carrollville Wetland.

PHYSIOGRAPHIC SETTING LM 179

Setting

Mequon Township Wetland is located in Ozaukee County, Wisconsin, 0.1 mile from the Lake Michigan shoreline, approximately 7.0 miles north of the village of Bayside. The wetland is Palustrine and occupies a raised, wooded site (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Topography

Mequon Township Wetland has little relief and an elevation of 705 feet above sea level. The wetland lies on a high bluff 125 feet above the approximate mean elevation of Lake Michigan. The Great Lakes Basin Commission (1975) has classified this portion of the Lake Michigan shoreline as subject to critical erosion and bluff seepage problems. The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Mequon Township Wetland is end moraine, characterized by a band of discontinuous hills paralleling Lake Michigan. These deposits consist of till and stratified sand and gravel (Skinner and Borman, 1973).

Soils

The soil series in Mequon Township Wetland is Manawa, a loamy, poorly drained soil found in waterways. This soil was formed from a reddish-brown silty clay loam deposited by glacial action (Parker et al., 1970).

Hydrology

There are no streams flowing through Mequon Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Ozaukee County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Mequon Township Wetland is located in Port Washington, Wisconsin. In 1975, the average monthly

temperature was 46.3°F, the average daily low for January was 17.3°F and the average daily high in July was 78.4°F. The average annual precipitation is 28.26 inches, with a mean monthly precipitation of 1.45 inches in January and 3.22 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Mequon Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

BIOTIC SETTING LM 179

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Mequon Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Mequon Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Mequon Township Wetland.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Mequon Township Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Mequon Township Wetland as Class I wildlife habitat, "most desirable" for songbirds (Thompson et al., 1976).

Five hundred feet east of Mequon Township Wetland, at the bottom of the high bluff, Tessen (1976) reports common loons (Gavia immer), red-throated loons (G. stellata), surf scoters (Melanitta perspicillata), white-winged scoters (M. fusca), black scoters (M. nigra), horned grebes (Paliceps auritus), and western grebes (Aechmophoros occidentalis), as well as most of the common lake ducks such as mergansers, goldeneyes (Bucephala clangula), buffleheads (B. albeola), greater scaup (Aythya marila), oldsquaw (Clangula hyemalis), and ruddy ducks (Oxyura jamaicensis). In addition, jaegers (Stercodrius spp.), black-legged kittiwakes (Rissa tridactyla), little gulls (Larus minutus), and Franklin's gulls (L. pipixcan) have been observed in the immediate vicinity during recent years.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Mequon Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to Mequon Township Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Mequon Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Mequon Township Wetland by the literature search.

Although no sightings of endangered birds have been documented for the wetland, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "most desirable" habitat for songbirds.

CULTURAL SETTING LM 179

Population

Mequon Township Wetland is located in Ozaukee County, Wisconsin. The county has a moderate population density of 231 persons per square mile. Table 9-7 indicates that both the county and the township experienced rapid growth between 1970 and 1975. The projected figures for Ozaukee County in 1990 indicate that the present growth trend may continue.

Table 9-7. Population Data for the Vicinity of Mequon Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Ozaukee County	64,519	18.5	112,140
Mequon Township	15,079	24.1	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetland is rural open space, while the surrounding area is agricultural open space with scattered rural residences. An access road lies adjacent to the wetland on the west and an orchard borders the wetland on the north (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Rockford Map Publishers, Inc., 1974) and is within an area planned for suburban residential development of 0.2-0.6 dwelling units per net residential acre (Southeastern Wisconsin Regional Planning Commission; U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

The location of this wetland within an area planned for residential development, combined with the rapid population growth of Mequon Township, suggests that the wetland may be subject to high development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Mequon Township Wetland.

Mineral, Energy, and Forest Resources

Although Mequon Township Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). End moraine deposits present in the wetland have a low potential for containing large deposits of commercial sand and gravel. The outwash fans and ice contact deposits often found in association with end moraines have a high potential to contain moderate to small deposits of sand and gravel (Hadley and Pelham, 1976), but no sand and gravel or clay operations are currently present in the wetland (Ostrom, 1970).

There are no significant forest resources in the wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Mequon Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Pollution Sources

There are no known NPDES permit holders adjacent to Mequon Township Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Mequon Township Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin, Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 179

The literature search identified no on-going or impending research projects pertaining to Mequon Township Wetland.

PHYSIOGRAPHIC SETTING LM 180

Setting

Grafton Township Wetland is located in Ozaukee County, Wisconsin, 0.2 mile from the Lake Michigan shoreline and 3.0 miles northeast of the town of Grafton. This intermittent Riverine wetland occupies a non-wooded, raised site (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Topography

Grafton Township Wetland has very little relief and an elevation of 675 feet above sea level. The wetland lies in a slight depression on a high bluff 95 feet above the approximate mean elevation of Lake Michigan. According to the Great Lakes Basin Commission (1975), this wetland is located in a non-critical erosion area which is subject to bluff seepage problems. The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Grafton Township Wetland is end moraine, characterized by a band of discontinuous hills paralleling Lake Michigan. These deposits consist of till and stratified sand and gravel (Skinner and Borman, 1973).

Soils

The soil series in Grafton Township Wetland is Manawa, a loamy, poorly drained soil which is found in waterways. This soil was formed from a reddish-brown silty clay loam deposited by glacial action (Parker et al., 1970).

Hydrology

There are no streams flowing through Grafton Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Ozaukee County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Grafton Township Wetland is located in Port Washington, Wisconsin. In 1975, the average monthly temperature was 46.3°F, the average daily low for January was 17.3°F and the average daily high in July was 78.4°F. The average annual precipitation is 28.26 inches, with a mean monthly precipitation of 1.45 inches in January and 3.22 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Grafton Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

BIOTIC SETTING LM 180

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Grafton Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Grafton Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Grafton Township Wetland.

Reptiles and Amphibians

Documentation of the green frog (Rana clamitans) within Grafton Township is found in Vogt (1978). Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Grafton Township Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Grafton Township Wetland as Class III wildlife habitat, with "supplemental" value for pheasant (Phasianus colchicus) (Thompson, 1976).

Rails, bitterns, puddle ducks, and many shorebirds including Wilson's phalaropes (Phalaropus tricolor) may nest in a larger wetland located one mile to the southwest of Grafton Township Wetland (Tessen, 1976). Upland sandpipers (Bartramia longicauda) are present in the vicinity each year. Red-shouldered hawks (Buteo lineatus), which are on the Wisconsin threatened species list (Hine et al., 1975), occasionally winter in the area (Tessen, 1976).

Grafton Township Wetland is located near an area of about 1,350 acres of leased hunting land between Ulao and Port Washington (Poff and Threinen, 1964). The Ulao Public Hunting Grounds (a partially forested wetland) are located 0.5 mile to the west and may be a source of information on the game birds of the vicinity. Information concerning the Ulao Public Hunting Grounds can be obtained from the Wisconsin Department of Natural Resources.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Grafton Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Grafton Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Grafton Township Wetland by the literature search. However, although no sightings of endangered birds have been documented for Grafton Township Wetland, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as having "supplemental" value for pheasant.

Population

Grafton Township Wetland is located in Grafton Township of Ozaukee County, Wisconsin. The county has a moderate population density of 231 persons per square mile. Table 9-8 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that the present growth trend may continue in Ozaukee County.

Table 9-8. Population Data for the Vicinity for Grafton Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Ozaukee County	64,519	18.5	112,140
Grafton Township	8,167	36.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Grafton Township Wetland is rural open space, and the surroundings are agricultural open space. An access road lies to the south and east of Grafton Township Wetland (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). The wetland is under private ownership (Rockford Map Publishers, Inc., 1974) but is within an area planned to be an environmental corridor (Southeastern Wisconsin Regional Planning Commission, 1975; U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). The location of the wetland within a planned environmental corridor suggests that the wetland may be subject to low development pressures.

Recreation

Grafton Township Wetland is situated near 1,350 acres of leased hunting land between Ulao and Port Washington (Poff and Threinen, 1964).

Mineral, Energy, and Forest Resources

Although Grafton Township Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). End moraine deposits present in the wetland have a low potential for containing large deposits of commercial sand and gravel. The outwash fans and ice contact deposits often found in

association with end moraines do have a high potential to contain moderate to small deposits of sand and gravel (Hadley and Pelham, 1976), but no sand and gravel or clay operations are currently present in the wetland (Ostrom, 1970).

There are no significant forest resources in Grafton Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Grafton Township Wetland (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Pollution Sources

There are no known NPDES permit holders adjacent to Grafton Township Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Grafton Township Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 180

The literature search identified no on-going or impending research projects pertaining to Grafton Township Wetland.

WASHINGTON SCHOOL WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 181-183

Setting

The Washington School Wetland Complex, comprised of Washington School Wetlands #1-#3, is located in Ozaukee County, Wisconsin. The distance of these wetlands from the Lake Michigan shoreline ranges from 250 feet to 0.1 mile. The wetlands are located 3.5 miles northeast of the town of Grafton. All three of these Palustrine wetlands are small (approximately one acre each) and occupy raised, non-wooded sites. They lie at the crest of a ridge which is bordered by a low ravine to the west and a high bluff shoreline to the east (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Topography

Washington School Wetlands #1 and #2 have an elevation of 680 feet above sea level, and Washington School Wetland #3 has an elevation of 690 feet above sea level. The wetlands lie on a high bluff 100 to 110 feet above the approximate mean elevation of Lake Michigan. This bluff is steep and nearly unvegetated (Mickelson et al., 1977). The Great Lakes Basin Commission (1975) has described the bluff line as a non-critical erosion area, although it is subject to bluff seepage problems. The area surrounding the wetlands is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Washington School Wetlands #1-#3 is end moraine, characterized by a band of discontinuous hills paralleling Lake Michigan. These deposits consist of till and stratified sand and gravel on terminal, recessional, and interlobate moraines (Hadley and Pelham, 1976).

Soils

The soil association in Washington School Wetlands #1-#3 is Kewaunee-Manawa. This association, where it occurs in wetland areas, is characterized by poorly drained soils that have a subsoil of clay loam glacial till. Most of these soils are nearly level and appear on broad, low-lying areas but also occur in uplands (Parker et al., 1970).

Hydrology

There are no streams flowing through Washington School Wetlands #1-#3 (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Ozaukee County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in these wetlands.

Climate

The closest weather station providing climatic data for the Washington School Wetland Complex is located in Port Washington, Wisconsin. In 1975, the average monthly temperature was 46.3°F, the average daily low for January was 17.3°F and the average daily high in July was 78.4°F. The average annual precipitation is 28.26 inches, with a mean monthly precipitation of 1.45 inches in January and 3.22 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Washington School Wetland Complex (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). This depression has formed where groundwater seepage is taking place (Mickelson et al., 1977).

BIOTIC SETTING LM 181-183

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Washington School Wetlands #1-#3.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Washington School Wetlands #1-#3.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Washington School Wetlands #1-#3.

Reptiles and Amphibians

Documentation of the green frog (Rana clamitans) within Grafton Township is found in Vogt (1978).

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Washington School Wetlands #1-#3. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Washington School Wetlands #1 and #2 as Class III wildlife habitat, having "supplemental" value for songbirds and pheasant (Phasianus colchicus). Washington School Wetland #3 is not classified (Thompson, 1976).

Rails, bitterns, puddle ducks, and many shorebirds including Wilson's phalaropes (Phalaropus tricolor) may nest in a larger wetland located 1.5 to 2.0 miles southwest of Washington School Wetlands #1-#3 (Tessen, 1976). Upland sandpipers (Bartramia longicauda) are present in the vicinity of these wetlands each year. Red-shouldered hawks (Buteo lineatus), which are on the Wisconsin threatened species list (Hine et al., 1975), occasionally winter in the area (Tessen, 1976).

Washington School Wetlands #1-#3 are located in an area between Ulao and Port Washington where about 1,350 acres of land are leased for hunting (Poff and Threinen, 1964). The Ulao Public Hunting Grounds (forested wetland) are located 0.5 mile to the west and may be a source of information on the game birds of the vicinity. Information concerning the Ulao Public Hunting Grounds can be obtained from the Wisconsin Department of Natural Resources.

The Scientific Areas Preservation Council of the Wisconsin Department of Natural Resources has some bird information on the wetlands in the area of Washington School Wetlands #1-#3. Ulao Marsh is a Lacustrine swamp forest and Natural Area located about five miles to the west (Germain et al., 1977). Cedarburg Bog, a 2,000 acre "relict" of the glacial period, is an important scientific area also located about five miles to the west (Wisconsin Scientific Area Preservation Council, 1976). The University of Wisconsin-Milwaukee Field Station conducts research at Cedarburg Bog.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Grafton Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to individual wetlands.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing the Washington School Wetland Complex.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the three wetlands comprising the Washington School Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in the Washington School Wetland Complex by the literature search.

Although no sightings of endangered birds have been documented for Washington School Wetlands #1-#3, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as having "supplemental" value for songbirds and pheasant.

CULTURAL SETTING LM 181-183

Population

Washington School Wetlands #1-#3 are located in Grafton Township of Ozaukee County, Wisconsin. The county has a moderate population density of 231 persons per square mile. Table 9-9 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that the present growth trend may continue in Ozankee County.

Table 9-9. Population Data for the Vicinity of Washington School Wetlands #1-#3

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Ozaukee County	64,519	18.5	112,140
Grafton Township	8,167	36.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Washington School Wetlands #1-#3 is rural open space, and the surroundings are primarily agricultural open space with scattered rural dwellings. An unimproved road lies to the north of Washington School Wetland #2. A bowl-shaped depression in the bluff top is located 0.1 mile north of Washington School Wetland #3 (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). All three wetlands are under private ownership (Rockford Map Publishers, Inc., 1974) but are within an area planned as an environmental corridor (Southeastern Wisconsin Regional Planning Commission, 1975; U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971). The location of the wetlands within an environmental corridor suggests that they are subject to low development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Washington School Wetlands #1-#3.

Mineral, Energy, and Forest Resources

Although Washington School Wetlands #1-#3 are within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetlands (Ostrom, 1970). The end moraine deposits present in the wetlands have a low potential for containing large deposits of commercial sand and gravel. The outwash fans and ice contact deposits often found in association with end moraines do have a high potential to contain moderate to small deposits of sand and gravel (Hadley and Pelham, 1976), but no sand and gravel or clay operations are currently present in the wetlands (Ostrom, 1970).

There are no significant forest resources in Washington School Wetlands #1-#3 (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are present within 0.5 mile of Washington School Wetlands #1-#3 (U.S.G.S. quadrangle map, Cedarburg, Wisconsin, 1971).

Pollution Sources

There are no known NPDES permit holders adjacent to Washington School Wetlands #1-#3 (Wisconsin Division of Environmental Protection, 1970). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Washington School Wetlands #1-#3, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 181-183

The literature search identified no on-going or impending research projects pertaining to Washington School Wetlands #1-#3.

MOSEL TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING LM 184

Setting

Mosel Township Wetland is located in Sheboygan County, Wisconsin, behind a bluff line 0.1 mile from the Lake Michigan shoreline and 7.3 miles north of the city of Sheboygan, Wisconsin. This Palustrine wetland is situated on a broad, non-wooded, upland plain (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973).

Topography

Mosel Township Wetland has very little relief and has an elevation of 635 feet above sea level, 55 feet above the approximate mean elevation of Lake Michigan (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973). The Great Lakes Basin Commission (1975), has described the bluff line in the vicinity of the wetland as a non-critical erosion area. The terrain surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Mosel Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil series in Mosel Township Wetland is Colwood silt loam. This soil, found in depressions on old glacial lake plains, is poorly drained and subject to ponding in the spring, particularly during heavy rainfalls. The substratum of this soil consists of silt and very fine sand (Engel et al., 1978).

Hydrology

There are no streams flowing through Mosel Township Wetland (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Sheboygan County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Mosel Township Wetland is located in Sheboygan, Wisconsin. In 1975, the average monthly temperature was 47.3°F, the average daily low for January was 17.4°F and the average daily high in July was 83.7°F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 13 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Mosel Township Wetland (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973).

BIOTIC SETTING LM 184

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Mosel Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Mosel Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Mosel Township Wetland.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Mosel Township Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Cleveland Lacustrine Forest (Centerville Swamp) is a 600-acre Natural Area (Wisconsin Scientific Areas Preservation Council, 1976) located immediately to the north of Mosel Township Wetland. This land is owned by the Manitowoc Fish and Game Association. It is likely that Mosel Township Wetland was at one time contiguous with and similar to the Lacustrine forest wetland to the north. Information on the game birds of the Lacustrine forest wetland can be obtained from the Manitowoc Fish and Game Association but will probably have only historical value for Mosel Township Wetland's bird community. Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Mosel Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Mosel Township Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Mosel Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Mosel Township Wetland by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

Population

Mosel Township Wetland is located in Mosel Township of Sheboygan County, Wisconsin. The county has a moderate population density of 191 persons per square mile. Table 9-10 indicates that Sheboygan County experienced a moderate increase in population, while Mosel Township had a slow decline in population, between 1970 and 1975. Population projections for 1990 indicate that moderate growth is expected to continue in Sheboygan County.

Table 9-10. Population Data for the Vicinity of Mosel Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Sheboygan County	99,814	3.3	110,150
Mosel Township	1,093	-3.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetland is rural open space, and the surrounding area is primarily agricultural open space with scattered rural dwellings. A secondary highway lies to the east of the wetland, between the wetland and the lakeshore. A drainage ditch is located a short distance to the north of the wetland, and the north-south Chicago and North Western rail line lies 0.5 mile to the west (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Rockford Map Publishers, Inc., 1977; U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973). The primarily agricultural nature of the surrounding area suggests that the wetland may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Mosel Township Wetland.

Mineral, Energy, and Forest Resources

Although Mosel Township Wetland lies within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no sand and gravel or clay operations active within the wetland vicinity (Ostrom, 1970).

Significant forested areas exist to the north and south of the wetland, but there are no known forest resources in the wetland itself (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973). There are no known oil, gas, or coal resources present in Mosel Township Wetland.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Mosel Township Wetland (U.S.G.S. quadrangle map, Cleveland East, Wisconsin, 1973).

Pollution Sources

There are no NPDES permit holders adjacent to Mosel Township Wetland (Wisconsin Division of Environmental Protection, 1970). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Mosel Township Wetland (Wisconsin Historic Preservation Division, unpublished). The Wisconsin Inventory of Archaeology indicates that one archaeological site (MN #93) is present in the vicinity of Mosel Township Wetland. Information regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 184

A modern soil survey is being prepared for Sheboygan County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

POINT BEACH STATE FOREST WETLAND

PHYSIOGRAPHIC SETTING LM 185

Setting

Point Beach State Forest Wetland is located in Manitowoc County, Wisconsin, 0.7 mile from the Lake Michigan shoreline and 2.0 miles northeast of the city of Two Rivers. This large Palustrine and Riverine Wetland occupies a low site behind a beach ridge complex. The beach ridge is wooded, and the low wetland area is covered by a substantial expanse of swamp timber and brush (Wisconsin Scientific Areas Preservation Council, 1976). The shoreline has a wide beach (U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954).

Topography

Point Beach State Forest Wetland has little relief and an elevation of 585 feet above sea level, 5 feet above the approximate mean elevation of Lake Michigan. The land surface slopes gradually toward the lake from the higher glacial moraine areas west of the wetland. The area surrounding the wetland is lake-border morainal plain featuring gently undulating topography.

Surficial Geology

The surficial geology of Point Beach State Forest Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Point Beach State Forest Wetland is Peat. Point Beach State Forest Wetland occupies a depression that has been filled with organic debris. The Peat in this wetland was formed mainly from reeds and sedges with some indication of wood and moss peat (Wisconsin Scientific Areas Preservation Council files, undated).

Hydrology

Molash Creek runs through the southern part of Point Beach State Forest Wetland. There is no elevational change in the creek as it travels through the wetland (U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954). Molash Creek has a gradient of 5.7 feet per mile, an average depth of one foot, and a drainage area of 19 square miles. The only water quality data available for Molash Creek were obtained in 1964 when the pH level was 7.1 (Weber et al., 1968).

A field visit to Point Beach State Forest Wetland was made by the Scientific Areas Preservation Council. The field data sheets indicate that the wetland boundary and surrounding soils have remained congruent, which indicates that there has been very little artificial drainage of this wetland (Wisconsin Department of Natural Resources, undated).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Manitowoc County (Holt and Skinner, 1973). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Point Beach State Forest Wetland.

Climate

The closest weather station providing climatic data for Point Beach State Forest Wetland is located in Two Rivers, Wisconsin. In 1975, the average monthly temperature was 44.9°F, the average daily low for January was 15.3°F and the average daily high in July was 79.2°F. The average annual precipitation is 32.96 inches, with a mean monthly precipitation of 1.89 inches in January and 1.19 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 14 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Point Beach State Forest Wetland (U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954).

BIOTIC SETTING LM 185

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Point Beach State Forest Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Point Beach State Forest Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Point Beach State Forest Wetland.

Reptiles and Amphibians

Records of reptiles and amphibians in Point Beach State Forest Wetland are available in Suzuki (1950) and Vogt (1978). This list (Table 9-11) includes the eastern garter snake (Thamnophis s. sirtalis) and 11 species of amphibians, all of which have wetland affinities. With the exception of the eastern garter snake, mudpuppy (Necturus maculosus), American toad (Bufo americanus), and Blanchard's cricket frog (Acris crepitans blanchardi), all of these animals have been recorded since 1970.

Table 9-11. Reptiles and Amphibians in Point Beach State Forest Wetland[a]

central newt	Blanchard's cricket frog
blue-spotted salamander	northern spring peeper
spotted salamander	gray treefrog
red-backed salamander	western chorus frog
mudpuppy	wood frog
American toad	eastern garter snake

[a] Adapted from Suzuki (1950) and Vogt (1978)

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Point Beach State Forest Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Point Beach State Forest Wetland as Class I wildlife habitat, "most desirable" for songbirds, ruffed grouse (Bonasa umbellus), and waterfowl (Thompson et al., 1976). Nesting and migrating waterfowl utilize the wetland, which is prime nesting habitat for wood ducks (Aix sponsa) (Weber et al., 1968). The great blue heron (Ardea herodias), black-crowned night heron (N. nycticorax), American bittern (Botaurus

lentiginosus), least bittern (Ixobrychus exilis), mallard (Anas platyrhynchos), black tern (Chlidonias nigra), and belted kingfisher (Megacerule alcyon) are also found here (Tessen, 1976). Tessen (1976) further notes that the habitat along Molash Creek, in the southern portion of Point Beach State Forest Wetland, is used by a diversity of songbirds, including warblers, vireos, flycatchers, and thrushes.

The Lake Michigan shoreline adjacent to Point Beach State Forest Wetland has a variety of ducks, gulls, and terns during the spring, summer, and fall. Goldeneye (Bucephala clangula), mergansers (Mergus spp.), oldsquaw (Clangula hyemalis), and bufflehead (Bucephala albeola) are common winter residents of the lakeshore. Waterfowl hunting in the area is dependent on weather conditions, as rough water on Lake Michigan forces the birds inland, often to small lakes (Weber et al., 1968). There is some hunting of diving ducks and geese directly east of Point Beach State Forest Wetland where several small sandbars provide calm water areas (Weber et al., 1968). This hunting is often done from the shore, since it is illegal to shoot from a boat that is less than 500 feet from the Lake Michigan shore.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Point Beach State Forest Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Point Beach State Forest Wetland.

Mammals

Point Beach State Forest Wetland has been classified as supplemental habitat for muskrat (Ondatra zibethicus) and as most desirable habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Point Beach State Forest Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Point Beach State Park Wetland by the literature search. However, the Woodland Dunes Nature Center, three miles south of this wetland, has recorded twenty species of raptors, including the peregrine falcon (Falco peregrinus) (Tessen, 1976), and the bald eagle (Haliaeetus leucocephalus), which are both on the federal list. A narrow raptor migration corridor exists along the shoreline of Lake Section 9 and is regularly used by the bald eagle

and peregrine falcon, by the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin, and by the harrier (Circus cyaneus), which has state watch status.

Health

Site-specific information indicates that the environmental quality of Point Beach State Forest Wetland is good for mammals and birds. The Wisconsin Department of Natural Resources has designated the wetland as "most desirable" habitat for songbirds, ruffed grouse, waterfowl, squirrels, and white tail deer.

CULTURAL SETTING LM 185

Population

Point Beach State Forest Wetland is located in Two Rivers Township of Manitowoc County, Wisconsin. The county has a moderate population density of 140 persons per square mile. Table 9-12 indicates that Manitowoc County maintained a stable population while Two Rivers Township had a moderate decline in population between 1970 and 1975. Population projections for 1990 indicate that Manitowoc County may experience slow growth in the future.

Table 9-12. Population Data for the Vicinity of Point Beach State Forest Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Manitowoc County	82,560	0.3	86,690
Two Rivers Township	2,736	-4.1	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Point Beach State Forest Wetland lies predominantly within the Point Beach State Forest, with only small areas of the wetland lying within private inholdings on the northern periphery of the state forest (Manitowoc County Planning and Park Commission, 1973). Land use within the wetland is rural open space subject to recreational usage. The area surrounding the wetland is also predominantly rural open space, with agricultural uses inland of the forest. A small area of residential development exists along the shore of Lake Michigan, east of the northern portion of Point Beach State Forest Wetland. A secondary highway is located 0.1 mile east of Point Beach State Forest Wetland. An access

road and a secondary highway cross the wetland and another access road lies to the west of the wetland. A lighthouse is located on the shoreline east of the wetland (U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

The state-owned portions of Point Beach State Forest Wetland are planned to remain in park and recreational use. The privately-owned portions of the wetland are within an area planned for resource protection (Manitowoc County Planning and Park Commission, 1973; U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954). These data suggest that the wetland is subject to minimal development pressure.

Recreation

Point Beach State Forest Wetland lies largely within the 2,770-acre Point Beach State Forest, in which recreational facilities include camp sites, picnic areas, a nature center, nature trails, hiking trails, snowmobile trails, and a sandy beach used for swimming and fishing (Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

Although Point Beach State Forest Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no active sand and gravel or clay operations active in the vicinity (Ostrom, 1970).

Point Beach State Forest Wetland has a substantial expanse of swamp timber (Wisconsin Scientific Areas Preservation Council, 1976). Additional forest resources are present within Point Beach State Forest and Rahr Forest, located adjacent to the northeast portion of Point Beach State Forest (Wisconsin State Planning Office, 1974; U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954). There are no known oil, gas, or coal resources present in the wetland.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Point Beach State Forest Wetland (U.S.G.S. quadrangle map, Manitowoc, Wisconsin, 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Point Beach State Park Wetland (Wisconsin Division of Environmental Protection, 1971). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Point Beach State Forest Wetland. The Wisconsin Inventory of Archaeology indicates that several archaeological sites (MN #'s 45, 63-65, 68-75, 213, 233, 234, 214, 215, 217, 86, 296, 297) are present in the vicinity of the wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 185

A modern soil survey is being prepared for Manitowoc County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

TWO CREEKS TOWNSHIP WETLAND #1

PHYSIOGRAPHIC SETTING

LM 186

Setting

Two Creeks Township Wetland #1 is located in Manitowoc County, Wisconsin, approximately 7.5 miles north of the city of Two Rivers. This Lacustrine System occupies a low, non-wooded site adjacent to a relatively narrow (20 to 50 feet wide) beach (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Topography

Two Creeks Township Wetland #1 is located in an area of subdued knob and kettle topography, gently rolling to flat. Relief within the wetland is slight; its elevation is 585 feet above sea level, only 5 feet higher than the approximate mean elevation of Lake Michigan. The Great Lakes Basin Commission (1975) has described the adjacent shoreline as an erodible low bluff. The low bluff has been eroded landward so that the shoreline slope falls gradually. The beach area consists mostly of bare mud slopes (U.S. Atomic Energy Commission, 1972).

Surficial Geology

Two Creeks Township Wetland #1 is situated in an area of great geological significance, known as Two Creeks Buried Forest. The remains of a spruce forest underlie glacial lake deposits of sand and gravel at a depth ranging from 13 to 18 feet below the surface. Two Creeks Buried Forest includes organic soil as well as the fossil remains of trees, mosses, and insects. These are shallow water, near shore, and beach deposits resulting from wave and current action on the underlying deposits (Black, 1970).

Soils

The soil type for Two Creeks Township Wetland #1 is Carlisle muck, which is derived from organic deposits, such as wood, sedges, and reeds. The surface layer usually consists of undecayed organic material and contains black, mucky peat to a depth of 36 or more inches. Carlisle muck is a poorly-drained soil found in well-defined depressions having distinct beach-like borders where standing water is often present (Anderson et al., 1926).

Hydrology

There are no streams flowing through Two Creeks Township Wetland #1 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Manitowoc County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level

influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Two Creeks Township Wetland #1 is located in Two Rivers, Wisconsin. In 1975, the average monthly temperature was 44.9°F, the average daily low for January was 15.3°F and the average daily high in July was 79.2°F. The average annual precipitation is 32.96 inches, with a mean monthly precipitation of 1.89 inches in January and 1.19 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 14 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Two Creeks Township Wetland #1 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

BIOTIC SETTING LM 186

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Two Creeks Township Wetland #1.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Two Creeks Township Wetland #1.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Two Creeks Township Wetland #1.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Two Creeks Township Wetland #1. However, the

literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Two Creeks Township Wetland #1 as Class II wildlife habitat, "desirable" for songbirds and of "supplemental" value for pheasant (Phasianus colchicus) (Thompson, 1976). The pheasant is listed as the most important game bird of the Point Beach Nuclear Power Plant site (U.S. Atomic Energy Commission, 1972), where this wetland is located. Waterfowl, including Canada geese (Branta canadensis) and several species of ducks, are known to migrate through the power plant site and use open water for resting and feeding.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Two Creeks Township Wetland #1 are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Two Creeks Township Wetland #1.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Two Creeks Township Wetland #1.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Two Creeks Township Wetland #1 by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "desirable" habitat for songbirds and of "supplemental" value for pheasant. A nuclear power plant is located near the wetland and may have some effect on its health.

Population

Two Creeks Township Wetland #1 is located in Two Creeks Township of Manitowoc County, Wisconsin. The county has a moderate population density of 140 persons per square mile. Table 9-13 indicates that between 1970 and 1975 Manitowoc County maintained a stable population, but Two Creeks Township rapidly declined in population. Population projections for 1990 indicate that Manitowoc County may experience slow population growth in the future.

Table 9-13. Population Data for the Vicinity of Two Creeks Township Wetland #1

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Manitowoc County	82,560	0.3	86,690
Two Creeks Township	513	-11.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Two Creeks Township Wetland #1 is rural open space, and the surrounding area is characterized by agricultural open space (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). An area of intensive industrial use (Point Beach Nuclear Power Plant) is located approximately one mile north of the wetland. An access road lies 300 feet to the west of the wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). The wetland is located within the southern periphery of the plant site holdings (Atomic Energy Commission, 1972; Bay-Lake Regional Planning Commission, personal communication), so developmental pressures are contingent upon future activities undertaken by the public utility.

Recreation

There are no known state or federal recreational facilities in the vicinity of Two Creeks Township Wetland #1.

Mineral, Energy, and Forest Resources

Although Two Creeks Township Wetland #1 lies within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little

potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

There are no significant wooded areas in Two Creeks Township Wetland #1 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

The Point Beach Nuclear Power Plant, located north of Two Creeks Township Wetland #1, is owned by the Wisconsin Electric Company. The plant is comprised of two units rated at 524 megawatts each. Condensing water is obtained from Lake Michigan (Federal Power Commission, 1977).

Pollution Sources

Cooling water from Point Beach Nuclear Power Plant is discharged into Lake Michigan at 18°F to 22°F above lake temperature. In addition, there is a polishing pond for sewage wastes, which are chemically treated and discharged into Lake Michigan (Wisconsin Division of Environmental Protection, 1971). The low level (585 feet) of the wetland may subject it to the discharges of the Point Beach Nuclear Power Plant; however, information to substantiate this is not available.

No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Two Creeks Township Wetland #1 (Wisconsin Historic Preservation Division, unpublished). The Wisconsin Inventory of Archaeology indicates that three archaeological sites (MN #67, #68, #266) are present in the vicinity of Two Creeks Township Wetland #1. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 186

A modern soil survey is being prepared for Manitowoc County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 187

Setting

Two Creeks Township Wetland #2 is located 0.1 mile from the Lake Michigan shoreline in Manitowoc County, Wisconsin, approximately nine miles north of the town of Two Rivers. This Palustrine wetland occupies a low, wooded site (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Topography

Two Creeks Township Wetland #2 is situated in an area of subdued knob and kettle topography, gently rolling to flat. Relief within the wetland is slight; the wetland elevation is 610 feet above sea level, 30 feet higher than the approximate mean elevation of Lake Michigan. The wetland lies behind an erodible low bluff (Great Lakes Basin Commission 1975). Several small mounds, having elevations approximately 10 feet higher, surround the wetland. The beach at this site consists mainly of bare mud slopes (U.S. Atomic Energy Commission, 1972).

Surficial Geology

Two Creeks Township Wetland #2 is situated in an area of great geological significance, known as Two Creeks Buried Forest. The remains of a spruce forest underlie glacial lake deposits of sand and gravel at a depth ranging from 13 to 18 feet below the surface. Two Creeks Buried Forest includes organic soil as well as the fossil remains of trees, mosses, and insects. These are shallow water, near shore, and beach deposits resulting from wave and current action on the underlying deposits (Black, 1970).

Soils

The soil type for Two Creeks Township Wetland #2 is Peat. Peat soil consists of poorly drained, organic material derived from sedges, reeds, wood and mosses (Anderson et al., 1926).

Hydrology

There are no streams flowing through Two Creeks Township Wetland #2 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Manitowoc County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Two Creeks Township Wetland #2 is located in Two Rivers, Wisconsin. In 1975, the average monthly temperature was 44.9°F, the average daily low for January was 15.3°F and the average daily high in July was 79.2°F. The average annual precipitation is 32.96 inches, with a mean monthly precipitation of 1.89 inches in January and 1.19 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 14 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Two Creeks Township Wetland #2 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

BIOTIC SETTING LM 187

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Two Creeks Township Wetland #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Two Creeks Township Wetland #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Two Creeks Township Wetland #2.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Two Creeks Township Wetland #2. However, the literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Two Creeks Township Wetland #2 as Class I wildlife habitat, "most desirable" for songbirds and of "supplemental" value for pheasant (Phasianus colchicus) (Thompson, 1976). The pheasant is listed as the most important game bird of the Point Beach Nuclear Power Plant site (U.S. Atomic Energy Commission, 1972), where this wetland is located. Waterfowl, including Canada geese (Branta canadensis) and several species of ducks, are known to migrate through the power plant site and use open water for resting and feeding.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Two Creeks Township Wetland #2 are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. However, the literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Two Creeks Township Wetland #2.

Mammals

Two Creeks Township Wetland #2 has been classified as supplemental habitat for squirrel and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Two Creeks Township Wetland #2.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Two Creeks Township Wetland #2 by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "most desirable" habitat for songbirds and of "supplemental" value for pheasant, squirrels, and white-tailed deer. A nuclear power plant is located near the wetland and may have some effect on its health.

Population

Two Creeks Township Wetland #2 is located in Two Creeks Township of Manitowoc County, Wisconsin. The county has a moderate population density of 140 persons per square mile. Table 9-14 indicates that between 1970 and 1975 Manitowoc County maintained a stable population, Two Creeks Township rapidly declined in population. Population projections for 1990 indicate that Manitowoc County may experience slow population growth in the future.

Table 9-14. Population Data for the Vicinity of Two Creeks Township Wetland #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Manitowoc County	82,560	0.3	86,690
Two Creeks Township	513	-11.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Two Creeks Township Wetland #2 is rural open space, and the surrounding area is characterized by agricultural open space. An access road lies adjacent to the west side of the wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). An area of intensive industrial use (Point Beach Nuclear Power Plant) is located approximately 0.5 mile south of the wetland. The wetland is located within the plant site holdings (Atomic Energy Commission, 1972; Bay-Lake Regional Planning Commission, personal communication), so that development pressures are contingent upon future activities undertaken by the public utility.

Recreation

There are no known state or federal recreational facilities in the vicinity of Two Creeks Township Wetland #2.

Mineral, Energy, and Forest Resources

Although Two Creeks Township Wetland #2 is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little

potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

Two Creeks Township Wetland #2 is part of a small wooded area (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954), but it was not determined through the literature search whether this area is used for wood production. There are no known oil, gas, or coal resources present in the wetland.

Public Utilities and Facilities

The Point Beach Nuclear Power Plant, located south of Two Creeks Township Wetland #2, is owned by the Wisconsin Electric Company. It is comprised of two units rated at 524 megawatts each. Condensing water is obtained from Lake Michigan (Federal Power Commission, 1977).

Pollution Sources

Cooling water from Point Beach Nuclear Power Plant is discharged into Lake Michigan at 18°F to 22°F above lake temperature. In addition, there is a polishing pond for sewage wastes, which are chemically treated and discharged into Lake Michigan (Wisconsin Division of Environmental Protection, 1971). Two Creeks Township Wetland #2 may be influenced by the discharges from the Point Beach Nuclear Plant, but no information substantiating this is available.

No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Two Creeks Township Wetland #2 (Wisconsin Historic Preservation Division, unpublished). The Wisconsin Inventory of Archaeology indicates that one archaeological site (MN #186) is present in the vicinity of Two Creeks Township Wetland #2. Information regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 187

A modern soil survey is being prepared for Manitowoc County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

TWO CREEKS TOWNSHIP WETLAND #3

PHYSIOGRAPHIC SETTING LM 188

Setting

Two Creeks Township Wetland #3 is located in Manitowoc County, Wisconsin, approximately 100 feet from the Lake Michigan shoreline and 10 miles north of the town of Two Rivers. This Lacustrine wetland occupies a low, non-wooded site adjacent to the beach at the base of a low bluff. The bluff line at this site is interrupted by two intermittent streams which have eroded the bluff landward. One of these streams is located to the north of the wetland and the other lies to the south of the wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Topography

Relief within Two Creeks Township Wetland #3 is slight. The wetland elevation is 590 feet above sea level, 10 feet above the approximate mean elevation of Lake Michigan. The beach at this site consists mainly of bare mud slopes (U.S. Atomic Energy Commission, 1972). The area above the bluff line is subdued knob and kettle topography, gently rolling to flat.

Surficial Geology

Two Creeks Township Wetland #3 is situated in an area of great geological significance, known as Two Creeks Buried Forest. The remains of a spruce forest underlie glacial lake deposits of sand and gravel at a depth ranging from 13 to 18 feet below the surface. Two Creeks Buried Forest includes organic soil as well as the fossil remains of trees, mosses, and insects. These are shallow water, near shore, and beach deposits resulting from wave and current action on the underlying deposits (Black, 1970).

Soils

The soil association in Two Creeks Township Wetland #3 is Superior, a clay loam soil characterized by slow drainage and a heavy texture. Superior clay loam is derived from calcareous lake-laid materials which were slightly modified by glacial action. This soil is found on level or gently undulating land (Anderson et al., 1926).

Hydrology

There are no streams flowing through Two Creeks Township Wetland #3 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep

well sites in Manitowoc County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Two Creeks Township Wetland #3 is located in Two Rivers, Wisconsin. In 1975, the average monthly temperature was 44.9°F, the average daily low for January was 15.3°F and the average daily high in July was 79.2°F. The average annual precipitation is 32.96 inches, with a mean monthly precipitation of 1.89 inches in January and 1.19 inches in July based on the normal period from 1941-1970. The growing season is approximately seven months long, with the last killing frost (28°F) in 1975 occurring on April 14 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Two Creeks Township Wetland #3 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

BIOTIC SETTING LM 188

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Two Creeks Township Wetland #3.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Two Creeks Township Wetland #3.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Two Creeks Township Wetland #3.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Two Creeks Township Wetland #3. However, the literature search yielded no site-specific information pertaining to major

species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Two Creeks Township Wetland #3 as Class III habitat, with "supplemental" value for songbirds (Thompson, 1976). Waterfowl, including Canada geese (Branta canadensis) and several species of ducks, are known to migrate through the Point Beach Nuclear Power Plant site immediately to the south of this wetland (U.S. Atomic Energy Commission, 1972). These birds use open water primarily for resting and feeding.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Two Creeks Township Wetland #3 are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Two Creeks Township Wetland #3.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Two Creeks Township Wetland #3.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Two Creeks Township Wetland #3 by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as having "supplemental" value for songbirds.

Population

Two Creeks Township Wetland #3 is located in Two Creeks Township of Manitowoc County, Wisconsin. The county has a moderate population density of 140 persons per square mile. Table 9-15 indicates that between 1970 and 1975 Manitowoc County maintained a stable population, and Two Creeks Township rapidly declined in population. Population projections for 1990 indicate that Manitowoc County may experience slow population growth in the future.

Table 9-15. Population Data for the Vicinity of Two Creeks Township Wetland #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Manitowoc County	82,560	0.3	86,690
Two Creeks Township	513	-11.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Two Creeks Township Wetland #3 is rural open space. The surrounding area is primarily under agricultural uses. An access road lies 0.1 mile to the west of the wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication), and the agricultural nature of the surrounding area suggests that this wetland may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Two Creeks Township Wetland #3.

Mineral, Energy, and Forest Resources

Although Two Creeks Township Wetland #3 is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little

potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

There are no significant forest resources in the wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Two Creeks Township Wetland #3 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Two Creeks Township Wetland #3 (Wisconsin Division of Environmental Protection, 1971). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical or archaeological sites exist within 500 feet of Two Creeks Township Wetland #3. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 188

A modern soil survey is being prepared for Manitowoc County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

CARLTON TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING

LM 189

Setting

Carlton Township Wetland is located in Kewaunee County, Wisconsin, approximately 700 feet from the Lake Michigan shoreline and 5.4 miles south of the city of Kewaunee. This Palustrine wetland occupies a raised, wooded site (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Topography

Carlton Township Wetland lies behind an erodible high bluff (Great Lakes Basin Commission, 1975). Total relief of the wetland is slight; elevation is 650 feet above sea level, 70 feet higher than the approximate mean elevation of Lake Michigan. The area surrounding the wetland is subdued knob and kettle topography, gently rolling to flat. This area is dissected by low ravines which generally run north and south.

Surficial Geology

The surficial geology of Carlton Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Carlton Township Wetland is Peat. Peat soil consists of poorly drained, organic material derived from sedges, reeds, and mosses (Whitson et al., 1914).

Hydrology

There are no streams flowing through Carlton Township Wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Kewaunee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Carlton Township Wetland is located in Kewaunee, Wisconsin. In 1975, the average monthly temperature was 44.9^{o}F. The average annual precipitation is 27.50 inches, with a mean monthly precipitation of 1.25 inches in January and 2.32 inches in July

based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Carlton Township Wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

BIOTIC SETTING LM 189

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Carlton Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Carlton Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Carlton Township Wetland.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Carlton Township Wetland. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Carlton Township Wetland as Class II wildlife habitat, "desirable" for songbirds and of "supplemental" value for pheasant (Phasianus colchicus) (Thompson, 1976).

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Carlton Township Wetland are included, but

care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Carlton Township Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Carlton Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Carlton Township Wetland by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "desirable" habitat for songbirds and of "supplemental" value for pheasant.

CULTURAL SETTING LM 189

Population

Carlton Township Wetland is located in Carlton Township of Kewaunee County, Wisconsin. The county is sparsely populated and has a density of 58 persons per square mile. Table 9-16 indicates that Kewaunee County experienced slow population growth between 1970 and 1975, while Carlton Township had moderate growth during the same time period. Population projections for 1990 indicate that population growth in Kewaunee County will continue to be slow.

Table 9-16. Population Data for the Vicinity of Carlton Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Kewaunee County	20,138	3.0	21,570
Carlton Township	1,155	4.5	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Carlton Township Wetland is rural open space. The surrounding area is primarily in agricultural open space uses. Access roads lie adjacent to the wetland on the east, south, and west (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication), and the agricultural nature of the surrounding area suggests that this wetland may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Carlton Township Wetland.

Mineral, Energy, and Forest Resources

Although Carlton Township Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

Carlton Township Wetland is situated in a small, wooded area (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954), but it was not determined through the literature search whether this area is used for wood production. There are no known oil, gas, or coal resources present in the wetland.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Carlton Township Wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Carlton Township Wetland (Wisconsin Division of Environmental Protection, 1971). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Carlton Township Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 189

A modern soil survey is being prepared for Kewaunee County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 190-191

Setting

The Kewaunee River Wetland Complex is comprised of Kewaunee River Wetlands #1 and #2. Kewaunee River Wetland #1 is shown on the U.S.G.S. quadrangle map, of Kewaunee, Wisconsin (1954). However, aerial photographs of the area (Wisconsin Coastal Zone Management Development Program, 1975) indicate that the wetland has been drained, and it will receive no further consideration. Kewaunee River Wetland #2 is located in Kewaunee County, Wisconsin, just north of the city of Kewaunee and approximately 0.2 mile from the Lake Michigan shoreline. Kewaunee River Wetland #2 is a Lower Perennial Riverine System occupying both sides of the Kewaunee River at the point were the river forms a large bend north of the city. The northern half of the wetland is non-wooded, while the southern half is wooded (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Topography

Kewaunee River Wetland #2 has very little relief; its elevation is 585 feet above sea level, only 5 feet above the approximate mean elevation of Lake Michigan. The area surrounding the wetland has gently rolling topography. Steep bluffs, 60 to 80 feet high, define the boundaries of both the flood plain and the wetland. The Lake Michigan shoreline in this area is an erodible low plain (Great Lakes Basin Commission, 1975).

Surficial Geology

The surficial geology of Kewaunee River Wetland #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Kewaunee River Wetland #2 is Peat. Peat soil consists of poorly drained, organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1914).

A field visit to Kewaunee River Wetland #2 was made by the Scientific Areas Preservation Council. The field data sheets indicate that other types of organic soils are present in addition to Peat, and the chemical analyses are available in file report form from the Wisconsin Scientific Areas Preservation Council.

Hydrology

The Kewaunee River has a gradient of 6.4 feet per mile. However, there is no elevational change in the river as it travels through the wetland (U.S.G.S.

quadrangle map, Kewaunee, Wisconsin, 1954). The river has a drainage area of 59 square miles and a pH value of 8.1. It is considered to be fertile and generally turbid (Poff and Threinen, 1966). Additional water quality information for the Kewaunee River, which may reflect the water quality of Kewaunee River Wetland #2, appears in Table 9-17.

Table 9-17. Water Quality Data for the Kewaunee River taken at the River Mouth[a]

Date	Temperature (^{o}C)	Discharge (cfs)	Dissolved Solids (milligrams/liter)
11/17/75	6.0	27.0	--
4/13/76	9.0	120.0	370.5

[a] U.S. Geological Survey (1976)

Groundwater quality information was recorded in 1968 for the city of Kewaunee near the Lake Michigan shore (T23N, R25E, Sec. 17). The pH value was 7.7 and hardness ($CaCO_3$) was 509 milligrams per liter. Sodium concentrations and dissolved solids were 25 milligrams per liter and 736 milligrams per liter, respectively (Holt and Skinner, 1973). Other groundwater quality information, including inorganic constituents and nutrients, is available for select deep well sites in Kewaunee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Kewaunee River Wetland #2.

Climate

The closest weather station providing climatic data for Kewaunee River Wetland #2 is located in Kewaunee, Wisconsin. In 1975, the average monthly temperature was 44.9^{o}F. The average annual precipitation is 27.50 inches, with a mean monthly precipitation of 1.25 inches in January and 2.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

A harbor is located at the mouth of the Kewaunee River. The harbor entrance channel is 600 feet wide and the harbor is 20 feet deep with a turning basin which is approximately 700 feet wide (U.S. Army Corps of Engineers, 1975).

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Kewaunee River Wetland #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Kewaunee River Wetland #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Kewaunee River Wetland #2.

Reptiles and Amphibians

Reptile and amphibian records are available for Pierce and West Kewaunee Townships in Suzuki (1950) and Vogt (1978). Species documented in these townships include the blue-spotted salamander (Ambystoma laterale), American toad (Bufo americanus), green frog (Rana clamitans), northern leopard frog (R. pipiens), wood frog (R. sylvatica), and midland painted turtle (Chrysemys picta marginata), all of which have wetland affinities.

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Kewaunee River Wetland #2. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Kewaunee River Wetland #2 as Class I wildlife habitat, "most desirable" for songbirds, waterfowl, gulls, and terns, and "desirable" for shore birds and pheasant (Phasianus colchicus) (Thompson et al., 1976). Kewaunee River Wetland #2 supports a diversity of birdlife because of the varied habitat of river, mudflats, sedges, cattails, shrubs, and lowland and upland forest present in and around the wetland, and because of the proximity of the wetland to Lake Michigan. Scharf et al. (1977) report that large numbers of ring-billed gulls (Larus delawarensis) and herring gulls (L. argentatus) nest on the inside of the cement breakwater in Lake Michigan near Kewaunee River Wetland #2 and utilize the harbor area adjacent to

the wetland for feeding and resting. Black terns (Chlidonias nigra) are also numerous in the harbor area and nest in the sedge community to the west. Sixty pairs of black terns nested in a 25 acre area primarily comprised of sedges (Scharf et al., 1977).

Nonbreeding gulls and terns that use the wetland include little gulls (Larus minutus), laughing gulls (L. atricilla), Bonaparte's gulls (L. philadelphia), Caspian terns (Hydroprogne caspia), common terns (Sterna hirundo), and Forster's terns (S. forsteri). During periods of continuous low water, portions of Kewaunee River Wetland #2 could be colonized by common and Forster's terns, which are currently being considered for endangered status in Wisconsin (Hine, personal communication), and little gulls (Scharf et al., 1977). At least one little gull was successfully raised in 1975 on a sedge marsh at the mouth of the West Twin River south of the wetland.

Most of Kewaunee River Wetland #2 is open marsh, ideal for nesting and migrating waterfowl and other shallow-marsh birds. According to file data of the Wisconsin Department of Natural Resources, nesting of the mallard (Anas platyrhynchos), blue-winged teal (A. discors), harrier (Circus cyaneus), Virginia rail (Rallus limicola), common snipe (Capella gallinago), red-winged blackbird (Agelaius phoeniceus), and Brewer's blackbird (Euphagus cyanocephalus) has been documented in this wetland. The pied-billed grebe (Podilymbus podiceps), least bittern (Ixobrychus exilis), gadwall (Anas strepera), ruddy duck (Oxyura jamaicensis), Virginia rail, sora rail (Porzana carolina), common gallinule (Gallinula chloropus), and American coot (Fulica americana) nest on a smaller, but similar, shallow river wetland on the West Twin River to the south (Scharf et al., 1977). During periods of rough weather, waterfowl blown in from Lake Michigan make use of this wetland (Poff and Threinen, 1966).

Noteworthy bird observations for Kewaunee River Wetland #2 include black-crowned night herons, (N. nycticorax), least bitterns, long-billed marsh wrens (Cistothorus palustris), and yellow-headed blackbirds (X. xanthocephalus). A cattle egret (Bubulcus ibis) was observed in 1974 and a sharp-tailed sparrow (Ammospiza caudacuta) in 1975 (Tessen, 1976). Thrushes, warblers, and vireos are among the birds found along the hardwood forest-wetland boundary near the Kewaunee County Park, located west of Kewaunee River Wetland #2.

The Kewaunee Nuclear Power Plant is located about 10 miles south of Kewaunee River Wetland #2. The warm water discharged from the plant into Lake Michigan attracts fish, which in turn draw large numbers of gulls and terns to the area. During the fall and winter, many waterfowl are found in the open water areas near the plant. Ducks and loons winter in the Kewaunee Harbor adjacent to Kewaunee River Wetland #2 and may feed at the power plant site.

A state-owned, public hunting area borders the Kewaunee River just upstream from Kewaunee River Wetland #2. The hunting ground is primarily wetland and may serve as a source of information for the game birds of the area.

Information concerning the hunting ground can be obtained from the Wisconsin Department of Natural Resources.

Appendix D-21 contains additional information on wetland birds. General studies on Lake Section 9 related to Kewaunee River Wetland #2 are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Kewaunee River Wetland #2.

Mammals

Kewaunee River Wetland #2 provides considerable wildlife habitat (Wisconsin Scientific Areas Preservation Council, 1976). The wetland has been classified as most desirable habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Kewaunee River Wetland #2.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Kewaunee River Wetland #2 by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), which are both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

Site-specific information indicates that the environmental quality of Kewaunee River Wetland #2 is good for birds. The Wisconsin Department of Natural Resources has designated the wetland as "most desirable" habitat for songbirds, waterfowl, gulls, terns, and muskrat, and as "desirable" habitat for shore birds and pheasant.

Six NPDES permit holders and other plants discharge waste water or cooling water in the vicinity of the wetlands. These discharges may have some effect on its health.

Population

Kewaunee River Wetland #2 is located on the north side of the city of Kewaunee in both Pierce and West Kewaunee Townships of Kewaunee County, Wisconsin. The county is sparsely populated and has a density of 58 persons per square mile. Table 9-18 indicates that Pierce Township and West Kewaunee Township experienced rapid population growth during the period 1970 to 1975, while the city of Kewaunee had moderate growth. Kewaunee County as a whole had slow growth during the five year period. Population estimates for 1990 indicate that Kewaunee County may continue a slow growth trend.

Table 9-18. Population Data for the Vicinity of Kewaunee River Wetland #2

	Estimated Population 1975[a]	Estimated % Δ 1970-1975[a]	Projected Population 1990[b]
Kewaunee County	20,138	3.0	21,570
Pierce Township	793	10.4	--
West Kewaunee Township	1,282	7.3	--
City of Kewaunee	3,016	4.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Kewaunee River Wetland #2 ranges from semi-urban open space in the portion of the wetland near the city of Kewaunee to rural open space upriver. The area surrounding the wetland is characterized by residential, commercial, and industrial land uses near the city of Kewaunee and by agricultural open space inland from the city. Rail lines and a secondary highway cross the wetland. Three bridges cross the Kewaunee River in the vicinity and gravel pits are located close by (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). Areas in the approximate middle of the wetland and in the extreme northwestern portion are under state ownership. The remainder of the wetland is privately owned (Bay-Lake Regional Planning Commission, personal communication). The 200-acre Kewaunee River Marshes State Natural Area is located within the wetland (Wisconsin Scientific Areas Preservation Council, 1976).

Kewaunee River Wetland #2 is a large wetland, and development pressures can be expected to vary with location. Those portions under state ownership are subject to minimal development pressures, while the portion of the wetland near the city may be subject to moderate pressure.

Recreation

There are no known state or federal recreational facilities in Kewaunee River Wetland #2. However, a state-owned public hunting area borders the Kewaunee River, just upstream from the wetland.

Mineral, Energy, and Forest Resources

Although Kewaunee River Wetland #2 is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

A small wooded area within the southern portion of Kewaunee River Wetland #2 provides, together with wooded areas on the bluffs overlooking the Kewaunee River from the north, the major wood resource in the vicinity (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). It was not determined through the literature search whether this area is used for commmercial wood production. There are no known oil, gas, or coal resources in the wetland.

Public Utilities and Facilities

Transmission lines run to the west and east of Kewaunee River Wetland #2 (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Pollution Sources

There are six dairy operations which hold NPDES permits to discharge into the groundwaters of the Kewaunee River Basin. These point source discharges consist mainly of process waste water. In addition, the Kewaunee Equipment Company discharges non-contact cooling water and the Layse Aluminum Company discharges waste water into the Kewaunee River (Wisconsin Industrial Discharge Section, 1978). The exact location and the effects of the NPDES permit holders on Kewaunee River Wetland #2 are unknown. However, the water quality of the Kewaunee River is considered to be good, and is safe for all uses (Great Lakes Basin Commission, 1975).

No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

There are no known historical sites within 500 feet of Kewaunee River Wetland #2. The Wisconsin Inventory of Archaeology indicates that two archaeological sites (KE #3, #5) are present in the vicinity of Kewaunee River Wetland #2. Two conical mounds, both explored, have provided evidence of Archaic habitation. Information regarding the specific site locations, field findings, and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin, Historic Preservation Division, unpublished).

A modern soil survey is being prepared for Manitowoc County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PIERCE TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING

LM 191A

Setting

Pierce Township Wetland is located in Kewaunee County, Wisconsin, 0.1 mile from the Lake Michigan shoreline and 3.3 miles southwest of the city of Algoma. This Intermittent Riverine System occupies a gently sloping, raised, non-wooded site (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960).

Topography

The relief of Pierce Township Wetland is slight. The elevation of the wetland is 620 feet above sea level, 40 feet above the approximate mean elevation of Lake Michigan. The terrain surrounding the wetland is subdued knob and kettle topography, gently rolling to flat. This area is dissected by a series of low ravines having an east-west orientation. An erodible low bluff (Great Lakes Basin Commission, 1975) approximately 40 feet high separates the wetland from the lakeshore.

Surficial Geology

The surficial geology of Pierce Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil association for Pierce Township Wetland is Superior clay loam, rolling phase. This soil contains a large amount of silt and a small amount of organic matter, and averages eight inches in depth. The rolling phase of Superior clay loam is a poorly drained soil, formed partly from glaciers and partly from lacustrine deposits (Whitson et al., 1914).

Hydrology

There are no streams flowing through Pierce Township Wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Kewaunee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Pierce Township Wetland is located in Kewaunee, Wisconsin. In 1975, the average monthly temperature was 44.9°F. The average annual precipitation is 27.50 inches, with a mean monthly precipitation of 1.25 inches in January and 2.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Pierce Township Wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960).

BIOTIC SETTING LM 191A

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Pierce Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Pierce Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Pierce Township Wetland.

Reptiles and Amphibians

Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Pierce Township Wetland. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources did not classify Pierce Township Wetland in its fish and wildlife habitat study of the coastal zone (Thompson et al., 1976). Appendix D-21 contains information on wetland birds. General studies on Lake Section 9 related to Pierce Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Pierce Township Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Pierce Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Pierce Township Wetland by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 191A

Population

Pierce Township Wetland is located in Pierce Township of Kewaunee County, Wisconsin. The county is sparsely populated and has a density of 58 persons per square mile. Table 9-19 indicates that Kewaunee County experienced slow population growth between 1970 and 1975, but Pierce Township had rapid growth during the same time period. Population projections for 1990 indicate that Kewaunee County may continue its slow growth trend.

Table 9-19. Population Data for the Vicinity of Pierce Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Kewaunee County	20,138	3.0	21,570
Pierce Township	794	10.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Pierce Township Wetland is rural open space. The area surrounding the wetland is primarily agricultural open space. A primary highway lies between the wetland and the lakeshore (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is privately owned (Bay-Lake Regional Planning Commission, personal communication), and the agricultural nature of the surrounding area suggests that Pierce Township Wetland may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Pierce Township Wetland.

Mineral, Energy, and Forest Resources

Although Pierce Township Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

There are no forest resources in the wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Pierce Township Wetland (U.S.G.S. quadrangle map, Kewaunee, Wisconsin, 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Pierce Township Wetland (Wisconsin Division of Environmental Protection, 1971). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Pierce Township Wetland, nor are there any known archaeological sites in the vicinity (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 191A

A modern soil survey is being prepared for Kewaunee County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 192

Setting

Threemile Creek Wetland is located in Kewaunee County, Wisconsin, 0.1 mile from the Lake Michigan shoreline and 2.0 miles south of the city of Algoma. The wetland lies on either side of Threemile Creek, one of several short streams along this portion of the shoreline. This Lower Perennial Riverine wetland is low and wooded (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960).

Topography

Total relief of Threemile Creek Wetland is 20 feet. Elevations range from 590 to 610 feet above sea level, 10 to 30 feet above the approximate mean elevation of Lake Michigan. The topography surrounding the wetland is gently rolling to flat. Threemile Creek flows into Lake Michigan through a gap in the coastal erodible low bluff (Great Lakes Basin Commission, 1975).

Surficial Geology

The surficial geology of Threemile Creek Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Glacial lake deposits are extensive throughout the Wisconsin shore of Lake Michigan.

Soils

There are three soil types present in Threemile Creek Wetland: Peat, Superior, and Dunkirk Sand. Peat is the predominant soil type and is found on both sides of Threemile Creek. This soil is derived from organic materials, sedges, and woods and is very poorly drained. Dunkirk sand is a loamy sand having an average depth of six inches, and is present along the eastern portion of Threemile Creek Wetland as well as along the shore. This soil was formed from lacustrine beach deposits and is generally well drained, except in depressional areas. Superior is the least extensive of the three soils present. This soil is poorly drained and contains a large amount of silt. It was formed from glacial and lacustrine deposits (Whitson et al., 1914).

Hydrology

Threemile Creek flows through the western portion of the wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960). The creek has a gradient of 7.3 feet per mile, a drainage area of nine square miles, and a pH value of 7.9 (Poff and Threinen, 1966).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality

information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Kewaunee County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in this wetland.

Climate

The closest weather station providing climatic data for Threemile Creek Wetland is located in Kewaunee, Wisconsin. In 1975, the average monthly temperature was 44.9°F. The average annual precipitation is 27.50 inches, with a mean monthly precipitation of 1.25 inches in January and 2.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Threemile Creek Wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960).

BIOTIC SETTING LM 192

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Threemile Creek Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Threemile Creek Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Threemile Creek Wetland.

Reptiles and Amphibians

The northern leopard frog (Rana pipiens) has been recorded in Pierce Township (Vogt, 1978). Appendix C-9 contains general information on reptiles and amphibians of Lake Section 9, but care should be exercised in the interpretation of the relevance of these studies to Threemile Creek Wetland. The literature search yielded no site-specific information pertaining to major

species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Threemile Creek Wetland as Class I wildlife habitat, "most desirable" for songbirds and waterfowl, "desirable" for ruffed grouse (Bonasa umbellus) and shore birds, and of "supplemental" value for pheasant (Phasianus colchicus) (Thompson et al., 1976).

Appendix D-21 contains information on wetland birds. General studies on Lake Section 9 related to Threemile Creek Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Threemile Creek Wetland.

Mammals

Threemile Creek Wetland has been classified as supplemental habitat for squirrel and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Threemile Creek Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine, et al., 1975) were documented in Threemile Creek Wetland by the literature search. However, a narrow raptor migration corridor along the shoreline of Lake Section 9 is regularly used by the peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list; the Cooper's hawk (Accipiter cooperii) and the red-shouldered hawk (Buteo lineatus), both threatened in Wisconsin; and the harrier (Circus cyaneus), which has state watch status.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as "most desirable" habitat for songbirds and waterfowl, "desirable" for ruffed grouse and shore birds and of "supplemental" value for pheasant, squirrel and white-tailed deer.

Population

Threemile Creek Wetland is located in Pierce Township of Kewaunee County, Wisconsin. Kewaunee County is sparsely populated and has a density of 58 persons per square mile. Table 9-20 indicates that Kewaunee County experienced slow population growth between 1970 and 1975, but Pierce Township experienced rapid population growth during the same time period. Population estimates for 1990 indicate that Kewaunee County may maintain its slow growth trend.

Table 9-20. Population Data for the Vicinity of Threemile Creek Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Kewaunee County	20,138	3.0	21,570
Pierce Township	794	10.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Threemile Creek Wetland is primarily rural open space, with a few residences located just within the wetland boundary in the northeast portion of the wetland. The 50-acre Threemile Creek Tag Alder State Natural Area is located within the wetland. A primary highway crosses Threemile Creek and separates the wetland from Lake Michigan. Access roads cross the wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960; Wisconsin Department of Natural Resources, Scientific Areas Preservation Council, 1976). The area surrounding the wetland is predominantly in agricultural open space uses. There is some residential development in the area, including a trailer park just south of the wetland (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication).

Because the wetland includes a state Natural Area and little residential growth is present in the immediate vicinity of the wetland, development pressures should be considered minimal.

Recreation

There are no known state or federal recreational facilities in the vicinity of Threemile Creek Wetland.

Mineral, Energy, and Forest Resources

Although Threemile Creek Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no active sand and gravel or clay operations in the vicinity (Ostrom, 1970).

Threemile Creek Wetland is part of a small wooded area (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960), but it was not determined through the literature search whether the area is used for wood production. There are no known oil, gas, or coal resources present in the wetland.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Threemile Creek Wetland (U.S.G.S. quadrangle map, Algoma, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Threemile Creek Wetland (Wisconsin Division of Environmental Protection, 1971). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Threemile Creek Wetland (Wisconsin, Historic Preservation Division, unpublished), but the Wisconsin Inventory of Archaeology indicates that three archaeological sites (KE #6, #18, #19) are present in the vicinity. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, unpublished).

RESEARCH PROJECTS LM 192

A modern soil survey is being prepared for Kewaunee County by the Soil Conservation Service. The field work for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

Table 9-21. Data Gaps - Lake Section 9

Data Gap*		Wetland Number	175	176	177-178	179	180	181	182	183	184	185	186	187	188	189	190-191	191A	192
Physiographic Setting		Setting																	
		Topography																	
		Surficial Geology																	
		Soils																	
	Hydrology	Water Level Fluctuations	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Groundwater	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Water Quality	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*
		Depth	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Changes	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Climate																	
		Special Features																	
Biotic Setting	Vegetation	Major Species Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Major Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Fish	Major species	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Spawning and Hatching Areas	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Commercial/Recreational Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Invertebrates	Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Amphibians/Reptiles	Major Species	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Avifauna	Major Species	*	*	*	*	*	*	*	*	*				*	*		*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*				*	*		*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Mammals	Major Species	*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Endangered Species																	
		Health	*	*	*	*	*	*	*	*	*		*	*	*	*		*	*
Cultural Setting		Population																	
		Land Use and Ownership																	
		Recreation																	
		Mineral, Energy, Forest Resource																	
		Public Utilities/Facilities																	
		Point Pollution Sources																	
		Non-Point Pollution Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Historic Features																	
		Archaeologic Features	*	*	*	*	*	*	*	*					*	*		*	

LAKE SECTION 10

INTRODUCTION

Lake Section 10 extends from the Kewaunee County-Door County border along Lake Michigan to the Kewaunee County-Brown County border along the eastern shore of Green Bay. The lake section includes the eastern and western shorelines of Door Peninsula, as well as a series of islands situated near the northern tip of the peninsula. The topography of Door Peninsula is generally flat along the shoreline. Inland topography is gently rolling to flat along the eastern portion of the peninsula; the western portion is generally rolling, with elevations ranging to 830 feet above sea level. The predominant shore types along Door Peninsula are erodible and non-erodible low plains. Erodible and non-erodible low bluffs and low sand dunes are also present (Great Lakes Basin Commission, 1975).

Figures 10-1 and 10-2 shows the approximate location of the 63 coastal wetlands in Lake Section 10. Latitude, longitude, acreage, and classification for each of these wetlands are presented in Table 10-1. The majority of the wetlands in Lake Section 10 have elevations ranging between 580 and 590 feet above sea level (lake level to ten feet above the approximate mean elevation of Lake Michigan), and these wetlands are probably lake-influenced. Approximately two-thirds of the wetlands in Lake Section 10 are Lacustrine Systems. Palustrine and Riverine wetlands are also present.

Information related to the physiographic and cultural features of the 63 wetlands is summarized in the individual wetland narratives presented in this chapter. Published sources lack site-specific information on the biotic characteristics of many of these wetlands. However, site-specific information is available for Baileys Harbor-Ephraim Swamp, Toft Point Wetland, North Bay Wetland, Rowleys Bay Wetland Complex, Liberty Grove Township Wetland #1, and Washington Island Wetland Complex. In addition, virtually all of the wetlands in Lake Section 10 have been classified by the Wisconsin Department of Natural Resources in terms of their value as fish and wildlife habitat.

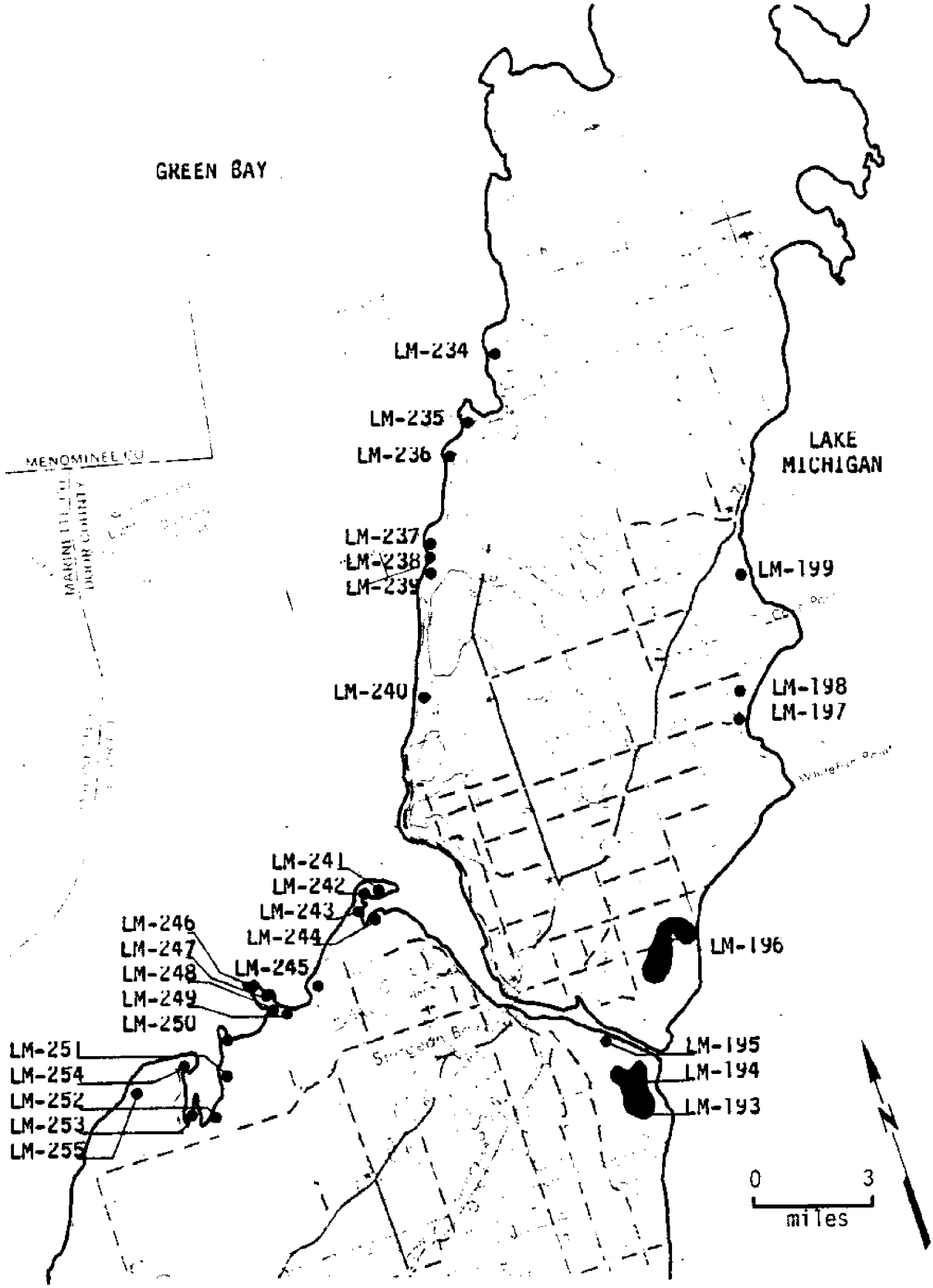

Figure 10-1. Lake Section 10 - Sturgeon Bay Area

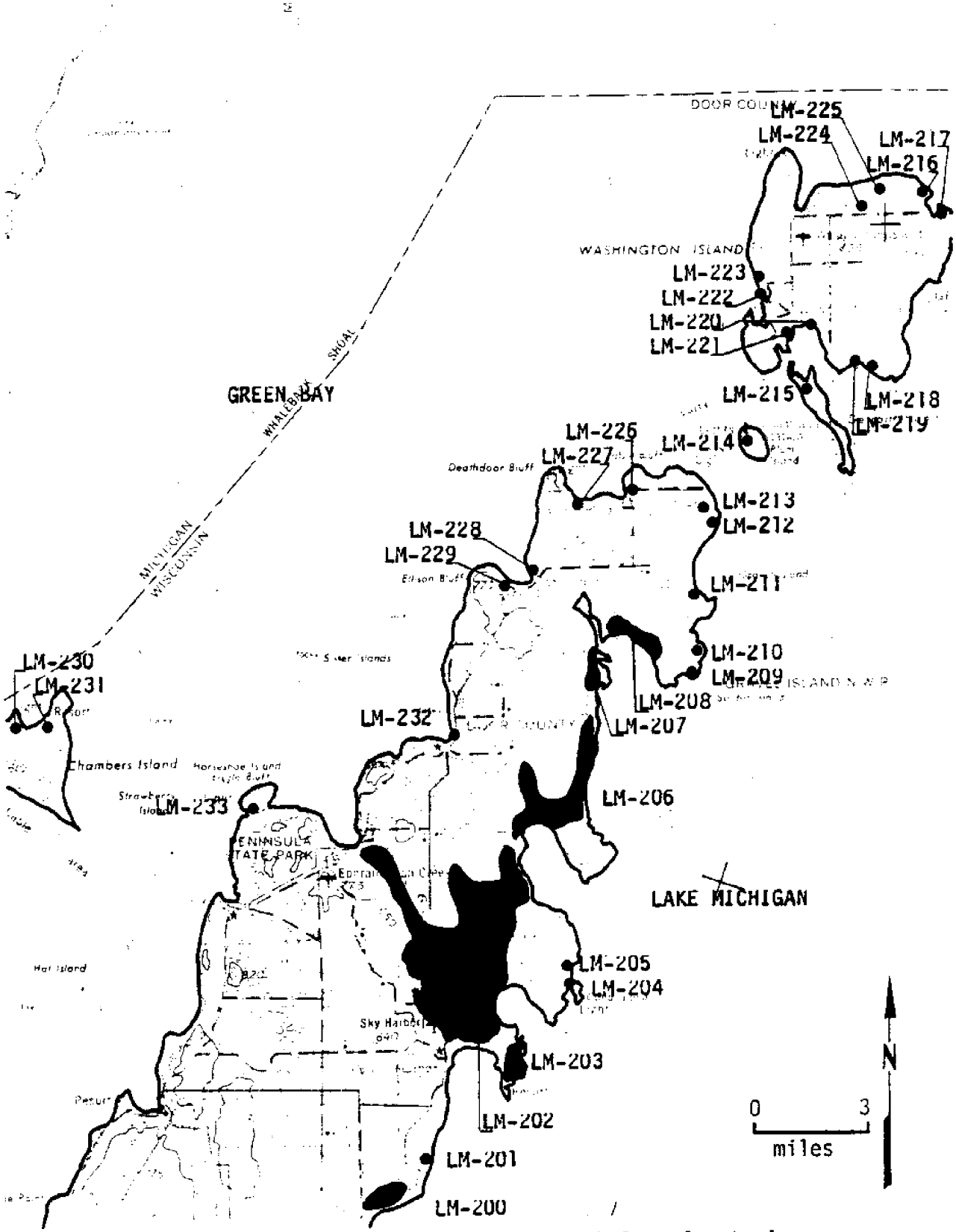

Figure 10-2. Lake Section 10 - North Door County Area

Table 10-1. Location, Acreage, and Classification of Wetlands in Lake Section 10

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
	ROCKY POINT WETLAND COMPLEX				
193	Rocky Point Wetland	44°46'50"	87°20'10"	690	P
194	Sturgeon Bay Township Wetland	44°47'20"	87°20'10"	640	P
195	Sturgeon Bay Canal Wetland	44°48'20"	87°20'20"	60	P
196	Lilly Bay Wetland	44°50'10"	87°27'40"	420	P
	WHITEFISH BAY WETLAND COMPLEX				
197	Whitefish Bay Wetland	44°54'30"	87°13'10"	22	P
198	Whitefish Bay Creek Wetland	44°55'10"	87°12'50"	130	R
199	Jacksonport Area Wetland	44°57'30"	87°11'30"	2	P
	KANGAROO LAKE AREA WETLAND COMPLEX				
200	Kangaroo Lake Area Wetland #1	45°00'50"	87°09'20"	160	P
201	Kangaroo Lake Area Wetland #2	45°01'30"	78°08'10"	3	P
202	Baileys Harbor-Ephraim Swamp	45°06'10"	87°06'20"	5050	L,P,R
203	Toft Point Wetland	45°04'00"	87°05'10"	100	L,P
	CANA ISLAND AREA WETLAND COMPLEX				
204	Cana Island Area Wetland #1	45°05'40"	87°03'00"	20	P
205	Cana Island Area Wetland #2	45°06'10"	87°03'20"	60	P
206	North Bay Wetland	45°09'40"	87°04'00"	2150	L,P
	ROWLEYS BAY WETLAND COMPLEX				
207	Rowleys Bay Wetland #1	45°13'30"	87°02'20"	250	P,R
208	Rowleys Bay Wetland #2	45°14'00"	87°01'00"	290	P
209	Liberty Grove Township Wetland #1	45°13'30"	86°45'50"	20	P
210	Liberty Grove Township Wetland #2	45°14'40"	86°45'50"	40	P
211	Europe Bay Wetland	45°15'20"	86°59'20"	3	P
	EUROPE LAKE WETLAND COMPLEX				
212	Europe Lake Wetland #1	45°16'50"	86°58'20"	2	P
213	Europe Lake Wetland #2	45°17'00"	86°58'40"	80	P
214	Plum Island Wetland	45°18'40"	86°59'30"	20	P
215	Detroit Island Wetland	45°19'40"	86°55'20"	30	L
	WASHINGTON ISLAND WETLAND COMPLEX				
216	Jackson Harbor Wetland #1	45°24'30"	86°51'10"	6	P
217	Jackson Harbor Wetland #2	45°24'00"	86°50'50"	4	P
218	South Point Wetland #1	45°20'30"	86°53'20"	2	P
219	South Point Wetland #2	45°20'20"	86°53'30"	3	P
220	Detroit Harbor Wetland #1	45°21'20"	86°55'30"	20	P
221	Detroit Harbor Wetland #2	45°21'00"	86°56'00"	50	L,P
222	West Harbor Area Wetland #1	45°22'00"	86°56'50"	4	P
223	West Harbor Area Wetland #2	45°22'20"	86°57'00"	1	P
224	Coffee Swamp	45°24'10"	86°53'20"	165	L
225	Coffee Swamp Area Wetland	45°24'30"	86°53'00"	15	L
226	Gills Rock Wetland	45°17'20"	87°07'10"	5	P
227	Garret Bay Wetland	45°17'00"	87°03'00"	2	P
	ELLISON BAY WETLAND COMPLEX				
228	Ellison Bay Wetland #1	45°15'30"	87°04'30"	3	P
229	Ellison Bay Wetland #2	45°15'10"	87°05'10"	3	P
	CHAMBERS ISLAND WETLAND COMPLEX				
230	Chambers Island Wetland #1	45°11'50"	87°21'50"	2	P
231	Chambers Island Wetland #2	45°12'60"	87°20'30"	2	P
232	Sister Bay Wetland	45°11'30"	87°07'00"	60	P

-continued-

Table 10-1. (concluded)

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
233	Tennison Bay Wetland	45°10'00"	87°13'50"	60	P
234	Juddville Bay Wetland	45°04'10"	87°16'40"	80	P
235	Egg Harbor Wetland	45°02'40"	87°18'10"	6	P
236	Leroys Point Wetland	45°07'00"	87°19'10"	5	P
	HORSESHOE POINT WETLAND COMPLEX				
237	Horseshoe Point Wetland	45°00'20"	87°20'20"	130	P
238	Monument Point Wetland #1	44°59'50"	87°20'50"	140	P
239	Monument Point Wetland #2	44°59'30"	87°21'10"	2	P
240	Egg Harbor Township Wetland	44°57'00"	87°22'30"	130	P
	SAWYER HARBOR WETLAND COMPLEX				
241	Sawyer Harbor Wetland #1	44°53'30"	87°26'20"	1	P
242	Sawyer Harbor Wetland #2	44°53'00"	87°26'30"	1	P
243	Sawyer Harbor Wetland #3	44°53'50"	87°26'30"	1	P
244	Sawyer Harbor Wetland #4	44°52'40"	87°26'30"	3	P
245	Sand Bay Area Wetland	44°51'40"	87°28'10"	120	L
	SAND BAY WETLAND COMPLEX				
246	Sand Bay Wetland #1	44°51'00"	87°29'20"	10	P
247	Sand Bay Wetland #2	44°51'10"	87°29'50"	40	P
248	Sand Bay Wetland #3	44°51'40"	87°30'10"	20	P
249	Snake Island Wetland	44°52'20"	87°31'00"	10	P
250	Rileys Point Wetland	44°51'10"	87°32'00"	30	P,L
	LITTLE STURGEON BAY WETLAND COMPLEX				
251	Little Sturgeon Bay Wetland #1	44°49'40"	87°32'20"	310	P
252	Little Sturgeon Bay Wetland #2	44°49'20"	87°33'20"	5	P
253	Keyes Creek Wetland	44°49'50"	87°34'20"	70	R,P
254	Henderson Point Wetland	44°50'50"	87°33'30"	30	L
255	Gardner Township Wetland #1	44°50'40"	87°35'20"	5	P

[a]P=palustrine
L=lacustrine
R=riverine

ROCKY POINT WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 193-195

Setting

The Rocky Point Wetland Complex is located in Door County, Wisconsin, 2.5 miles southeast of the City of Sturgeon Bay. The wetland complex is comprised of Rocky Point Wetland, Sturgeon Bay Township Wetland, and Sturgeon Bay Canal Wetland, which are situated near the eastern shoreline of Door Peninsula just south of the Sturgeon Bay Canal. Rocky Point Wetland and Sturgeon Bay Township Wetland lie 400 feet and 1,000 feet, respectively, from the Lake Michigan shore line. Sturgeon Bay Canal Wetland lies adjacent to the canal (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960), which cuts through Door Peninsula and connects Green Bay (on the west side of the peninsula) to Lake Michigan. Door Peninsula extends about 85 miles into Lake Michigan, and the canal is located approximately 12 miles north of the Kewaunee County-Door County line. The Lake Michigan shoreline in this area exhibits typical beach ridge physiography, and the wetlands lie south of and behind the coastal beach ridges in wooded lowland sites close to one another. Rocky Point Wetland is a Palustrine System and Sturgeon Bay Township Wetland and Sturgeon Bay Canal Wetland are Lacustrine Systems.

Topography

The wetlands of the Rocky Point Wetland Complex have elevations ranging from 580 to 610 feet above sea level. Rocky Point Wetland has a total relief of 10 feet and elevations ranging from 600 to 610 feet above sea level, 20 to 30 feet above the mean elevation of Lake Michigan. Sturgeon Bay Township Wetland has a total relief of 15 feet, and elevations ranging from 585 to 600 feet above sea level. Sturgeon Bay Canal Wetland has only slight relief and elevations ranging from lake level (580 feet) to 585 feet above sea level. The topography inland of the wetland complex is gently rolling to flat.

The three wetlands are located on an erodible low plain (Great Lakes Basin Commission, 1975), adjacent to the Sturgeon Bay gap. This gap, which crosses Door Peninsula, represents the preglacial course of the Menominee River. The preglacial river valley was deepened by glacial sculpture and submerged beneath the waters of Lake Michigan (Martin, 1965).

Beach development is occurring on the southern side of the south breakwall located at the eastern end of the canal. This beach development indicates that littoral current here is moving northward.

Surficial Geology

The surficial geology of the wetlands of the Rocky Point Wetland Complex is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in the Rocky Point Wetland Complex is Peat. Peat soil is very poorly drained and consists of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through any of the wetlands in the Rocky Point Wetland Complex. However, Sturgeon Bay Canal Wetland is adjacent to Sturgeon Bay Canal and to an inlet off the canal (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Bottom sediments from the Sturgeon Bay Canal directly above Sturgeon Bay Canal Wetland were found to be heavily polluted following sample collections by the Federal Water Pollution Control Administration in 1969 (U.S. Army Corps of Engineers, 1974). A pollution investigation survey by the Wisconsin Department of Natural Resources also indicates that the canal is polluted, since no intolerant organisms, such as mayflies, are present (Wisconsin Division of Environmental Protection, 1971). The water quality of Sturgeon Bay Canal may affect Sturgeon Bay Canal Wetland.

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in any of the wetlands of the Rocky Point Wetland Complex.

Climate

The closest weather station providing climatic data for the Rocky Point Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3^{o}F, the average daily low for January was 14.9^{o}F and the average daily high in July was 81.5^{o}F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Rocky Point Wetland Complex (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of the Rocky Point Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Rocky Point Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Rocky Point Wetland Complex.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the Rocky Point Wetland Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Rocky Point Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus). This wetland has supplemental value for pheasant (Phasianus colchicus). The study designates Sturgeon Bay Township Wetland as Class II habitat and Sturgeon Bay Canal Wetland as Class III habitat, with supplemental value for pheasant (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to this wetland complex.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing the Rocky Point Wetland Complex.

Mammals

Rocky Point Wetland has been classified as most desirable habitat for squirrels and white-tailed deer (Odocoileus virginianus). Sturgeon Bay Township Wetland has been classified as most desirable habitat for white-tailed deer, as desirable habitat for squirrels, and as supplemental habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Rocky Point Wetland Complex, or to major species in Sturgeon Bay Canal Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Service, 1978; Hine, et al., 1975) were documented in the Rocky Point Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 193-195

Population

The three wetlands of the Rocky Point Wetland Complex are located in Clay Banks and Sturgeon Bay Townships of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-2 indicates that the county and both townships experienced a rapid rate of population growth between 1970 and 1975. Projections for 1990 indicate that Door County is expected to experience a slow rate of population decline in the future.

Table 10-2. Population Data for the Vicinity of the Rocky Point Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Clay Banks Township	424	22.9	--
Sturgeon Bay Township	6,776	10.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetlands of the Rocky Point Wetland Complex is rural open space. The area surrounding the wetlands is primarily agricultural open space, with scattered areas of shoreline residential development. Several man-made special features are present in the vicinity of the three wetlands. Rocky Point Wetland is crossed by an access road, and a gravel pit lies to the south of the wetland. Secondary highways cross Sturgeon Bay Township Wetland; an access road lies to the west. A navigation light for Sturgeon Bay Canal and access roads are located adjacent to Sturgeon Bay Canal Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975). No information related to development pressures for the three wetlands was identified through the literature search.

Recreation

There are no known state or federal recreational facilities in the vicinity of the wetlands in the Rocky Point Wetland Complex.

Mineral, Energy, and Forest Resources

Although the wetlands of the Rocky Point Wetland Complex are within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarries in the vicinity (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present within the wetlands, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are numerous sand and gravel pits inland from the wetland complex, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetlands.

The wetlands are situated within a large, wooded area (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960), but it was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of any of the wetlands in the Rocky Point Wetland Complex (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to the three wetlands, but the Sturgeon Bay Sewage Treatment Plant and Wisconsin Foods, inc., have been identified as problem dischargers in the Sturgeon Bay area (Wisconsin Division of Environmental Protection, 1971). The impact of these dischargers on Sturgeon Bay Canal Wetland is unknown.

Historical and Archaeological Features

The Hamlet of Hornspier, located near Rocky Point Wetland, is a vanished community that derived its livelihood from waterfront commerce. The site is now a grassy area along the coast. The Sturgeon Bay Canal Coast Guard Station, located near Sturgeon Bay Canal Wetland, is a large, 2½-story building with an intersecting gable roof (Wisconsin Historic Preservation Division, 1978). No known historical sites exist within 500 feet of Sturgeon Bay Township Wetland (Wisconsin Historic Preservation Division, 1977).

The Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #6, #37) are present in the vicinity of Rocky Point Wetland. No known archaeological resources exist in the Sturgeon Bay Canal Wetland; one archaeological site (DR #82) is present in the vicinity of Sturgeon Bay Township Wetland. Information regarding the specific site locations and field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 193-195

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The field work for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

LILLY BAY WETLAND

PHYSIOGRAPHIC SETTING LM 196

Setting

Lilly Bay Wetland is located in Door County, approximately 0.1 mile from the Lake Michigan shoreline and three miles east of the city of Sturgeon Bay, Wisconsin. The Sturgeon Bay Canal, which cuts through Door Peninsula and connects Green Bay to Lake Michigan, is situated approximately two miles southwest of the wetland. Lilly Bay Wetland is a Riverine System occupying a low, wooded site. Portage Point is a headland area located roughly one mile south of the wetland. The shoreline between the wetland and Portage Point represents a break in the coastal beach ridges lying to the south and the north (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Topography

The total relief of Lilly Bay Wetland is 30 feet. Elevations of the wetland range from 590 to 620 feet above sea level, 10 to 40 feet above the approximate mean elevation of Lake Michigan. The surrounding landscape varies from gently rolling to flat. The Great Lakes Basin Commission (1975) has described the shoreline near the wetland as an erodible low plain.

Surficial Geology

The surficial geology of Lilly Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Lilly Bay Wetland is Peat. Peat soil is poorly drained and consists of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

An unnamed continuous stream orginates in Lilly Bay Wetland and flows into Lake Michigan. The elevation of the stream is 620 feet at its source and 590 feet as it leaves the wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). The stream has a drainage area of two square miles and a total length of 1.1 miles. Water quality data, which may reflect conditions in Lilly Bay Wetland, are available for this stream. The pH value is 7.5 and alkalinity ($CaCO_3$) is 229 milligrams per liter (Poff and Threinen, 1965).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific information pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Lilly Bay Wetland.

Climate

The closest weather station providing climatic data for Lilly Bay Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Lilly Bay Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

BIOTIC SETTING LM 196

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Lilly Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Lilly Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Lilly Bay Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Lilly Bay Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Lilly Bay Wetland as Class I wildlife habitat, "most desirable" for ruffed grouse (Bonasa umbellus) and waterfowl. The wetland has "supplemental" value for gulls and terns and shore birds (Thompson et al., 1976). The Sturgeon Bay Lake Natural Area is contiguous to the southern border of Lilly Bay Wetland and may include a portion of it. This natural area has value as an education site and as an "ecological zone" and may be considered as a State Scientific Area in the future (Wisconsin Scientific Areas Preservation Council, 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Lilly Bay Wetland.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Lilly Bay Wetland.

Mammals

Lilly Bay Wetland has been classified as most desirable habitat for white-tailed deer (Odocoileus virginianus) and as supplemental habitat for squirrels and muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A survey of the mammals of the Green Bay Island (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Lilly Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Lilly Bay Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

Population

Lilly Bay Wetland is located in Sevastopol Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-3 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population estimates for 1990 indicate that Door County may show a slow population decrease in the future.

Table 10-3. Population Data for the Vicinity of Lilly Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Sevastopol Township	2,375	16.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Lilly Bay Wetland is rural open space. The area surrounding the wetland is characterized by agricultural and other rural open space uses, with residential development along the shoreline and scattered through the inland area (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975). The primarily agricultural nature of this area suggests that this wetland may be subject to low to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Lilly Bay Wetland.

Mineral, Energy, and Forest Resources

Although Lilly Bay Wetland is within an area underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the vicinity of the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and

Pelham, 1976; Ostrom, 1970). There are numerous sand and gravel pits in the vicinity of the wetland, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetland.

Lilly Bay Wetland lies within a wooded area, and sizeable wooded areas lie to the south, west, and northwest of the wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). It was not determined through the literature search whether these areas are used for wood production.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Lilly Bay Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Lilly Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Lilly Bay Wetland (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #69, #101) are present in the vicinity of the wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 196

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

WHITEFISH BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 197-198

Setting

The Whitefish Bay Wetland Complex, comprised of Whitefish Bay Wetland and Whitefish Bay Creek Wetland, is located in Door County, Wisconsin, 0.2 mile from the Lake Michigan shoreline and approximately 7.0 miles northeast of the city of Sturgeon Bay. The wetlands are situated on the eastern side of Door Peninsula, less than ten miles north of the Sturgeon Bay Canal (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960).

Whitefish Bay Creek Wetland is a Lower Perennial Riverine System. It lies on either side of Whitefish Bay Creek, which drains Clark Lake roughly 0.5 mile inland. Clark Lake was a bay of Lake Michigan at one time; however, the action of waves and currents has built a bar of gravel and sand across the mouth of the indentation, converting the bay into a lake (Martin, 1965). Whitefish Bay Creek Wetland is low and wooded.

Whitefish Bay Wetland is a slightly elevated and wooded Palustrine System (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960). The portion of the Lake Michigan shoreline in which the wetlands are situated has a sand beach approximately 75 feet wide. Sand dunes, 12 to 15 feet above lake level, parallel the shoreline (Wisconsin Division of Environmental Protection, 1971). These wetlands are included in a single wetland complex because they are located behind the coastal sand dunes in close proximity to one another.

Topography

Whitefish Bay Wetland has a total relief of less than 3 feet, and its elevations range from approximately 596 to 599 feet above sea level (16 to 19 feet above the approximate mean elevation of Lake Michigan). Whitefish Bay Creek Wetland has a total relief of 6 feet, with elevations ranging from approximately 584 to 590 feet above sea level. The wetlands occupy a relatively low area in close proximity to Whitefish Bay Creek, which cuts through well-developed open and stabilized sand dunes and high quality beach. Moist forests cover the steep sand dunes in the area (Wisconsin Scientific Areas Preservation Council, 1976).

Surficial Geology

The surficial geology of Whitefish Bay Wetland and Whitefish Bay Creek Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Whitefish Bay Wetland Complex is Peat. Peat soil is poorly drained and consists of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Whitefish Bay Wetland, but Whitefish Bay Creek flows through the southern part of Whitefish Bay Creek Wetland. No significant elevational change occurs in the creek as it flows through the wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960). Hydrologic information on Whitefish Bay Creek, taken in 1965, is reported in Table 10-4. The water quality information may reflect conditions in the southern portion of Whitefish Bay Creek Wetland.

Table 10-4. Hydrological Data for Whitefish Bay Creek Sampled in 1965[a]

Drainage area (sq.mi.)	Length (mi.)	Gradient (ft./mi.)	pH	Alkalinity $CaCO_3$ (mg/l)
23	1.1	7.3	78	205

[a] Poff and Threinen, 1965

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific information pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Whitefish Bay Wetland and Whitefish Bay Creek Wetland.

Climate

The closest weather station providing climatic data for the Whitefish Bay Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Whitefish Bay Wetland Complex (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960).

BIOTIC SETTING LM 197-198

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Whitefish Bay Wetland and Whitefish Bay Creek Wetland.

Fish

Northern pike (Esox lucius) inhabit Whitefish Bay Creek during spring and presumably utilize Whitefish Bay Creek Wetland for spawning (Wisconsin Department of Natural Resources, 1965). However, a search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Whitefish Bay Wetland and Whitefish Bay Creek Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Whitefish Bay Wetland and Whitefish Bay Creek Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the Whitefish Bay Wetland Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Whitefish Bay Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976). Mud Lake and its surrounding 600 acres of wooded swamp lie one mile to the south of Whitefish Bay Wetland. The Mud Lake Area receives significant use by waterfowl (Poff and Threinen, 1965). The fish and wildlife habitat study also designates Whitefish Bay Creek Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Thompson et al., 1976). Clark Lake, located near the northern edge of Whitefish Bay

Creek Wetland, is a 864-acre body of water used extensively by waterfowl in the fall. It constitutes an important waterfowl hunting area (Poff and Threinen, 1965).

Jackson (1927) reports that mallards (Anas platyrhynchos) and red-breasted mergansers (Mergus serrator) bred on Clark Lake in 1917 and that a pair of common loons were observed there in the same year. Spotted sandpipers (Actitus macularia) were plentiful, and a rare black-billed cuckoo (Coccyzus erythropthalmus) was also observed. Nighthawks (Chordeiles minor) and purple martins (Progne subis) were very common, capturing insects over the lake and wetland area.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to these two wetlands.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing the Whitefish Bay Wetland Complex.

Mammals

Both wetlands of the Whitefish Bay Wetland Complex have been classified as most desirable habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

Snowshoe hare (Lepus americanus), eastern cottontail (Sulvilagus floridanus), squirrels, red fox (Vulpes vulpes), raccoon (Procyon lotor), and white-tailed deer have been observed on Whitefish Bay Creek Wetland (Wisconsin Department of Natural Resources, 1977). A survey of the mammals of the Green Bay Island (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the two wetlands comprising Whitefish Bay Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Whitefish Bay Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of

Natural Resources has designated them as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 197-198

Population

Whitefish Bay Wetland and Whitefish Bay Creek Wetland are located in Sevastopol Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-5 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population estimates for 1990 indicate that Door County may show a slow population decrease in the future.

Table 10-5. Population Data for the Vicinity of the Whitefish Bay Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Sevastopol Township	2,375	16.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Whitefish Bay Wetland and Whitefish Bay Creek Wetland is rural open space. The area surrounding the wetlands is characterized by a mixture of agricultural and other rural open space uses, with residential development along the shoreline. A secondary road crosses Whitefish Bay Creek Wetland and another secondary road lies adjacent to Whitefish Bay Wetland. Two bridges cross Whitefish Bay Creek near the wetlands, and several gravel pits are located in the vicinity (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The extreme eastern portion of Whitefish Bay Creek Wetland and the northern portion of Whitefish Bay Wetland are located within Whitefish Dunes State Park which is owned by the Wisconsin Department of Natural Resources. The remainder of the land in these wetlands is under private ownership (Schinkten, 1975; Wisconsin State Planning Office, 1974).

The portion of the wetlands situated within Whitefish Dunes State Park is assumed to be under minimal development pressures. Development pressures on the remaining portions of the wetlands may be greater owing to their proximity to the park.

Recreation

Whitefish Bay Wetland and Whitefish Bay Creek Wetland lie partially within the western portion of Whitefish Dunes State Park. Recreational activities in the park are oriented toward the dunes area and the Lake Michigan beach. Major activities include shore fishing, swimming, hiking, and nature study of the dune area. No recreational development is planned for the wetland area (Wisconsin Bureau of Parks and Recreation, 1977).

Mineral, Energy, and Forest Resources

Although Whitefish Bay Wetland and Whitefish Bay Creek Wetland are within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetlands (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetlands, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are numerous sand and gravel pits in close proximity to the wetland, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetlands.

Whitefish Bay Wetland and Whitefish Bay Creek Wetland lie within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Whitefish Bay Wetland and Whitefish Bay Creek Wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to the wetlands of the Whitefish Bay Wetland Complex. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Whitefish Bay Wetland and Whitefish Bay Creek Wetland (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that one

archaeological site (DR #100) is present in the vicinity of Whitefish Bay Wetland; two archaeological sites (DR #28, #29) are present in the vicinity of Whitefish Bay Creek Wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 197-198

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 199

Setting

Jacksonport Area Wetland is located on the eastern side of Door Peninsula in Door County, Wisconsin, 11 miles northeast of the city of Sturgeon Bay. The wetland is a Palustrine System; it lies 0.1 mile from the Lake Michigan shoreline, approximately one mile north of Clark Lake, and occupies a low, wooded site (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960). Clark Lake was a bay of Lake Michigan at one time, but the action of waves and currents has built a bar of gravel and sand across the mouth of the indentation, converting the bay into a lake (Martin, 1965).

Topography

Jacksonport Area Wetland has very little relief. Its elevation is just below 600 feet above sea level, 20 feet above the approximate mean elevation of Lake Michigan. The wetland lies in a small depression on a low coastal plain that includes Clark Lake. The topography inland from the wetland is gently rolling, with wetlands and depressions scattered throughout the upland. The shoreline in this area has been described by the Great Lakes Basin Commission (1975) as a non-erodible low plain.

Surficial Geology

The surficial geology of Jacksonport Area Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Jacksonport Area Wetland is Peat, which is a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Jacksonport Area Wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). However, the literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Jacksonport Area Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Jacksonport Area Wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960).

BIOTIC SETTING LM 199

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Jacksonport Area Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Jacksonport Area Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Jacksonport Area Wetland.

Reptiles and Amphibians

The blue-spotted salamander (Ambystoma laterale) was collected between 1971 and 1975 in Jacksonport Township, in which this wetland and several interior wetlands are located (Vogt, Wisconsin Department of Natural Resources, unpublished). The species breeds in small vernal ponds and may use Jacksonport Area Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Jacksonport Area Wetland as Class I wildlife habitat, "most desirable" for ruffed grouse (Bonasa umbellus). The wetland has "supplemental" value for waterfowl (Thompson et al., 1976). Jacksonport Area Wetland lies near Clark Lake, a 864-acre body of water important for waterfowl and for hunting (Poff and Threinen, 1965). Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Jacksonport Area Wetland.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing this wetland.

Mammals

Jacksonport Area Wetland has been classified as most desirable habitat for white-tailed deer (Odocoileus virginianus), as desirable habitat for squirrels, and as supplemental habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Jacksonport Area Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Jacksonport Area Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

Population

Jacksonport Area Wetland is located in Jacksonport Township of Door County, Wisconsin. Door County is sparsely populated and has a density of 41 persons per square mile. Table 10-6 indicates that Door County experienced rapid population growth between 1970 and 1975, while Jacksonport Township reported a moderate decline during the same time period. Population projections for 1990 indicate that Door County may show a slow population decline in the future.

Table 10-6. Population Data for the Vicinity of Jacksonport Area Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Jacksonport Township	622	-4.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Jacksonport Area Wetland is rural open space. The surrounding area is characterized by a mixture of agricultural and other rural open space uses with some shoreline residential development. A secondary road, access roads, and gravel pits are located in the vicinity of the wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975).

The rural nature of the wetland area, combined with the declining population of Jacksonport Township, suggests that this wetland may be subject to low development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Jacksonport Area Wetland.

Mineral, Energy, and Forest Resources

Although Jacksonport Area Wetland is within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are numerous sand and gravel pits in the surrounding area, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetland. Jacksonport Area Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960), but it was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Jacksonport Area Wetland (U.S.G.S. quadrangle map, Jacksonport, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Jacksonport Area Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Jacksonport Area Wetland (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that one archaeological site (DR #1) is present in the vicinity of Jacksonport Area Wetland. Information regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 199

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

KANGAROO LAKE AREA WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 200-201

Setting

The Kangaroo Lake Area Wetland Complex, comprised of Kangaroo Lake Area Wetlands #1 and #2, is situated near Kangaroo Lake on the eastern side of Door Peninsula in Door County, Wisconsin. The wetlands lie three miles south of the town of Baileys Harbor, Wisconsin, approximately 0.1 mile from the Lake Michigan shoreline. Kangaroo Lake Area Wetland #1 is located between two lines of coastal sand dunes which separate Kangaroo Lake and Lake Michigan. Kangaroo 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 indentation, forming the lake (Martin, 1965). Kangaroo Lake Area Wetland #2 is located east of Kangaroo Lake on a gentle slope. Both of the wetlands are Lacustrine Systems; they occupy low, wooded sites (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Kangaroo Lake Area Wetland #1 has a total relief of less than 10 feet, and its elevations range from roughly 582 to 590 feet above sea level, 2 to 10 feet above the approximate mean level of Lake Michigan. Kangaroo Lake Area Wetland #2 has very slight relief. Its elevation is 585 feet above sea level. Kangaroo Lake Area Wetland #1 is located between two beach ridges, and Kangaroo Lake Area Wetland #2 lies in a gently sloping, low area. The topography upland of the wetland is gently rolling with wetlands and depressions scattered throughout (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). The portion of the Lake Michigan shoreline near the wetlands has been described by the Great Lakes Basin Commission (1975) as an area of low sand dunes, less than 30 feet high.

Surficial Geology

The surficial geology of Kangaroo Lake Area Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Kangaroo Lake Area Wetlands #1 and #2 is Peat, which is a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

Heines Creek flows through the northeastern portion of Kangaroo Lake Area Wetland #1. The creek drains Kangaroo Lake and has a stream bed of marl and sand (Poff and Threinen, 1965). Heines Creek has a change in elevation of less than 10 feet as it flows through the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). Hydrologic data for Heines Creek are reported in Table 10-7. The water quality data were gathered in 1962 and may reflect conditions in Kangaroo Lake Area Wetland #1.

Table 10-7. Hydrological Data for Heines Creek Sampled in 1962[a]

Drainage area (sq.mi.)	Length (mi.)	Gradient (ft./mi.)	pH	Alkalinity $CaCO_3$ (mg/l)
14	2.9	7.8	8.1	199

[a] Poff and Threinen, 1965

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific information pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Kangaroo Lake Area Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for the Kangaroo Lake Area Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 29.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Kangaroo Lake Area Wetland Complex (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING LM 200-201

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Kangaroo Lake Area Wetlands #1 and #2.

Fish

Major fish species present in Kangaroo Lake include northern pike (Esox lucius), walleye (Stizostedion vitreum), largemouth bass (Micropterus salmoides), and unidentified panfish (Wisconsin Department of Natural Resources, 1965). These species may utilize Kangaroo Lake Area Wetlands #1 and #2.

A search of the literature provided no site-specific information pertaining to species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Kangaroo Lake Area Wetlands #1 and #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Kangaroo Lake Area Wetlands #1 and #2.

Reptiles and Amphibians

The blue-spotted salamander (Ambystoma laterale) was collected between 1971 and 1975 in Jacksonport Township, in which Kangaroo Lake Area Wetlands #1 and #2 and several interior wetlands are located (Vogt, 1978). The species breeds in small vernal ponds and may use these wetlands. However, the literature search provided no published, site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Kangaroo Lake Area Wetlands #1 and #2.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Kangaroo Lake Area Wetland #1

as Class I wildlife habitat, "most desirable" for ruffed grouse (Bonasa umbellus) (Thompson et al., 1976). The wetland adjoins the southern end of Kangaroo Lake. Waterfowl use this lake and Kangaroo Lake Area Wetland #1 for nesting and resting (Poff and Threinen, 1965). Kangaroo Lake Area Wetland #2 was not included in the study. Although this wetland lies less than one mile from Kangaroo Lake, its small size and its location between a gravel pit and a dirt road probably limit its use by waterfowl. A black tern (Chlidonias nigra) colony has existed for several years at the north end of Kangaroo Lake. The population of this colony has been estimated at 15 to 20 pairs (Scharf et al., 1977).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Kangaroo Lake Area Wetlands #1 and #2.

The literature search provided no site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing these wetlands.

Mammals

Kangaroo Lake Area Wetland #1 has been classified as most desirable habitat for white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Kangaroo Lake Area Wetland Complex, or to major species present in Kangaroo Lake Area Wetland #2.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Kangaroo Lake Area Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated Kangaroo Lake Area Wetland #1 as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

Population

Kangaroo Lake Area Wetlands #1 and #2 are located in Jacksonport Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-8 indicates that Door County experienced rapid population growth between 1970 and 1975, while Jacksonport Township reported a moderate decline during the same time period. Population projections for 1990 indicate that Door County may show a slow population decline in the future.

Table 10-8. Population Data for the Vicinity of Kangaroo Lake Area Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Jacksonport Township	622	-4.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Kangaroo Lake Area Wetlands #1 and #2 is rural open space. The surrounding area is primarily a mixture of agricultural and other rural open space uses, with residential development along the shorelines of both Lake Michigan and Kangaroo Lake (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975), and their proximity to Kangaroo Lake and Lake Michigan suggests that they may be subject to recreational development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Kangaroo Lake Area Wetlands #1 and #2.

Mineral, Energy, and Forest Resources

Although Kangaroo Lake Area Wetlands #1 and #2 are within an area underlain by Niagara limestone, there are no quarrying operations within the vicinity of the wetlands (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetlands, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901;

Hadley and Pelham, 1976; Ostrom, 1970). There are numerous sand and gravel pits in the vicinity of the wetlands, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetlands.

Kangaroo Lake Area Wetlands #1 and #2 lie within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Kangaroo Lake Area Wetlands #1 and #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Kangaroo Lake Area Wetlands #1 and #2. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Kangaroo Lake Area Wetlands #1 and #2, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 200-201

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

BAILEYS HARBOR-EPHRAIM SWAMP

PHYSIOGRAPHIC SETTING LM 202

Setting

Baileys Harbor-Ephraim Swamp is located in Door County, Wisconsin, near the northern tip of Door Peninsula. The wetland lies 0.3 mile north of the town of Baileys Harbor and extends northwestward to a point approximately one mile south of the village of Ephraim. The wetland is adjacent to the Lake Michigan shoreline at Baileys Harbor, Moonlight Bay, and North Bay on the eastern side of the peninsula and to Green Bay at Eagle Harbor on the western side of the peninsula (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Baileys Harbor Swamp and Ephraim Swamp merge to form a wetland corridor which almost completely bisects the upper extent of Door Peninsula. The southern portion of the wetland lies adjacent to Baileys Harbor; this area consists of parallel, abandoned beach ridges and swales of former Lake Michigan levels. Some of these swales are wet and open, while others are forested with swamp conifers (Germain et al., 1977). Baileys Harbor-Ephraim Swamp is a low, almost completely wooded, Lacustrine and Riverine System.

Topography

Baileys Harbor-Ephraim Swamp is a large wetland area, and total relief is approximately 40 feet; wetland elevations range from 580 to 620 feet above sea level, lake level to 40 feet above lake level. The southern portion of the wetland is separated from Baileys Harbor by a line of coastal beach ridges. The topography surrounding the wetland is gently rolling to flat. A high bluff line paralleling the western shoreline of Door Peninsula is interrupted by this low wetland area at Eagle Harbor. The landscape generally tends to slope downward east of the bluffline. The Great Lakes Basin Commission (1975) describes the east shoreline of this portion of Door Peninsula as a non-erodible low plain, and the west shoreline as an erodible low plain.

Surficial Geology

The surficial geology of Baileys Harbor-Ephraim Swamp is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Baileys Harbor-Ephraim Swamp is Peat, which is a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

Ephraim Creek is a low gradient creek which originates in Ephraim Swamp and flows to Eagle Harbor in Green Bay. This stream is approximately 1.5 miles long. Reiboldt Creek, which has a moderate gradient, drains the wetland adjacent to Mud Lake as it flows from Mud Lake to Moonlight Bay. There are also two unnamed streams of continuous flow located in Baileys Swamp. One stream originates in the western part of Baileys Swamp and flows into Mud Lake. The other unnamed stream flows into Mud Lake from a point north of the lake (Poff and Threinen, 1965).

There are several ponds and lakes in Baileys Harbor Swamp. These include Pluff Pond, Pickerel Pond, and Mud Lake as well as several unnamed ponds in the southern portion of Baileys Harbor Swamp. Pluff Pond is a small, springfed wilderness lake located in the northern portion of Baileys Swamp. The water of this pond is clear and stays cold throughout the summer (Poff and Threinen, 1965). Pickerel Pond is located in the southern portion of the wetland, within an area called Voecks Marsh. Pickerel Pond is a bay mouth bar pond which drains into Lake Michigan (Wisconsin Scientific Areas Preservation Council, 1972). Mud Lake is fed by two streams, several springs, and the natural drainage of the surrounding Baileys Harbor Swamp. This shallow (5 feet) drainage lake has a marl bottom.

Baileys Swamp is influenced by the periodic natural fluctuations in Lake Michigan. The groundwater levels of this area also fluctuate. The major effect of these periodic fluctuations on Baileys Harbor Swamp is to reduce the value of the timber in the wetland (Wisconsin Scientific Areas Preservation Council, 1975).

Baileys Harbor Swamp and Ephraim Swamp have separate surface drainage systems. This distinction occurs near the point where Ephraim Creek begins (T31N, R27E, Sec. 25).

The southern portion of Baileys Harbor Swamp (the area surrounding Pickerel Pond) is called Voecks Marsh. The maximum depth of Voecks Marsh is two feet; however, the water depth of Baileys Harbor Swamp is dependent on fluctuations in Lake Michigan and on local recharge from rainfall. Limited water quality data is available for Voecks Marsh, which was sampled in 1962. At that time, the pH value was 7.6 and the alkalinity was 126 parts per million (Poff and Threinen, 1965). Additional water quality data for the surface waters of Baileys Harbor-Ephraim Swamp are presented in Table 10-9.

Table 10-9. Hydrological Data for Baileys Harbor-Ephraim Swamp Sampled in 1962[a]

Stream/lake	Drainage area (sq.mi.)	Length (mi.)	Gradient (ft./mi.)	pH	Alkalinity ($CaCO_3$)
Mud Lake	155.0	1.4	--	8.5	181 (ppm)
Pluff Pond	.5	.1	--	7.3	255 (ppm)
Ephraim Creek	3.0	1.5	2.0	7.9	215 (mg/l)
Reiboldt Creek	12.0	1.0	5.0	7.9	170 (mg/l)
T30N, R28E, Sec. 3 (unnamed stream)	4.0	2.8	6.1	7.6	220 (mg/l)
T31N, R28E, Sec. 33 (unnamed stream)	7.0	2.7	13.7	7.6	256 (mg/l)

[a] Poff and Threinen, 1965

Groundwater quality data were taken in 1972 from a deep well site located in T30N, R28E, Sec. 8. The pH value was 7.4 and the hardness was 280.0 milligrams per liter. Dissolved solids and sodium concentrations were 273.0 and 6.7 milligrams per liter, respectively (Holt and Skinner, 1973). These data may reflect groundwater conditions beneath Baileys Harbor Swamp.

The literature search yielded no site-specific information pertaining to groundwater drainage patterns and runoff, or seasonal changes in Baileys Harbor-Ephraim Swamp.

Climate

The closest weather station providing climatic data for Baileys Harbor-Ephraim Swamp is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Bay mouth bars are located at Baileys Harbor and Moonlight Bay (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Vegetation

Information regarding major species composition and distribution for the Ridges Sanctuary, which comprises a small part of the wetland at Bailey's Harbor, is provided by Fuller (1950) and the Milwaukee Public Museum (1977, 1978).

The Ridges Sanctuary, a 736.5-acre, privately owned nature preserve, consists of swales and sand ridges, remnants of former Lake Michigan shorelines. The flora of Ridges Sanctuary is highly diverse owing to diversity of habitat offered by wetland depressions between dry sand ridges, cool micro-climate provided by winds from Lake Michigan which favors aboreal forest flora, and excellent preservation of this natural area.

Variability in wetland vegetation of swales is largely dependent on water level and age. Swales which contain water throughout most of the year are characterized by a sedge meadow-bog type of vegetation dominated by sedges with patches of reed grass (Phragmites communis). Along the wet borders of swales are pitcher plants (Sarracenia purpurea), tamarack (Larix larcina), white cedar (Thuja occidentalis), and many species of orchids. Plants of shallow open water areas include marsh marigold (Caltha palustris), bullhead lily (Nuphar variegatum), and bladderwort (Utricularia vulgaris). In more mature swales where decayed organic material is prominent, vegetation is composed of lowland trees, and shrubs such as swamp alder (Alnus sp.), dogwood (Cornus sp.), white cedar, quaking aspen (Populus tremuloides), black ash (Fraxinus nigra), and paper birch (Betula papyrifera). A third type of wetland, the cedar swamp, occurs at Ridges Sanctuary. In this wetland type, cedar and other trees form a dense overstory allowing little light penetration. Lack of incident light at ground level, coupled with nearly sterile soil, results in a lack of plant growth in the cedar swamp understory; small shrubs and forbs are sparse or missing entirely. Of the conifers occurring in Wisconsin all but two, the red cedar (Juniperus virginiana) and jack pine (Pinus banksiana), occur in the Ridges Sanctuary. Of the 45 species of orchids occurring in Wisconsin, at least 30 are found in Door County, with 25 native species thriving in a 40-acre tract in Ridges Sanctuary. Additionally, many species of the heath family (Ericaceae) thrive in the cool boreal microclimate of the Ridges. Finally, many plants which are rare or of only local occurrence in Wisconsin are frequently found in the Ridges Sanctuary.

Table 10-10. Flora of Baileys Harbor Bog[a]

Native conifers occurring at the Ridges Sanctuary

balsam fir	red pine
common juniper	white pine
prostrate juniper	American yew
tamarack	arborvitae
white spruce	hemlock
black spruce	

Orchids growing in the vicinity of Baileys Harbor

arethusa	tall white bog orchid
grass pink	tall leafy green orchid
calypso	blunt-leaved orchid
spotted coralroot	large round-leaved orchid
striped coralroot	smaller purple fringed orchid
early coralroot	long-bracted orchid
pink moccasin flower	heart-leaved twayblade
ram's-head lady's-slipper	white adder's-mouth orchid
large yellow lady's-slipper	rose pogonia
showy lady's-slipper	nodding lady's-tresses
giant rattlesnake plantain	slender lady's-tresses
dwarf rattlesnake plantain	hooded lady's-tresses
intermediate rattlesnake plantain	

Members of the heath family occurring abundantly at The Ridges

bog-rosemary	labrador tea
bearberry	Indiana pipe
leather-leaf	pine drops
pipsissewa	pink-flowered shinleaf
creeping snowberry	shinleaf
trailing arbutus	one-sided shinleaf
wintergreen	green-flowered shinleaf
huckleberry	velvet-leaved blueberry
pale laurel	small cranberry

Plants that are rare or local in many parts of Wisconsin but frequent at The Ridges

dwarf mistletoe	brook lobelia
clintonia	buckbean
bastard toad-flax	partridge-berry
goldthread	yellow pond lily
bunchberry	one-flowered broomrape
round-leaved sundew	gay-wings
smaller fringed gentian	silverweed
spurred gentian	marsh five-finger
shrubby St. John's-wort	dwarf Canadian primrose
dwarf lake iris	pitcher plant

beach pea	meadow spikemoss
midland lily	northern spikemoss
wood lily	Canadian buffalo-berry
twinflower	

[a] Fuller (1950), based on Sieker (1934)

Fish

The possibility of lake-run fish species exists in this wetland (Wisconsin Department of Natural Resources, 1965), but a search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Baileys Harbor-Ephrain Swamp.

Invertebrates

Information on the composition and relative abundance of the invertebrate fauna of this wetland is available from the files of the Wisconsin Department of Natural Resources (1970). The oligochaetes, tendipedids (Diptera), and amphipods have been the major species collected at the sample sites, and these organisms can probably still be found in this wetland.

The literature search provided no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels for the invertebrates present in Baileys Harbor-Ephraim Swamp.

Reptiles and Amphibians

There are eight species of amphibians reported from the Ridges Sanctuary, located in the southern part of Baileys Harbor-Ephraim Swamp. These are the blue-spotted salamander (Ambystoma laterale), spotted salamander (Ambystoma maculatum), red-backed salamander (Plethodon cinereus), American toad (Bufo americanus), northern spring peeper (Hyla c. crucifer), gray tree frog (H. versicolor), northern leopard frog (Rana pipiens), and wood frog (R. sylvatica). There are also seven species of reptiles: the snapping turtle (Chelydra serpentina), midland painted turtle (Chrysemys picta marginata), northern water snake (Natrix s. sipedon), eastern garter snake (Thamnophis s. sirtalis), northern red-bellied snake (Storeria o. occipitomaculata), eastern milk snake (Lampropeltis triangulum) and western fox snake (Elaphe v. vulpina) (Ridges Sanctuary, 1977).

In Mud Lake, located in the central part of the wetland, turtles are abundant; snapping turtles and painted turtles have been identified (Wisconsin Department of Natural Resources, 1969, 1970). Green frogs (Rana clamitans) and northern leopard frogs have also been observed. Spring peepers were observed at Moonlight Bay, in the eastern part of the wetland.

The four-toed salamander (Hemidactylium scutatum) was collected between 1971 and 1975 in Baileys Harbor Township, which includes the southern portion of Baileys Harbor-Ephraim Swamp (Vogt, 1978). This species frequents bogs and could be present in the wetland.

The literature search provided site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the amphibians and reptiles in Baileys Harbor-Ephraim Swamp.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Baileys Harbor-Ephraim Swamp as Class I wildlife habitat. The western portion of this wetland is "most desirable" for ruffed grouse (Bonasa umbellus) and songbirds, "desirable" for woodcock (Philohela minor), and of "supplemental" value for waterfowl and pheasant (Phasianus colchicus). The area near Mud Lake is "most desirable" for waterfowl and songbirds and has "supplemental" value for gulls and terns. The portion of the wetland along Lake Michigan is "most desirable" for waterfowl, gulls and terns, and shore birds (Thompson et al., 1976).

Within Baileys Harbor-Ephraim Swamp lie the Mud Lake Scientific Area, the Ridges Sanctuary Scientific area, and Pickerel Pond. These units make up an extremely diverse ecological area. The Mud Lake Scientific Area is a National Natural Landmark. A portion of the surrounding area is managed by the Wisconsin Department of Natural Resources, Bureau of Game Management. Mud Lake receives heavy use by waterfowl and was an important hunting area prior to its designation as a scientific preserve (Wisconsin Scientific Areas Preservation Council files). The great blue heron (Ardea herodias), green heron (Butorides striatus), wood duck (Aix sponsa), black-billed cuckoo (Coccyzus erythropthalmus), and pileated woodpecker (Dryocopus pileatus) are among the species of birds recorded in Mud Lake Scientific Area (Wisconsin Scientific Areas Preservation Council files). A Mississippi kite (Ictinia mississipiensis) was present in May, 1972 (Tessen, 1976).

The Ridges Sanctuary Scientific Area is also a National Natural Landmark. Fifty-six species of birds are recorded as summer residents of Ridges Sanctuary and the adjacent area (Ridges Sanctuary, Inc., 1977). The green heron, American bittern (Botaurus lentiginosus), herring gull (Larus argentatus), ring-billed gull (L. delawarensis), Caspian tern (Sterna caspia), and ten species of warblers are among the species included on the list. The staff of the Ridges Sanctuary conducts regular bird censuses, the results of which are published in the newsletter Ridges News. Bluebirds (Sialia sialis), indigo buntings (Passerina cyanea), green herons, bobolinks (Dolichonyx oryzivorus), and eastern kingbirds (T. tyrannus) were more abundant in 1976 than in previous years (Lukes, 1976); upland sandpipers (Bartramia longicauda) were particularly abundant in 1977 (Lukes, 1977). Purple grackles (Quiscalus quiscala), many of which are frightened out of nearby orchards by explosive devices, seek shelter in the sanctuary (Lukes, 1976). These explosive devices may affect the distribution of other bird species as well.

Pickerel Pond, which is very shallow, is used by both mallards and American coots (Fulica americana). Two old duck hunters' blinds on the shore attest to the pond's use for hunting (Wisconsin Scientific Areas Preservation Council files). The Pickerel Pond area is classified as a Natural Area - 2 by the Wisconsin Scientific Areas Preservation Council (1976). This designation means that the area has educational and ecological value.

Mammals

Fourteen species of mammals (Table 10-11) have been reported from Ridges Sanctuary, located in the southern part of Bailey's Harbor-Ephraim Swamp. Snowshoe hare (Lepus americanus), coyote (Canis latrans), raccoon (Procyon lotor), mink (Mustela vison), and white-tailed deer (Odocoileus virginianus) have been observed on the central portion of this wetland at Mud Lake Wildlife Area (Wisconsin Scientific Areas Preservation Council, open file report, 1974; Wisconsin Department of Natural Resources, open file reports, 1975 and undated). White-tailed deer and snowshoe hare are hunted on portions of this wetland (Wisconsin Department of Natural Resources, open file report), and trapping of beaver, muskrat, and mink is permitted.

Table 10-11. Mammal Species of Ridges Sanctuary

Common name	Common name
short-tailed shrew	porcupine
eastern cottontail	coyote
snowshoe hare	red fox
red squirrel	raccoon
deer mouse	weasel
white-footed mouse	mink
Gapper's red-backed mouse	white-tailed deer

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, life histories, food sources, or relationship to water levels of the mammals inhabiting Baileys Harbor-Ephraim Swamp.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine et al., 1975) were documented in Baileys Harbor-Ephraim Swamp by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 202

Population

Baileys Harbor-Ephraim Swamp is located in Baileys Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-12 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-12. Population Data for the Vicinity of Baileys Harbor-Ephraim Swamp

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Baileys Harbor Township	687	11.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Baileys Harbor-Ephraim Swamp is primarily rural open space, with some of the eastern portion of the wetland in agricultural uses. There are a few shoreline residences within the wetland, primarily in the Moonlight Bay area. The surrounding land is largely in agricultural use, with with residential and commercial development near the southeastern, northeastern, and northwestern portions of the wetland (the towns of Baileys Harbor, North Bay, and Ephraim, respectively). The wetland is crossed by secondary highways and light-duty access roads, as well as a series of foot trails. Several gravel pits are located in the wetland or close by. The Ephraim-Fish Creek airport is located to the west of the wetland, south of Eagle Harbor (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

The State of Wisconsin owns approximately 1,800 acres within the wetland in the vicinity of Mud Lake, 1,060 acres of which were designated in 1975 as a state scientific area. The remainder of these holdings constitutes the Mud Lake Wildlife Area. The Regents of the University of Wisconsin own about 235 acres which front on the southern portion of Moonlight Bay, and Door County owns a small parcel of land, used as a county park, in the extreme southwest corner of the wetland. The remainder of the wetland is under private ownership; notable is the Ridges Sanctuary, an area of 708 acres to the south of the state holdings that is owned by a private foundation and designated as a state scientific area (Schinkten, 1975; Wisconsin State Planning Office, 1974).

Owing to the extent of public holdings and the relatively scattered residential development in the wetland area, development pressures are likely to be low.

Recreation

The Ridges Sanctuary provides an excellent opportunity for nature study, with well-planned nature trails and guided tours drawing over 30,000 visitors annually (Germain et al., 1977). Mud Lake State Scientific Area received an estimated 33 visitors for recreational purposes in 1977 (Younkman, 1978). The Mud Lake Wildlife Area receives its primary recreational use from hunting. Other uses include trapping, snowmobiling, limited cross-country skiing, fishing, and canoeing. The wildlife area is considered to afford high quality, low density recreational use (Dan Olson, Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

Although Baileys Harbor-Ephraim Swamp is within an area underlain by Niagara limestone, there are no quarrying operations within the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). Although there are several sand and gravel pits in the eastern portion of the wetland, none are active (Ostrom, 1970). No oil, gas, or coal resources are present in the wetland.

Baileys Harbor-Ephraim Swamp is almost completely wooded (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960), but it was not known whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Baileys Harbor-Ephraim Swamp (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There is one NPDES permit holder adjacent to and possibly discharging into Baileys Harbor Swamp. Wastewater from a laundry operation is placed in a five-acre disposal site located in or near the southwestern portion (T30N, R28E, SE

1/4, SE 1/4, Sec. 7) of Baileys Harbor Swamp (Wisconsin Industrial Discharge Section, 1978). In addition, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

The Ridges Sanctuary Scientific Area and Mud Lake Scientific Area are both National Natural Landmarks (Wisconsin Historic Preservation Division, 1978). The Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #3, #72) are present in the vicinity of Baileys Harbor-Ephraim Swamp. Information regarding the specific site locations, field findings, and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 202

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

Mud Lake State Scientific Area and the Ridges Sanctuary Scientific Area are used for research purposes, with Mud Lake State Scientific Area estimated to have had eight visitors for such use in 1977 and the Ridges Sanctuary estimated to have had forty-two such contacts (Younkman, 1978). Information concerning these State Scientific Areas is available from the Wisconsin Scientific Areas Preservation Council.

TOFT POINT WETLAND

PHYSIOGRAPHIC SETTING LM 203

Setting

Toft Point Wetland is located in Door county, 1.7 miles east of the town of Baileys Harbor, Wisconsin. This Lacustrine wetland lies on the eastern side of Toft Point, which juts into Lake Michigan, separating Baileys Harbor and Moonlight Bay (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). Toft Point is low and is mostly covered by hardwood forest with old-growth hemlock and white pine. The Lake Michigan frontage on the point is rocky (Germain et al., 1977).

Topography

Toft Point Wetland has slight relief, and its elevations range from 580 to approximately 588 feet above sea level (lake level to 8 feet above the approximate mean elevation of Lake Michigan). The surrounding topography is gently rolling. The Great Lakes Basin Commission (1975) has described the shoreline in the vicinity of Toft Point as a non-erodible low plain.

Surficial Geology

The surficial geology of Toft Point Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Toft Point Wetland is Peat, which is a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Toft Point Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Toft Point Wetland.

Climate

The closest weather station providing climatic data for Toft Point Wetland is located in Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Two very small islands lie west of Toft Point, and a narrow bay extends southward from the peninsula (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING LM 203

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Toft Point Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Toft Point Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Toft Point Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Toft Point Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Toft Point Wetland as Class I

wildlife habitat, "most desirable" for waterfowl, gulls and terns, and shore birds (Thompson et al., 1976). Toft Point is one of the Wisconsin State Scientific Areas included in the scientific area breeding bird surveys (Wisconsin Scientific Areas Preservation Council, 1974). The surveys for Toft Point were conducted during two- to three-day periods in late June and early July of 1971, 1972, 1973, and 1976 (Table 10-13). A total of 96 species of birds were recorded at Toft Point during this survey, including 9 species of ducks and 15 species of warblers. Red-breasted mergansers (Mergus serrator) and mallards (Anas platyrhynchos) were the most numerous duck species observed.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Toft Point Wetland.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Toft Point Wetland.

Mammals

Snowshoe hare (Lepus americanus), coyote (Canis latrans), red fox (Vulpes vulpes), and weasel (Mustela sp.) have been observed on Toft Point Wetland (Wisconsin Scientific Areas Preservation Council, open file report, 1972). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Toft Point Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Toft Point Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

Table 10-13. Breeding Bird Survey of Toft Point Scientific Area[a,b]

Species	1971	1972	1973	1976
common loon		2		
pied-billed grebe			1	
great blue heron	1		1	1
green heron	1	1	1	
American bittern			1	
black duck	1			
mallard	13	15	2	7
pintail		2		
green-winged teal	2			
blue-winged teal	2	2		
wood duck				1
common goldeneye	4		15	7
common merganser	2	2	2	
red-breasted merganser	36	3	8	x
ruffed grouse	4	2		x
spotted sandpiper	1	1		1
herring gull	13	6	x	16
ring-billed gull	60	350	x	
Bonaparte's gull				x
caspian tern	2		7	
mourning dove	3	1	x	
black-billed cuckoo	1		1	
whip-poor-will		1	1	
chimney swift	3			
ruby-throated hummingbird	1		1	
belted kingfisher	2	1	1	
flicker	4	3	1	1
pileated woodpecker	1			
hairy woodpecker	2		1	
downy woodpecker	1	5	3	
eastern kingbird	2		1	1
crested flycatcher	12	9	6	4
trail's flycatcher	1	1		x
least flycatcher	3	1		
wood pewee	7	11	7	3
olive-sided flycatcher		1	2	1
tree swallow	4	4	2	3
bank swallow				2
barn swallow	2			x
purple martin	7	2		1
blue jay	23	15	8	14
crow	11	6	4	10
black-capped chickadee	31	33	10	15
white-breasted nuthatch	2		2	
red-breasted nuthatch	14	9	5	

(Continued)

Table 10-13. (Continued)

Species	1971	1972	1973	1976
brown creeper	1			
house wren	3	3		7
winter wren	6	11	5	8
long-billed marsh wren				7
short-billed marsh wren		1	1	
catbird	2		1	x
brown thrasher	1			x
robin	30	21	17	8
wood thrush	5	4	2	1
hermit thrush				1
veery	3	1	1	x
bluebird	2			
golden-crowned kinglet				x
cedar waxwing	19	12	16	6
yellow-throated vireo			1	
red-eyed vireo	1	4	5	
warbling vireo				3
black-and-white warbler	1	9	x	1
Nashville warbler	2		1	3
parula warbler	4	8	7	3
yellow warbler		1		
magnolia warbler		1	1	x
yellow-rumped warbler	3	12		x
black-throated green warbler	22	28	13	5
cerulean warbler		1	1	
blackburnian warbler	4	1	2	
pine warbler		4	4	
ovenbird	21	17	13	12
mourning warbler		2		x
yellowthroat	7	10	1	2
Canada warbler	2			
redstart	21	18	14	9
red-winged blackbird	6	22	7	23
northern oriole	2		x	x
grackle	8	26	1	4
cowbird	4	5	5	4
scarlet tanager	1		2	
cardinal	7	1	3	3
rose-breasted grosbeak	4	3	2	3
indigo bunting	4			5
dickcissel				
evening grosbeak				
purple finch	2	2	1	x
goldfinch	3	1	7	2
red crossbill				

(Continued)

Table 10-13(Concluded)

Species	1971	1972	1973	1976
rufous-sided towhee	2		1	
savannah sparrow				
grasshopper sparrow				
Henslow's sparrow				
vesper sparrow				
lark sparrow				
slate-colored junco				
chipping sparrow	13	6	9	5
clay-colored sparrow				
field sparrow				x
white-throated sparrow	1	1	3	8
Lincoln's sparrow				
swamp sparrow	1	4	3	1
song sparrow	7	16	8	5

[a]Tofts Point Scientific Area includes all of Tofts Point Wetland as well as sections of northern mesic hardwood forest and upland white cedar forest. Survey dates were June 29 and 30 and July 1, 1971; June 27, 28, and 29, 1972; June 27 and 29, 1973; July 8 and 11, 1976.

[b]Wisconsin Department of Natural Resources, Scientific Areas Preservation Council, 1974; Wisconsin Department of Natural Resources, Scientific Areas Preservation Council, files.

Population

Toft Point Wetland is located in Baileys Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-14 indicates that both the county and the township experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-14. Population Data for the Vicinity of Toft Point Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Baileys Harbor Township	687	11.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Toft Point Wetland is rural open space. The surrounding area is predominantly rural open space, with some shoreline residential development abutting on Baileys Harbor on the western shore of the peninsula. Access roads are located to the west and north of Toft Point Wetland, and a hiking trail lies to the south (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The extreme northern tip of the wetland is located within land owned by the Regents of the University of Wisconsin; the remainder of the wetland is under private ownership (Schinkten, 1975).

The University of Wisconsin holds 340 acres on this peninsula which have been designated as the Toft Point Scientific Area (Wisconsin Scientific Areas Preservation Council, 1977).

Those portions of the wetland under the ownership of the University of Wisconsin can be considered to be subject to minimal development pressure. The privately-owned portion of the wetland, however, has been the target of recent development efforts in the form of the discontinued Marshalls Point resort development. In view of these efforts, development pressures should be considered high.

Recreation

Younkman (1978) states that the Toft Point State Scientific Area received recreational use in 1977. No other information on recreational uses of the area was found.

Mineral, Energy, and Forest Resources

Although Toft Point Wetland is within an area underlain by Niagara limestone, there are no quarrying operations within the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no active sand and gravel or clay operations in the vicinity of the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

Toft Point Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Toft Point Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Toft Point Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Toft Point Wetland (Wisconsin Historic Preservation Division, 1978), but the Wisconsin Inventory of Archaeology indicates that one archaeological site (DR #73) is present in the vicinity of Toft Point Wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 203

Toft Point State Scientific Area is used for research purposes and is estimated to have had 40 visitors for such use in 1977 (Younkman, 1978).

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

CANA ISLAND AREA WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 204-205

Setting

The Cana Island Area Wetland Complex, comprised of Cana Island Area Wetlands #1 and #2, is located near the northern end of Door Peninsula in Door County, Wisconsin. The wetlands lie adjacent to the Lake Michigan shoreline, near the eastern end of a small peninsula that separates Moonlight Bay and North Bay. Both wetlands are located approximately four miles northeast of the town of Baileys Harbor, Wisconsin. Cana Island is located just offshore of Cana Island Area Wetland #1 and is connected to the mainland by a sand spit. Cana Island Area Wetland #2 is located to the north of Cana Island Area Wetland #1 and extends inland from the shoreline approximately 0.4 mile. Both of these wetlands are low, wooded, Lacustrine Systems (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Cana Island Area Wetland #1 has elevations ranging from 580 feet (lake level) to approximately 585 feet above sea level, 5 feet above the approximate mean elevation of Lake Michigan. Cana Island Area Wetland #2 has slightly more relief, with elevations ranging from 580 feet to 590 feet above sea level. The shoreline in the area of Cana Island Area Wetlands #1 and #2 has been described as a non-erodible low plain (Great Lakes Basin Commission, 1975). A hill rising to 668 feet above sea level is located inland from the wetlands, and large wetland areas lie beyond. Much of the upper portion of Door Peninsula has rolling topography.

Surficial Geology

The surficial geology of Cana Island Area Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Cana Island Area Wetlands #1 and #2 is Peat, which is a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Cana Island Area Wetlands #1 and #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for

select deep well sites in Door County (Holt and Skinner, 1973). However, the literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Cana Island Area Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for Cana Island Area Wetland Complex is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

A sand spit connects Cana Island to the mainland near Cana Island Area Wetland #1 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING

LM 204-205

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Cana Island Area Wetlands #1 and #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Cana Island Area Wetlands #1 and #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Cana Island Area Wetlands #1 and #2.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Cana Island Area Wetlands #1 and #2.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Cana Island Area Wetlands #1 and #2 as Class I wildlife habitat (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Cana Island Wetlands #1 and #2. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing these wetlands.

Mammals

A survey of the mammals of the Green Bay Island (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Cana Island Area Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Cana Island Area Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

Population

Cana Island Area Wetlands #1 and #2 are located in Baileys Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-15 indicates that Door County and Baileys Harbor Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may show a slow population decline in the future.

Table 10-15. Population Data for the Vicinity of Cana Island Area Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Baileys Harbor Township	687	11.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Cana Island Area Wetlands #1 and #2 is predominantly rural open space, although there is some shoreline residential development within the boundary of Cana Island Area Wetland #2. The surrounding area is primarily rural open space, with some shoreline residential development. Access roads and foot trails cross both Cana Island Area Wetlands #1 and #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975). The rural nature of this area suggests that these wetlands may be subject to low to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Cana Island Area Wetlands #1 and #2.

Mineral, Energy, and Forest Resources

Although Cana Island Area Wetlands #1 and #2 are within an area underlain by Niagara limestone, there are no quarries in the vicinity of the wetlands (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetlands, but have little potential for

containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no sand and gravel or clay operations active in the vicinity (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetlands.

Cana Island Area Wetlands #1 and #2 lie within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Cana Island Area Wetlands #1 and #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Cana Island Area Wetlands #1 and #2. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

Cana Island Lighthouse, situated in the vicinity of Cana Island Area Wetland #1, was built in 1868. The keeper's house is a 1½ story cream brick dwelling with a shed-roof entrance. The detached lighthouse is very tall and was encased in steel in 1901 (Wisconsin Historic Preservation Division, 1978).

No known archaeological resources exist in the vicinity of Cana Island Area Wetlands #1 and #2. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 204-205

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication). A study is currently under way to relate the level of environmental contaminants to eggshell thickness and reproductive success of common mergansers (Mergus merganser) and red-breasted mergansers (M. serrator). Eggs are being collected from eight islands along the Lake Michigan coast of Door County, including Cana Island (Heinz, 1977).

NORTH BAY WETLAND

PHYSIOGRAPHIC SETTING LM 206

Setting

North Bay Wetland is located in Door County, six miles northeast of the town of Baileys Harbor, Wisconsin. The wetland lies adjacent to the shoreline of Lake Michigan at North Bay on the eastern shore of Door Peninsula. It extends inland for two miles and extends northward from Marshalls Point as a narrow band paralleling the coastline for a distance of roughly 3.5 miles. The entire wetland is low, and is wooded with the exception of a few small areas (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). North Bay Wetland is a Lacustrine and Riverine System.

Topography

North Bay Wetland has a total relief of 20 feet; elevations in the wetland range from 580 to 600 feet above sea level (lake level to 20 feet above the approximate mean elevation of Lake Michigan). The shoreline adjacent to the wetland has been described by the Great Lakes Basin Commission (1975) as a non-erodible low plain. The topography inland from the wetland is gently rolling to flat. The western shoreline of Door Peninsula is paralleled by a steep bluffline, and the landscape slopes gently downward from this bluffline to the east.

Surficial Geology

The surficial gology of North Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for North Bay Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

Three Springs Creek drains the western portion of North Bay Wetland as it flows to North Bay. The creek originates from several intermittent streams which drain the adjacent upland area and is augmented by springs at Zoo Lake. Zoo Lake, located in the northwestern portion of the wetland, is a small, spring-fed pond with a maximum depth of three feet (Poff and Threinen, 1965). Hydrologic data for Zoo Lake and Three Springs Creek, presented in Table 10-16, may reflect water quality conditions in North Bay Wetland.

Table 10-16. Hydrological Data for Three Springs Creek and Zoo Lake[a]

Stream/lake	Drainage area (sq.mi.)	Length (mi.)	Gradient (ft./mi.)	pH	Alkalinity ($CaCO_3$)
Zoo Lake	1.0	0.1		7.3	220
Three Springs Creek	5.0	2.3	10.9	7.6	210

[a] Poff and Threinen, 1965

North Bay is shallow and the area adjacent to the wetland is three feet deep at most. Because of the sheltered nature of North Bay, little mixing with Lake Michigan occurs for most of the year (Wisconsin Bureau of Environmental Impact, 1974). Water quality data for North Bay Wetland appear in Table 10-17. Data for North Bay are also included and may supplement the data for the wetland. Additional data on water quality are available from Wisconsin Bureau of Environmental Impact (1974).

The hydrology of North Bay Wetland is dependent on Lake Michigan and its fluctuations. As a result, the shore of North Bay and the adjoining wetland are often inundated. A well in the community of North Bay (situated near the southwestern border of the wetland), monitored by the U.S. Geological Survey, has a static water level of approximately 580 feet (October 1970), which is equal to the mean elevation of Lake Michigan. Static water levels on Marshalls Point can rise above the lake level due to local recharge from rainfall. Percolation to the groundwater occurs, although the nearness of the bedrock to the ground surface limits the depth of infiltration and causes most of the percolated water to move laterally into the lake. Rates of groundwater movement into Lake Michigan are slow. North Bay Wetland functions as a groundwater discharge area (Wisconsin Bureau of Environmental Impact, 1974).

Groundwater quality information is available from a deep well site (T31N, R28E, Sec. 2), not far from North Bay Wetland, which was sampled in 1972. This data may be representative of the North Bay-Marshalls Point area, as the chemical content of the groundwater in the area is similar. The pH value was 8.0 and calcium was 64 parts per million. Dissolved solids and alkalinity ($CaCO_3$) were 264 and 260 parts per million, respectively (Wisconsin Bureau of Environmental Impact, 1974).

Climate

The closest weather station providing climatic data for North Bay Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Table 10-17. Water Quality Data for North Bay Wetland and North Bay[a]

Sample from	Date	Kheldahl nitrogen (ppm.)	Dissolved oxygen (ppm.)	Total phosphate (ppm.)	Temperature (°F)	Calcium (ppm.)	Sodium (ppm.)	pH	Alkalinity (ppm.)
North Bay	4/7/69	.92	10.6	.1	47	16.0	3.7	8.1	151
North Bay	9/16/69	.49	8.9	.1	68	18.0	4.4	--	103
North Bay Wetland	7/24/69	.27	--	.05	--	--	--	8.1	214

[a]Wisconsin Department of Natural Resources, Bureau of Environmental Impact, 1974

Special Features

No natural special features are found in the vicinity of North Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING LM 206

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of North Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in North Bay Wetland.

Invertebrates

Information on the composition and relative abundance of the invertebrate fauna of this wetland is available from the files of the Wisconsin Department of Natural Resources (1970). The oligochaetes, tendipedids (Diptera), and amphipods have been the major species collected at the sample sites. These organisms can probably still be found in this wetland.

The literature search produced no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in North Bay Wetland.

Reptiles and Amphibians

During a field survey of fauna of the North Bay area, the Wisconsin Department of Natural Resources (1970 observed northern leopard frogs (Rana pipiens) and heard northern spring peepers (Hyla crucifer). However, the literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in North Bay Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated North Bay Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus), "desirable" for woodcock (Philohela minor), and "supplemental" for pheasant (Phasianus colchicus) and waterfowl. The nearshore area along Lake Michigan is classified as "most desirable" for waterfowl, gulls and terns, and shore birds (Thompson et al., 1976). The Wisconsin Scientific Areas

Preservation Council conducted breeding bird surveys in North Bay during the springs of 1969 and 1970. The results of those surveys are presented in Table 10-18. A total of 52 species of birds were recorded for North Bay Wetland during the surveys. Mallards (Anas platyrhynchos), green-winged teal (A. crecca), pintails (A. acuta), common mergansers (Mergus merganser), herring gulls (Larus argentatus), and red-winged blackbirds (Agelaius phoeniceus) were particularly abundant.

Marshalls Point forms the northern edge of North Bay. In an environmental impact statement for a recreational development proposed for Marshalls Point, including portions of North Bay Wetland, the Wisconsin Bureau of Environmental Impact (1974) lists the birds that have been observed within the project area. The list includes 80 summer residents, one winter resident, and 22 permanent residents. Most notable on this list is the double-crested cormorant (Phalacrocorax auritus), an endangered species in Wisconsin. Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to North Bay Wetland.

The literature search provided no site-specific information pertaining to density and productivity, recreational and commercial use, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

North Bay Wetland has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus), as "desirable" habitat for squirrels, and as "supplemental" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting North Bay Wetland.

Endangered Species

The only endangered bird species known to have bred in the vicinity of North Bay Wetland is the double-crested cormorant. This species is endangered in Wisconsin (Hine et al., 1975). Cormorants nested along Marshalls Point in the 1940's and 1950's. Spider Island, located in Lake Michigan several miles north of Marshalls Point, had nesting cormorants as late as 1962. Three cormorants were sighted on North Bay several times during the summer of 1972 by local residents. No nesting sites were found at that time. The cormorants' habit of feeding on commercially valuable fish led, in part, to its decline on Lake Michigan. Commercial fishermen purposely destroyed this bird in the past,

Table 10-18. Breeding Bird Survey of North Bay Wetland[a,b]

Species	1969	1970
great blue heron	3	6
green heron		4
great egret		2
least bittern		4
black duck	16	21
mallard	111	22
American widgeon	40	3
pintail	15	22
green-winged teal	40	26
blue-winged teal	50	7
shoveler	12	5
lesser scaup	60	
bufflehead	24	9
common mergnaser	11	26
turkey vulture	1	20
red-tailed hawk		1
harrier	1	1
ruffed grouse		1
sora rail	1	2
coot		2
least yellowlegs	2	
herring gull	235	310
ring-billed gull		3
black tern	20	
belted kingfisher	1	1
flicker	6	
yellow-bellied sapsucker		1
downy woodpecker		3
phoebe	1	
tree swallow	200	18
blue jay		8
crow	5	2
red-breasted nuthatch		1
brown creeper		1
short-billed marsh wren		1
robin		10
ruby-crowned kinglet		3
black-and-white warbler		1
Nashville warbler		1
magnolia warbler		1
palm warbler		10

(Continued)

Table 10-18. (Concluded)

Species	1969	1970
black-throated green warbler		1
red-winged blackbird	50*	46
cowbird		12
rose-breasted grosbeak		6
tree sparrow	12	
dark-eyed junco	20	
white-throated sparrow		2
song sparrow		5

[a]Survey dates were April 7, 21, 22 and May 26, 1969; April 19 and May 12, 13, 1970.
[b]Wisconsin Department of Natural Resources Scientific Areas Preservation Council files.

to the point where virtually no nesting now occurs (Wisconsin Bureau of Environmental Impact, 1974).

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in North Bay Wetland by the literature search.

Health

Site-specific information indicates that the environmental quality of North Bay Wetland is very good for birds. A large diversity of songbirds and waterfowl are present, and the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. However, numerous dairy and orchard operators dispose of process waste-water in the area and this may have some effect on the health of the wetland.

CULTURAL SETTING LM 206

Population

North Bay Wetland is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-19 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-19. Population Data for the Vicinity of North Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within North Bay Wetland is rural open space, while the surrounding area is primarily in agricultural open space uses, with scattered areas of shoreline residential development. Access roads and foot trails cross North Bay Wetland. Several gravel pits and fruit orchards are located nearby, and boat docks have been built along the shoreline in the northern extent of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin

Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975). The rural nature of this area suggests that this wetland may be subject to low to moderate developmental pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of North Bay Wetland.

Mineral, Energy, and Forest Resources

Although North Bay Wetland lies within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are a number of sand and gravel pits in the vicinity of the wetland, but none of these pits are active (Ostrom, 1970). There are no known oil, gas, or coal resources present in the wetland.

North Bay Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of North Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to North Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

Deserted fish shanties found near the northeastern portion of the wetland, just south of the Sand Bay Park, are remnants of a once-flourishing fishing industry. The site is comprised of one-story frame buildings in deteriorating condition (Wisconsin Historic Preservation Division, 1978).

The Wisconsin Inventory of Archaeology indicates that one archaeological site (DR #83) is present in the vicinity of North Bay Wetland. Information regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

ROWLEYS BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 207-208

Setting

The Rowleys Bay Wetland Complex, comprised of Rowleys Bay Wetlands #1 and #2, is located in Door County, Wisconsin, approximately 0.8 mile southeast of the community of Ellison Bay. The wetlands are adjacent to Rowleys Bay on the eastern side of Door Peninsula; Rowleys Bay Wetland #1 lies on the western side of Rowleys Bay, south of the point at which the Mink River joins the bay, and Rowleys Bay Wetland #2 lies on the northern end of the bay, east of the junction of the Mink River and the bay. Both of these wetlands are low, almost completely wooded, Lacustrine Systems (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Rowleys Bay Wetland #1 has elevations that range from 580 to 589 feet, 0 to 9 feet above the approximate mean elevation of Lake Michigan. The elevations of Rowleys Bay Wetland #2 range from 580 to 602 feet. The wetlands are located on a non-erodible low plain (Great Lakes Basin Commission, 1975), and the surrounding topography is gently rolling.

Rowleys Bay and the Mink River lie in a low area that forms a break in the elevated Niagara escarpment, which roughly parallels the western shoreline of Door Peninsula (Martin, 1965).

Surficial Geology

The surficial geology of Rowleys Bay Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Rowleys Bay Wetland Complex is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Rowleys Bay Wetland #2. However, three unnamed ponds and one river are present in Rowleys Bay Wetland #1 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). The unnamed ponds are in the southern portion of the wetland. The Mink River is a wide, low gradient stream which flows through the upper portion of the wetland. Hydrologic data for the Mink River appears in Table 10-20. The Mink river is subject to regular flow reversals caused by the wind-driven waters of Lake Michigan (Wisconsin Scientific Areas Preservtion Council, 1976). During periods of low water levels

Table 10-20. Hydrologic Data for the Mink River Sampled in 1969[a]

Date	Kheldahl nitrogen (ppm.)	Dissolved oxygen (ppm.)	Total phosphate (ppm.)	Temperature (°F)	Calcium (ppm.)	Sodium (ppm.)	pH	Alkalinity (ppm.)
7/24/69	.68	2.5	.1	76	--	--	7.6	291
9/16/69	.72	2.9	.1	64	32.3	2.0	--	250

[a]Wisconsin Department of Natural Resources, Scientific Areas Preservation Council

in Lake Michigan, Rowleys Bay Wetland #1 may be maintained by groundwater (Bedford et al., 1976).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Rowleys Bay Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for Rowleys Bay Wetland Complex is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Rowleys Bay Wetland Complex (Wisconsin Coastal Zone Management Development Program aerial photographs, 1975).

BIOTIC SETTING LM 207-208

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Rowleys Wetlands #1 and #2.

Fish

Smallmouth bass (*Micropterus dolomieui*), bluegill (*Lepomis macrochirus*), and northern pike (*Esox lucius*) provide a recreational fishery in the Mink River, and these species probably utilize Rawleys Bay Wetlands #1 and #2 (Wisconsin Department of Natural Resources, 1965). However, a search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in these wetlands.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Rowleys Bay Wetlands #1 and #2.

Reptiles and Amphibians

The Wisconsin Department of Natural Resources (1970) lists the northern leopard frog (Rana pipiens) among a group of animals observed in the vicinity of the Mink River.

Appendix C-10 includes a list and general estimate of abundance of amphibians and reptiles known to be in the vicinity of Rowleys Bay Wetland #2. Although the area surveyed in the list is relatively small and includes only two additional wetlands, care should be exercised in the interpretation of the relevance of this list to Rowleys Bay Wetland #2. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in Rowleys Bay Wetlands #1 and #2.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Rowleys Bay Wetland #1 as Class I wildlife habitat, "most desirable" for shore birds, waterfowl, and gulls and terns (Thompson et al., 1976). This study also designates Rowleys Bay Wetland #2 as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shore birds and woodcock (Philohela minor) (Thompson et al., 1976).

Portions of both are included within the proposed Mink River Marsh Area. This area is on the priority acquisition list of the Wisconsin Scientific Areas Preservation Council, but there has been no action to date owing to limited funding. The Mink River Marsh Area is described in the Scientific Areas Preservation Council's (1976) Natural Area Inventory of the coastal zone as having high waterfowl significance.

Twenty-six species of birds were recorded during a canoe survey of the Mink River Marsh Area in June, 1970 (Table 10-21); most of these species probably nest on the site. The list includes common loon (Gavia immer), American bittern (Botaurus lentiginosus), red-breasted merganser (Mergus serrator), harrier (Circus cyaneus), osprey (Pandion haliaetus) and herring gull (Larus argentatus). Spring waterfowl use of the marsh area was estimated at 500-1,000 individuals. A June, 1976, survey by Scharf et al. (1977) recorded 10-12 black terns (Chlidonias nigra) feeding in Rowley Bay Wetlands #1 and #2. An August, 1977, visit by the Wisconsin Department of Natural Resources' staff recorded several hundred blue-winged teal (Anas discors), mallard (A. platyrhynchos), wood duck (Aix sponsa) and black duck (Anas rubripes) in the wetlands and thousands of blackbirds feeding on a large crop of wild rice. Fifteen to twenty

Table 10-21. Birds Recorded at the Proposed Mink River Marsh Area on June 2, 1970[a]

Species	Number
common loon	1
pied-billed grebe	1
American bittern	2
black duck	1
mallard	3
blue-winged teal	2 (pair)
red-breasted merganser	2 (pair)
red-tailed hawk	1
broad-winged hawk	1
harrier	1
osprey	2
Virginia rail	1
sora rail	6
coot	1
herring gull	15
eastern kingbird	2
tree swallow	5+
bank swallow	2
barn swallow	1+
cliff swallow	1+
long-billed marsh wren	1
short-billed marsh wren	9
black-and-white warbler	1
Nashville warbler	2
common yellowthroat	1
red-winged blackbird	11

[a]Wisconsin Department of Natural Resources, Scientific Areas Preservation Council (files)

great blue herons (Ardea herodias) and a number of black terns were also observed during the August, 1977, visit. Ospreys, harriers, common loons, red-breasted mergansers, and herring gulls are species of most concern thought to nest in the Mink River Marsh Area. These species have suffered major population declines in the Great Lakes Region (Wisconsin Scientific Areas Preservation Council, files).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Rowleys Bay Wetlands #1 and #2. The literature search provided no site-specific information pertaining to productivity, commercial use, life histories, food sources, or relationship to water levels of the birds utilizing these wetlands.

Mammals

Beaver (Castor canadensis), muskrat (Ondatra zibethicus), and raccoon (Procyon lotor) have been observed on the two wetlands of the Rowleys Bay Wetland Complex (Wisconsin Scientific Areas Preservation Council, open file report, 1974; Wisconsin Department of Natural Resources, open file report, 1974). Beaver and muskrat are trapped on these wetlands.

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5). However, the literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, life histories, food sources, or relationship to water levels of the mammals inhabiting the two wetlands comprising the Rowleys Bay Wetland Complex.

Endangered Species

The osprey, which is on Wisconsin's list of endangered species (U.S. Fish and Wildlife Service, 1977), is thought to nest in the vicinity of the Rowleys Bay Wetland Complex (Wisconsin Scientific Areas Preservation Council files). A pair was observed in the wetlands during a June, 1970, survey by the Wisconsin Department of Natural Resources. That survey also recorded a single harrier; this species has a watch status in Wisconsin (Hine et al., 1975).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

Population

Rowleys Bay Wetlands #1 and #2 are located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-21 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-21. Population Data for the Vicinity of Rowleys Bay Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Rowleys Bay Wetlands #1 and #2 is rural and wooded. The surrounding area is primarily in agricultural open space uses, with a limited amount of residential and commercial development in the town of Rowleys Bay. A secondary highway runs through Rowleys Bay Wetland #1 (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975) between Rowleys Bay Wetland #1 and Lake Michigan. With the exception of the extreme eastern portion of Rowleys Bay Wetland #2, which is within an area owned by the State of Wisconsin, the wetlands are under private ownership (Schinkten, 1975).

The portion of Rowleys Bay Wetland #2 under state ownership appears to be under minimal development pressure. The remaining portion of Rowleys Bay Wetland #2 as well as Rowleys Bay Wetland #1 may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Rowleys Bay Wetlands #1 and #2.

Mineral, Energy, and Forest Resources

Although Rowleys Bay Wetlands #1 and #2 are within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetlands (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetlands, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no active sand and gravel or clay operations in the vicinity of the wetlands (Ostrom, 1970). No oil, gas, or coal resources are known to be present.

Rowleys Bay Wetlands #1 and #2 lie within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Rowleys Bay Wetlands #1 and #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Rowleys Bay Wetlands #1 and #2. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Rowleys Bay Wetland Complex (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #21, #24) are present in the vicinity of Rowleys Bay Wetlands #1 and #2. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 207-208

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 209

Setting

Liberty Grove Township Wetland #1 is located near the northern tip of Door Peninsula in Door County, Wisconsin. The wetland lies 0.1 mile from the shoreline of Lake Michigan and four miles east of the community of Ellison Bay. The wetland is a Lacustrine System; it is low and wooded with swamp hardwoods (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Liberty Grove Township Wetland #1 has a total relief of approximately two feet; elevations in the wetland range from 588 to 590 feet above sea level, 8 to 10 feet above the approximate mean elevation of Lake Michigan. A rocky reef extends approximately 0.3 mile into Lake Michigan east of the wetland; the shoreline to the north of the wetland is a sandy area of abandoned shorelines. The gently sloping peninsula on which the wetland is located has been described by the Great Lakes Basin Commission (1975) as a non-erodible low plain. The topography inland of the wetland is gently rolling terrain of the Niagara Upland.

Surficial Geology

The surficial geology of Liberty Grove Township Wetland #1 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Liberty Grove Township Wetland #1 is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Liberty Grove Township Wetland #1 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It is likely that the wetland results from the high water table in the northern portion of Door Peninsula. The hydrology of Liberty Grove Township Wetland #1 is affected by levels of Lake Michigan, which are subject to short and long term fluctuations (Wisconsin Bureau of Parks and Recreation, 1974).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Liberty Township Wetland #1.

Climate

The closest weather station providing climatic data for Liberty Grove Township Wetland #1 is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Spider Island lies offshore from the wetland (U.S.G.S. quaddrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING

LM 209

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Liberty Grove Township Wetland #1.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Liberty Grove Township Wetland #1.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Liberty Grove Township Wetland #1.

Reptiles and Amphibians

Appendix C-10 includes a list and general estimate of abundance of reptiles and amphibians known to be in the vicinity of Liberty Grove Township Wetland #1. Although the area surveyed is relatively small and includes only two additional wetlands, care should be exercised in the interpretation of the relevance of this list to Liberty Grove Township Wetland #1.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Liberty Grove Township Wetland #1 as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shorebirds and woodcock (Philohela minor) (Thompson et al., 1976). A portion of Liberty Grove Township Wetland #1 lies within the Newport State Park Conifer-Hardwoods Scientific Area. A breeding bird survey was conducted in this scientific area on July 9, 1971 (Table 10-23). Forty-nine species of birds are represented on the list, including mallards, (Anas platyrhynchos), red-breasted mergansers (Mergus serrator), herring gulls (Larus argentatus), veeries (Catharus fuscescens), and red-winged blackbirds (Agelaius phoeniceus) (Wisconsin Scientific Areas Preservation Council, 1974).

Nearby Spider Island has been an historical nesting site for Caspian terns (Sterna caspia) and red-breasted mergansers. In addition, a breeding colony of great blue herons (Ardea herodias), numbering 35 pairs, existed on the island in 1917 (Jackson, 1927). Scharf et al. (1977) report that great blue herons nested on the island until 1967 and double-crested cormorants (Phalacrocorax auritus) nested there until 1962. In a visit to Spider Island in June, 1976, Scharf flushed eight double-crested cormorants from the island and discovered nesting colonies of six pairs of black-crowned night herons (N. nycticorax) and 400 pairs of herring gulls. It is probable that some of these species use Liberty Grove Township Wetland #1 for feeding.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data Liberty Grove Township Wetland #1. The literature search provided no site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing this wetland.

Table 10-23. Breeding Bird Survey of Newport State Park Conifer-Hardwoods, July 9, 1971[a]

Species	Number	Species	Number
mallard	21	winter wren	4
black duck	2	robin	28
gadwall	2	wood thrush	4
blue-winged teal	1	veery	23
common goldeneye	1	cedar waxwing	8
red-breasted merganser	13	starling	6
ruffed grouse	1	red-eyed vireo	31
killdeer	2	black-and-white warbler	3
spotted sandpiper	1	black-throated green warbler	16
herring gull	33	blackburnian warbler	1
ring-billed gull	3	pine warbler	3
mourning dove	1	ovenbird	26
whip-poor-will	2	northern waterthrush	1
hairy woodpecker	2	mourning warbler	1
downy woodpecker	1	Canada warbler	1
great crested flycatcher	2	American redstart	18
least flycatcher	3	red-winged blackbird	52
eastern wood pewee	11	common grackle	18
tree swallow	6	brown-headed cowbird	6
purple martin	4	scarlet tanager	7
blue jay	12	rose-breasted grosbeak	14
black-capped chickadee	8	chipping sparrow	4
white-breasted nuthatch	1	white-throated sparrow	1
red-breasted nuthatch	2	song sparrow	11
house wren	6		

[a]Wisconsin Scientific Areas Preservation Council, 1974

Mammals

The relative abundance of mammal species which may utilize Liberty Grove Township Wetland #1 are listed in Appendix E-6. Liberty Grove Township Wetland #1 has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" habitat for squirrels and furbearers (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-3).

The literature search provided no site-specific data pertaining to density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Liberty Grove Township Wetland #1.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Liberty Grove Township Wetland #1 by the literature search. However, double-crested cormorants, an endangered species in Wisconsin, have historically nested on nearby Spider Island and have recently been observed there (Scharf et al., 1977).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

CULTURAL SETTING LM 209

Population

Liberty Grove Township Wetland #1 is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-24 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-24. Population Data for the Vicinity of Liberty Grove Township Wetland #1

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Liberty Grove Township Wetland #1 and the surrounding area is rural, wooded space. Liberty Grove Township Wetland #1 is located within Newport State Park (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under public ownership (Newport State Park ; Schinkten, 1975). In 1971, a part of the Newport State Park totalling 140 acres, including the wetland, was designated as the Newport Conifer-Hardwoods Scientific Area (Germain et al., 1977). The location of the wetland suggests that it is subject to minimal development pressure.

Recreation

Liberty Grove Township Wetland #1 lies within the 2,321-acre Newport State Park. The park has a wilderness orientation, with only a few facilities for day use in the Newport Bay area. The remainder of the park is in non-intensive uses, with hiking trails throughout the area and primitive campsites along the shore of Lake Michigan. The wetland is located within that portion of the park constituting the 140-acre Newport Conifer-Hardwoods State Scientific Area and receives recreational use only from a hiking trail (Wisconsin Bureau of Parks and Recreation, 1974; Germain et al., 1977).

Mineral, Energy, and Forest Resources

Although Liberty Grove Township Wetland #1 lies within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no sand and gravel or clay operations active in close proximity to the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

Liberty Grove Township Wetland #1 lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was

not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Liberty Grove Township Wetland #1 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Liberty Grove Township Wetland #1. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Liberty Grove Township Wetland #1, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 209

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

LIBERTY GROVE TOWNSHIP WETLAND #2

PHYSIOGRAPHIC SETTING

LM 210

Setting

Liberty Grove Township Wetland #2 is located near the northern tip of Door Peninsula in Door County, Wisconsin, 0.1 mile from the Lake Michigan shoreline and four miles east of the community of Ellison Bay. Liberty Grove Township Wetland #2 lies at the base of Lynd Point, a small peninsula that separates Newport Bay and Europe Bay. The wetland is a Palustrine System; it lies in a low depression, and the entire area is wooded with northern wet-mesic forest (Wisconsin Scientific Areas Preservation Council, 1976). The wetland is part of the Newport State Park (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Liberty Grove Township Wetland #2 has a total relief of less than 10 feet; the wetland elevations range from approximately 590 to 600 feet above sea level (10 to 20 feet above the approximate mean elevation of Lake Michigan). The shoreline of Newport Bay in this area consists of a ledge of exposed rock 6 to 10 feet above water level, with little or no beach. Trees overhang the rocky lake bank (Wisconsin Division of Environmental Protection, 1978). The shoreline to the north of the wetland on Europe Bay features a sand beach which is approximately 50 feet wide and gradually slopes upward to a tree line 10 to 12 feet above lake level. Liberty Grove Township Wetland #2 lies on a non-erodible low plain (Great Lakes Basin Commission, 1975). The inland topography is rolling, with elevations of up to 700 feet above sea level.

Surficial Geology

The surficial geology of Liberty Grove Township Wetland #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Liberty Grove Township Wetland #2 is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Liberty Grove Township Wetland #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It is likely that the wetland is the result of the high water table in the northern portion of Door Peninsula. The hydrology of Liberty Grove Township Wetland #2 is affected by the levels of Lake Michigan, which are subject to short and long term fluctuations (Wisconsin Bureau of Parks and Recreation, 1974).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Liberty Township Wetland #2.

Climate

The closest weather station providing climatic data for Liberty Grove Township Wetland #2 is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Rocky reefs and shoals extend into Lake Michigan and include Gravel Island, which is part of the Gravel Island National Wildlife Refuge (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

BIOTIC SETTING LM 210

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Liberty Grove Township Wetland #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Liberty Grove Township Wetland #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Liberty Grove Township Wetland #2.

Reptiles and Amphibians

Appendix C-10 includes a list and general estimate of abundance of reptiles and amphibians known to be in the vicinity of Liberty Grove Township Wetland #1. Although the area surveyed is relatively small and includes only two additional wetlands, care should be exercised in the interpretation of the relevance of this list to Liberty Grove Township Wetland #2.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Liberty Grove Township Wetland #2 as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shorebirds and woodcock (Philohela minor) (Thompson et al., 1975).

Although no breeding bird surveys have been conducted on Liberty Grove Township Wetland #2, its comparable habitat and close proximity to the Newport State Park Conifer-Hardwoods Scientific Area could result in a similar species list Table 10-25 lists the birds observed at the Scientific Area.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Liberty Grove Township Wetland #2. The literature search provided no site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing this wetland.

Mammals

The relative abundance of mammal species which may utilize Liberty Grove Township Wetland #2 are listed in Appendix E-6. Liberty Grove Township Wetland #2 has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" habitat for squirrels and furbearers (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Liberty Grove Township Wetland #2.

Table 10-25. Breeding Bird Survey of Newport State Park Conifer-Hardwoods, July 9, 1971[a]

Species	Number	Species	Number
mallard	21	winter wren	4
black duck	2	robin	28
gadwall	2	wood thrush	4
blue-winged teal	1	veery	23
common goldeneye	1	cedar waxwing	8
red-breasted merganser	13	starling	6
ruffed grouse	1	red-eyed vireo	31
killdeer	2	black-and-white warbler	3
spotted sandpiper	1	black-throated green warbler	16
herring gull	33	blackburnian warbler	1
ring-billed gull	3	pine warbler	3
mourning dove	1	ovenbird	26
whip-poor-will	2	northern waterthrush	1
hairy woodpecker	2	mourning warbler	1
downy woodpecker	1	Canada warbler	1
great crested flycatcher	2	American redstart	18
least flycatcher	3	red-winged blackbird	52
eastern wood pewee	11	common grackle	18
tree swallow	6	brown-headed cowbird	6
purple martin	4	scarlet tanager	7
blue jay	12	rose-breasted grosbeak	14
black-capped chickadee	8	chipping sparrow	4
white-breasted nuthatch	1	white-throated sparrow	1
red-breasted nuthatch	2	song sparrow	11
house wren	6		

[a]Wisconsin Scientific Areas Preservation Council, 1974

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Liberty Grove Township Wetland #2 by the literature search. However, double-crested cormorants, an endangered species in Wisconsin, have historically nested on nearby Spider Island and have recently been observed there (Scharf et al., 1977).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

CULTURAL SETTING LM 210

Population

Liberty Grove Township Wetland #2 is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-26 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-26. Population Data for the Vicinity of Liberty Grove Township Wetland #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Liberty Grove Township Wetland #2 and the surrounding area is rural, wooded space (Wisconsin Coastal Zone Management Development Program

aerial photograph, 1975). The wetland is under public ownership (Newport State Park) (Schinkten, 1975) and its location suggests that it is subject to minimal development pressures.

Recreation

Liberty Grove Township Wetland #2 lies within the 2,321-acre Newport State Park. The park has a wilderness orientation, with only a few facilities for day use in the Newport Bay area. The remainder of the park is in non-intensive uses, with hiking trails throughout the area and primitive campsites along the shore of Lake Michigan. Hiking trails extend on either side of the wetland and the day-use area, including a parking lot and a swimming beach, is less than 1,000 feet south of the wetland (Wisconsin Bureau of Parks and Recreation, 1974).

Mineral, Energy, and Forest Resources

Although Liberty Grove Township Wetland #2 lies within an area underlain by Niagara limestone, there are no quarrying operations in the vicinity of the wetland (Hotchkiss and Steidtmann, 1914; Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976; Ostrom, 1970). There are no sand and gravel or clay operations active in close proximity to the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

Liberty Grove Township Wetland #2 lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Liberty Grove Township Wetland #2 (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Liberty Grove Township Wetland #2. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Liberty Grove Township Wetland #2 (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that one archaeological site (DR #1034) is present in the vicinity of Liberty Grove Township Wetland #2. Information

regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 210

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

EUROPE BAY WETLAND

PHYSIOGRAPHIC SETTING

LM 211

Setting

Europe Bay Wetland is located on the eastern side of the northern tip of Door Peninsula in Door County, Wisconsin, roughly 300 feet inland from the Lake Michigan shoreline, 3.0 miles east of the community of Ellison Bay and 0.5 mile south of Europe Lake. 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 indentation, forming the lake (Martin, 1965). The wetland is a Lacustrine System; it is low and wooded with virgin red pine and beech-sugar maple mesic forest (Wisconsin Scientific Areas Preservation Council, 1976). Orchards lie to the west of the wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Topography

Total relief of Europe Bay Wetland is slight; elevations range from 591 to 595 feet above sea level (11 to 15 feet above the approximate mean elevation of Lake Michigan). The Lake Michigan shoreline in the vicinity of the wetland is undeveloped low dune-limestone, and the Europe Lake shoreline is cobblestone. The wetland lies on a non-erodible low plain (Great Lakes Basin Commission, 1975). Inland topography is rolling, with elevations of up to 700 feet above sea level.

Surficial Geology

The surficial geology of Europe Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Europe Bay Wetland is Beach sand, which is comprised of grayish fine or very fine sand with little or no organic matter in the soil. Beach sand is derived from material washed onto shore by waves (Whitson et al., 1919).

Hydrology

There are no streams flowing through Europe Bay Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level

influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Europe Bay Wetland.

Climate

The closest weather station providing climatic data for Europe Bay Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Natural features include the coastal dune-limestone ridges, rocky beach, and offshore rock reefs and shoals which extend into Lake Michigan offshore of the wetland. These rocky reefs and shoals include Gravel Island, part of the Gravel Island National Wildlife Refuge (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

BIOTIC SETTING LM 211

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Europe Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Europe Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Europe Bay Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in Europe Bay Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Europe Bay Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shore birds and woodcock (Philohela minor) (Thompson et al., 1976).

Gravel Island lies approximately one mile off the coast from Europe Bay Wetland. This island is included within the Gravel Island National Wildlife Refuge. Scharf et al. (1977) observed 450-500 adult herring gulls (Larus argentatus) and 266 young herring gulls on the island in June, 1976. Scharf estimated herring gull productivity at one fledged young per nest. During that same survey, Schart observed one subadult double-crested cormorant (Phalacrocorax auritus), three common mergansers (Mergus merganser), and nine gadwalls (Anas strepera) on the island.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Europe Bay Wetland. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Europe Bay Wetland.

Mammals

The relative abundance of mammal species which may utilize Europe Bay Wetland are listed in Appendix E-6. Europe Bay Wetland has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" habitat for squirrels and furbearers (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Europe Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Europe Bay Wetland by the literature search. However, double-crested cormorants, an endangered species in Wisconsin, have been observed on Gravel Island, approximately one mile east of Europe Bay Wetland (Scharf et al., 1977).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

CULTURAL SETTING LM 211

Population

Europe Bay Wetland is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-27 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-27. Population Data for the Vicinity of Europe Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Europe Bay Wetland and the surrounding area is predominantly rural, woodedspace (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under public ownership (Schinkten, 1975), and its location suggests that it is subject to minimal development pressures.

Recreation

Europe Bay Wetland lies just within the northern boundary of the 2,321-acre Newport State Park. The park has a wilderness orientation, with only a few facilities for day use in the Newport Bay area. The remainder of the park is in non-intensive uses, with hiking trails throughout the area and primitive campsites along the shore of Lake Michigan. A hiking trail lies just inland from the wetland (Wisconsin Bureau of Parks and Recreation, 1974).

Mineral, Energy, and Forest Resources

Europe Bay Wetland lies within an area of glaciolacustrine deposits of sand, silt, and clay. These deposits have low potential for containing commercial deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976), but are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). There are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

Europe Bay Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Europe Bay Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Europe Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Europe Bay Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 211

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 212-213

Setting

The Europe Lake Wetland Complex, comprised of Europe Lake Wetlands #1 and #2, is located at the northern tip of Door Peninsula in Door County, Wisconsin. The wetlands lie just north of Europe Lake, approximately 0.1 mile from the Lake Michigan shoreline and three miles east of the community of Ellison Bay, Wisconsin. 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 indentation, forming a lake (Martin, 1965). Europe Lake Wetlands #1 and #2 are Lacustrine Systems; they are low and wooded with virgin red pine and beech-surgar maple mesic forest (Wisconsin Scientific Areas Preservation Council, 1976). Orchards are common in the area (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Topography

Europe Lake Wetland #1 has little relief; its elevation is 596 feet above sea level, 16 feet above the approximate mean elevation of Lake Michigan. Europe Lake Wetland #2 has a total relief of 20 feet and elevations ranging from 585 to 605 feet above sea level. The shoreline in the area is a non-erodible low plain composed partially of low dune-limestone frontage. The inland topography is rolling, with elevations of up to 700 feet above sea level.

Surficial Geology

The surficial geology of Europe Lake Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Europe Lake Wetlands #1 and #2 is Beach sand, which is comprised of grayish fine or very fine sand with little or no organic matter in the soil. Beach sand is derived from material washed onto shore by waves (Whitson et al., 1919).

Hydrology

There are no streams flowing through Europe Lake Wetland #1. The southern portion of Europe Lake Wetland #2 is adjacent to Europe Lake (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). Europe Lake is a shallow, hard-water lake that is found in a bedrock depression (Poff and Threinen, 1965). Hydrologic data for Europe Lake were collected in April, 1962

(Poff and Threinen, 1965), at which time the pH value was 7.8 and alkalinity was 150 parts per million. Sodium and calcium samples were 0.6 and 28.0 parts per million, respectively. These data may reflect conditions in Europe Lake Wetland #2.

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Europe Lake Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for the Europe Lake Wetland Complex is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Europe Lake Wetlands #1 and #2 (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

BIOTIC SETTING

LM 212-213

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Europe Lake Wetlands #1 and #2.

Fish

Smallmouth bass (*Micropterus dolomieui*), unidentified panfish, walleye (*Stizostedion vitreum*), and northern pike (*Esox lucius*) constitute the fishery in Europe Lake (Wisconsin Department of Natural Resources, 1965). These species probably utilize Europe Lake Wetlands #1 and #2, although Europe Lake Wetland #1 is a small palustrine unit which may not be utilized perennially. A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Europe Lake Wetlands #1 and #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Europe Lake Wetland #1 and #2.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in the Europe Lake Wetland Complex.

Avifauna

Europe Lake Wetland #1 was not included in the Wisconsin Department of Natural Resource's wildlife habitat study of the coastal zone. Europe Lake Wetland #1 lies adjacent to and may be included in the Hotz Tract (Europe Lake) Natural Area. The Wisconsin Scientific Areas Preservation Council (1976) states that this natural area, on the isthmus between Lake Michigan and Europe Lake, is of statewide or greater significance.

The fish and wildlife habitat study designated Europe Bay Wetland #2 as Class I wildlife habitat, "desirable" for waterfowl (Thompson et al., 1976). Europe Lake Wetland #2 adjoins the northern edge of Europe Lake. Waterfowl make some use of this lake, and hunting is an important fall acitivity (Poff and Threinen, 1965).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Europe Lake Wetlands #1 and #2. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing these wetlands.

Mammals

Europe Lake Wetland #2 has been classified as "desirable" habitat for furbearers (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Europe Lake Wetland Complex, or to major species in Europe Lake Wetland #1.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Europe Lake Wetland #1 and #2 by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process waste-water in the vicinity of these wetlands and this may have some effect on its health.

CULTURAL SETTING LM 212-213

Population

Europe Lake Wetlands #1 and #2 are located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-28 indicates that Door County and Liberty Grove Township both experienced rapid population growth between 1970 and 1975. Population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-28. Population Data for the Vicinity of Europe Lake Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Europe Lake Wetlands #1 and #2 and the surrounding area is rural, wooded space. An access road separates Europe Lake Wetlands #1 and #2 (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975). The lack of agricultural use of this area suggests that the wetlands are subject to low development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Europe Lake Wetlands #1 and #2. However, Europe Lake is used for waterfowl hunting during the fall, and Europe Lake Wetland #2 adjoins the northern edge of Europe Lake. In addition, a 5,600-acre area around Europe Lake has been suggested as an area for recreational development (Great Lakes Basin Commission, 1975).

Mineral, Energy, and Forest Resources

Europe Lake Wetlands #1 and #2 lie within an area of glaciolacustrine deposits of sand, silt, and clay. These deposits have little potential for containing commercial deposits of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901), but are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). There are no active clay, sand and gravel, or quarrying operations in close proximity to the wetlands (Ostrom, 1970). No oil, gas, or coal resources are known to be present.

Europe Lake Wetlands #1 and #2 lie within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Europe Lake Wetlands #1 and #2 (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Europe Lake Wetlands #1 and #2. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Europe Lake Wetlands #1 and #2, but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #20, #81) are present in the vicinity of the wetlands. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PLUM ISLAND WETLAND

PHYSIOGRAPHIC SETTING

LM 214

Setting

Plum Island Wetland is located on the northwestern end of Plum Island in Door County, Wisconsin, adjacent to Lake Michigan and a small, unnamed lake. The town of Washington Island is situated three miles to the north on Washington Island. The wetland is a low Lacustrine System. The entire island is forested, with sugar maple and basswood dominating. Plum Island lies offshore of the northern tip of Door Peninsula, and is the southernmost island chain extending from Door Peninsula to Michigan's Upper Peninsula. Detroit Island Passage lies to the north of Plum Island and Porte Des Morts Passage lies to the south (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Topography

Plum Island Wetland has a total relief of less than 10 feet; elevations of the wetland range from 580 to roughly 588 feet above sea level (lake level to 8 feet above the approximate mean elevation of Lake Michigan). The shoreline of Plum Island features cobblestone beaches and low dolomite cliffs (Wisconsin Scientific Areas Preservation Council, 1976). The entire island is low, with maximum elevations of 620 feet above sea level.

Surficial Geology

The surficial geology of Plum Island Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Plum Island Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Plum Island Wetland, but the wetland is adjacent to a small, unnamed lake (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). No published hydrologic information is available for this lake. Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Plum Island Wetland.

Climate

The closest weather station providing climatic data for Plum Island Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

A sand and gravel bar extends northwestward into Lake Michigan offshore of Plum Island Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photographs, 1975).

BIOTIC SETTING LM 214

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Plum Island Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Plum Island Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Plum Island Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in Plum Island Wetland.

Avifauna

Plum Island Wetland was not included in the Wisconsin Department of Natural Resources' wildlife habitat study of the coastal zone. However, the Wisconsin Scientific Areas Preservation Council (1974) conducted a breeding bird survey on Plum Island on June 30, 1971. Although the survey does not appear to include Plum Island Wetland, many of the species observed could be associated with the wetland. The results of the survey are shown in Table 10-29. The 49 species observed included the red-breasted merganser (Mergus serrator), spotted sandpiper (Actitis macularia), herring gull (Larus argentatus), and common tern (Sterna hirundo). All of Plum Island, including Plum Island Wetland, has been designated as a natural area of state or wider significance by the Scientific Areas Preservation Council (1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Plum Island Wetland. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing this wetland.

Mammals

Information discussed concerning the ten wetlands of the Washington Island Wetland Complex (LM 216-225) may be useful in characterizing Plum Island Wetland.

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Plum Island Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Plum Island Wetland by the literature search. However, bald eagle (Haliaeetus leucocephalus), which is on the federal list, formerly nested on Plum Island. The species has not been observed on the island since 1927 (Jackson, 1927).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

Table 10-29. Breeding Bird Survey of Plum Island[a]

Species	Number	Species	Number
black duck	1	robin	33
red-breasted merganser	2	veery	26
red-tailed hawk	1	cedar waxwing	46
killdeer	16	starling	72
spotted sandpiper	11	red-eyed vireo	26
herring gull	172	warbling vireo	2
ring-billed gull	2	black-and-white warbler	7
common tern	3	yellow warbler	1
chimney swift	19	chestnut-sided warbler	1
flicker	2	ovenbird	21
downy woodpecker	1	mourning warbler	1
eastern kingbird	7	redstart	51
crested flycatcher	2	red-winged blackbird	31
least flycatcher	7	Baltimore oriole	3
wood pewee	16	cowbird	22
tree swallow	56	scarlet tanager	2
barn swallow	32	rose-breasted grosbeak	6
cliff swallow	217	indigo bunting	4
purple martin	2	purple finch	1
blue jay	37	goldfinch	6
crow	6	rufous-sided towhee	3
house wren	4	chipping sparrow	3
winter wren	9	white-throated sparrow	4
catbird	2	song sparrow	9
brown thrasher	1		

[a]Wisconsin Department of Natural Resources, Scientific Areas Preservation Council, 1974

Population

Plum Island Wetland is located in Washington Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-30 indicates that Door County and Washington Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-30. Population Data of the Vicinity of Plum Island Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Washington Township	545	22.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Plum Island Wetland and the surrounding area is rural, wooded space. Two navigation lights are situated south of the wetland and an air strip is located to the southwest (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). Plum Island is owned by the United States Government (Schinkten, 1975), suggesting that the wetland is subject to minimal developmental pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Plum Island Wetland. However, the Great Lakes Basin Commission (1975) has suggested the Door County Islands as a possible area for recreational development.

Mineral, Energy, and Forest Resources

Plum Island Wetland lies within an area of glaciolacustrine deposits of sand, silt, and clay, underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). These deposits have little potential for containing commercial deposits of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901), and there are no active clay, sand and gravel, or quarrying operations on Plum Island (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially useful deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Plum Island Wetland.

Plum Island Wetland is entirely wooded, as is most of Plum Island (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). It is not known whether Plum Island is used for wood production. However, it is doubtful that production would be commercially viable since the forest stand is situated on a small island.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Plum Island Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Plum Island Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

There are no known historical sites within 500 feet of Plum Island Wetland, but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #48, #103) are present in the vicinity of the wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 214

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

A study is currently under way to relate the level of environmental contaminants to eggshell thickness and reproductive success of common mergansers (Mergus merganser) and red-breasted mergansers (M. serrator). Eggs are being collected from eight islands along the Lake Michigan coast of Door County, including Plum Island (Heinz, 1977).

DETROIT ISLAND WETLAND

PHYSIOGRAPHIC SETTING

LM 215

Setting

Detroit Island Wetland is located at the northern end of Detroit Island in Door County, Wisconsin. The town of Washington Island, situated on Washington Island, lies 1.6 miles to the north. The wetland lies adjacent to Lake Michigan on a bay formed by bay mouth bars located east and west of the wetland. Detroit Island Wetland is a low and wooded Lacustrine System (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Topography

Detroit Island Wetland has a total relief of less than 10 feet; elevations range from 580 to 590 feet above sea level (lake level to 10 feet above the approximate mean elevation of Lake Michigan). The shoreline adjacent to the wetland is sand beach, and the wetland lies in swales of low beach dunes. The Great Lakes Basin Commission (1975) describes this portion of the Detroit Island shoreline as an erodible low plain with landward wetland areas. Detroit Island features one hill, which rises to a maximum elevation of 660 feet above sea level. This hill lies to the south of the wetland, near the center of the island.

Surficial Geology

The surficial geology of Detroit Island Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Detroit Island Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Detroit Island Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). The literature search yielded no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in Detroit Island Wetland.

Climate

The closest weather station providing climatic data for Detroit Island Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Bay mouth bars are situated to the west and east (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

BIOTIC SETTING LM 215

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Detroit Island Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Detroit Island Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Detroit Island Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in Detroit Island Wetland.

Avifauna

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Detroit Island Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Information discussed for the ten wetlands of the Washington Island Wetland Complex (LM 216-225) may be useful in characterizing Detroit Island Wetland.

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Detroit Island Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Detroit Island Wetland by the literature search. However, the bald eagle (Haliaeetus leucocephalus), which is on the federal list, formerly nested on Detroit Island. This species has not been documented on the island since 1927 (Jackson, 1927).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland.

CULTURAL SETTING LM 215

Population

Detroit Island Wetland is located in Washington Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-31 indicates that Door County and Washington Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-31. Population Data for the Vicinity of Detroit Island Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Washington Township	545	22.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Detroit Island Wetland and the surrounding area is rural wooded space. Detroit Island is largely undeveloped. A foot trail lies adjacent to the wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), but the unsuitablility of Detroit Island for agricultural uses and the lack of current development suggests that the wetland is subject to low development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Detroit Island Wetland. However, the Great Lakes Basin Commission (1975) has suggested the Door County Islands as a possible area for recreational development.

Mineral, Energy, and Forest Resources

Detroit Island Wetland lies within an area of glaciolacustrine deposits of sand, silt, and clay, underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). These deposits have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901), and there are no active clay, sand and gravel, or quarrying operations on Detroit Island (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland. Commercially useful deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Detroit Island Wetland.

Detroit Island Wetland is entirely wooded, as is all of Detroit Island (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). It is not known whether Detroit Island is used for wood production. However, it is doubtful that production would be commercially valuable since the forest stand is situated on a small island.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Detroit Island Wetland (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Detroit Island Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Detroit Island Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 215

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

A study is currently under way to relate the level of environmental contaminants to eggshell thickness and reproductive success of common mergansers (Mergus merganser) and red-breasted mergansers (M. serrator). Eggs are being collected from eight islands along the Lake Michigan coast of Door County, including Detroit Island (Heinz, 1977).

WASHINGTON ISLAND WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 216-225

Setting

The Washington Island Wetland Complex is comprised of Jackson Harbor Wetlands #1 and #2, South Point Wetlands #1 and #2, Detroit Harbor Wetlands #1 and #2, West Harbor Area Wetlands #1 and #2, Coffee Swamp, and Coffee Swamp Area Wetland. The wetland complex is located on Washington Island in Door County, Wisconsin; the island lies at the entrance to Green Bay in a chain of islands extending from Door Peninsula to Michigan's Upper Peninsula. The shoreline of Washington Island is irregular and forms four prominent bays: Detroit Harbor, Washington Harbor, Jackson Harbor, and West Harbor (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

All of the wetlands in the Washington Island Wetland Complex occupy low sites and all but South Point Wetland #1 are Lacustrine Systems. South Point Wetland #1 is a Palustrine System. Jackson Harbor Wetland #1, South Point Wetlands #1 and #2, West Harbor Wetland #2, Coffee Swamp, and Coffee Swamp Area Wetland are all wooded; the remainder of the wetlands in the complex are non-wooded. Jackson Harbor Wetlands #1 and #2 lie on opposite sides of Jackson Harbor, which is protected by a bay mouth bar. A Wisconsin Scientific Area is located to the west of Jackson Harbor Wetland #1. South Point Area is located to the west of Jackson Harbor Wetland #1. South Point Wetlands #1 and #2 lie to the west of South Point. Detroit Harbor Wetlands #1 and #2 are south of the community of Washington Island, on Detroit Harbor. West Harbor Wetlands #1 and #2 lie to the north of West Harbor; West Harbor Wetland #1 is located on a sand spit that protects a small bay. Coffee Swamp and Coffee Swamp Area Wetland occupy the largest wetland area on Washington Island. These two wetlands are located on the northern side of the island on a flat low plain (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). Coffee Swamp consists of several acres of open sedge bog and several acres of open water surrounded by second growth swamp forest.

The location of each of the ten wetlands in this complex relative to the shoreline and nearest city is described in Table 10-32.

Table 10-32. Locations of Washington Island Wetlands

Wetland	Distance to shoreline	Distance to nearest city
Jackson Harbor Wetlands #1 and #2	100 feet	4.5 miles northeast of Washington Island
South Point Wetlands #1 and #2	0.1 mile	2 miles southeast of Washington Island
Detroit Harbor Wetlands #1 and #2	adjacent	0.2 mile south of Washington Island
West Harbor Area Wetlands #1 and #2	adjacent	1.5 miles northwest of Washington Island
Coffee Swamp and Coffee Swamp Area Wetland	0.1 mile	3.7 miles north of Washington Island

Topography

All of the wetlands in the Washington Island Wetland Complex have very little total relief and have elevations at or near 590 feet above sea level (10 feet above the approximate mean elevation of Lake Michigan). All of the wetlands with the exception of West Harbor Wetlands #1 and #2 lie on an erodible low bluff shoreline (Great Lakes Basin Commission, 1975). Jackson Harbor features a sand beach and low dunes covered with boreal forest (Wisconsin Scientific Areas Preservation Council, 1976). Shoals and three small islands lie offshore of the east side of Washington Island. The upland interior portion of Washington Island is hilly, with elevations as high as 760 feet above sea level.

Surficial Geology

The surficial geology of the Washington Island Wetland Complex is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

There are two soil types found in the Washington Island Wetland Complex, Peat and Beach sand. Peat soil is poorly drained and consists of organic material derived from sedges, reeds, wood, and mosses. Beach sand is comprised of grayish fine or very fine sand with little or no organic matter. Beach sand is derived from material washed onto shore by waves (Whitson et al., 1919). Beach sand is present in Jackson Harbor Wetland #2 and Detroit Harbor Wetland #1. Peat soil is present in the other eight wetlands in the Washington Island Wetland Complex.

Hydrology

There are no streams flowing through any of the wetlands in the Washington Island Wetland Complex. However, Coffee Swamp has two ponds, one of which is intermittent (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). Coffee Swamp is a calcareous bog with a drainage area of one square mile and a maximum depth of 1.5 feet. Water quality data for Coffee Swamp were collected in 1962, at which time the alkalinity was 187 milligrams per liter and the pH value was 8.4 (Poff and Threinen, 1965). Coffee Swamp is influenced by fluctuations in the water level of Lake Michigan (Wisconsin Scientific Areas Preservation Council, 1974).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

No site-specific information was located through the literature search pertaining to groundwater drainage patterns and runoff, or seasonal changes in Coffee Swamp. Site-specific information is not available on water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the remaining nine wetlands of the Washington Island Wetland Complex.

Climate

The closest weather station providing climatic data for Washington Island Wetland Complex is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Jackson Harbor Wetland #2 lies at the base of a bay mouth bar. South Point Wetlands #1 and #2 are located near coastal beach ridges on the south side of Washington Island. Several small bay mouth bars are located in the vicinity of West Harbor (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

BIOTIC SETTING LM 216-225

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or

relationship to water levels of the vegetation of the Washington Island Wetland Complex.

Fish

Winterkill in Coffee Swamp, which is very shallow, has precluded the existence of a significant fish fauna in that unit. A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Washington Island Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Washington Island Wetland Complex.

Reptiles and Amphibians

The mudpuppy (Necturus maculosus) has been collected from Lake Michigan along the rocky shoreline immediately adjacent to Jackson Harbor Wetland #2 (Charles A. Long, personal communication). A snapping turtle (Chelydra serpentina) was observed at Jackson Harbor, which lies between Jackson Harbor Wetland #1 and Jackson Harbor Wetland #2 (Long and Long, 1976). Another snapping turtle and a painted turtle (Chrysemys picta) were observed at Jackson Harbor Wetland #2 (Long and Long 1976; Charles A. Long, personal communication). The eastern garter snake (Thamnophis s. sirtalis) also occurs at Jackson Harbor Wetland #2 (Charles A. Long, personal communication). The eastern garter snake, brown snake (Storeria dekayi) and western fox snake (Elaphe v. vulpina) have been observed in or near Coffee Swamp (Charles A. Long, personal communication).

Other wetland associated reptiles and amphibians known to occur on Washington Island include the red-backed salamander (Plethodon c. cinereus), American toad (Bufo americanus), green frog (Rana clamitans), northern leopard frog (R. pipiens), northern water snake (Natrix sipedon), ringneck snake (Diadophis punctatus). The red-backed salamander is common in upland situations; the northern water snake is common along the coast of Lake Michigan. The painted turtle has been observed nesting on Washington Island (Long and Long, 1976; Charles A. Long, personal communication).

The literature search provided no site-specific information pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the reptiles and amphibians present in Jackson Harbor Wetlands #1 and #2 and Coffee Swamp. No site-specific information of any kind was located for the seven other wetlands in the Washington Island Wetland Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Jackson Harbor Wetlands #1 and #2 as Class I wildlife habitat, "most desirable" for waterfowl, gulls and terns, and shore birds (Thompson et al., 1976). The Jackson Harbor State Scientific Area, known for its diversity of vegetation and wildlife, is located near these wetlands at the lower end of Jackson Harbor. The study also designated South Point Wetlands #1 and #2 as Class I wildlife habitat. South Point Wetland #1 is "most desirable" for waterfowl, shore birds, and gulls and terns. South Point Wetland #2 is "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976). The area around the wetlands is good for birdwatching. Sora (Porzana carolina), Virginia rails (Rallus limicola), red-winged blackbirds (Agelaius phoeniceus), and yellowthroats (Geothlypis trichas) are common. Fifteen species of warblers, including the parula (Parula americana), magnolia (Dendroica magnolia), and mourning (Oporornis philadelphia) warblers, and the northern waterthrush (Seiurus noveboracensis), are known to nest in the immediate area (Tessen, 1976).

The Wisconsin Department of Natural Resources' study designated Detroit Harbor Wetlands #1 and #2 as Class I wildlife habitat, "most desirable" for waterfowl, shore birds, and gulls and terns (Thompson et al., 1976). The Detroit Harbor area, particularly Lobdells Point at the southwestern end of the harbor, is a "funnel" spot for spring and fall migration routes. In late August or early September, warblers and other passerines use this area as a resting and staging area before they fly to the mainland and then south (Tessen, 1976). The habitat study also designated West Harbor Area Wetlands #1 and #2, Coffee Swamp, and Coffee Swamp Area Wetland as Class I wildlife habitat. West harbor Wetlands #1 and #2 are "most desirable" for waterfowl, gulls and terns, and songbirds, and are "desirable" for shorebirds. Coffee Swamp and Coffee Swamp Area Wetland are "most desirable" for songbirds and ruffed grouse (Thompson et al., 1976). Coffee Swamp has high significance as a natural area and has been designated as "Natural Area - 2" by the Wisconsin Scientific Areas Preservation Council (1976). This designation indicates that the area has importance as an "ecological zone" and as an education area.

The red-breasted merganser (Mergus serrator) has historically bred on Washington Island. Fishermans Shoal, approximately three miles east of the island, was reported to support one of the principal nesting gull colonies in that part of Lake Michigan (Jackson, 1927). On June 26, 1960, 300-1,000 broad-winged hawks (Buteo platypterus) were observed over the northern end of Washington Island (Mueller and Berger, 1965). This phenomenon was partially explained by the possibility that the configuration of Door Peninsula acts as a trap for water-shy northbound or northward-drifted migrants. When the hawks reached open water at Washington Island, they circled in great numbers to get their bearings before continuing northward. This behavior may apply to other migratory birds as well.

Hog Island, situated 0.5 mile to the east of Washington Island, is a federal bird reserve primarily for protection of red-breasted mergansers (Jackson, 1927). Sixteen nests of this species were located in 1975. In

addition, the island had 75-125 nesting pairs of herring gulls in 1976 (Scharf et al., 1977). Breeding bird surveys have been conducted in 1971 and 1973 on Rock Island, one mile northeast of Washington island, as part of a series of surveys on scientific areas conducted by the Wisconsin Scientific Areas Preservation Council (1974).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to the Washington Island Wetland Complex.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

South Point Wetland #1 has been classified as "most desirable" habitat for furbearers, and South Point Wetland #2 has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus). Detroit Harbor Wetlands #1 and #2 and West Harbor Area Wetlands #1 and #2 have been classified as "most desirable" habitat for muskrat (Ondatra zibethicus).

Coffee Swamp has been classified as "most desirable" habitat for white-tailed deer and "supplemental" habitat for squirrels, and Coffee Swamp Area Wetland has been classified as "most desirable" habitat for white-tailed deer (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

Mammalian species which may be found on the ten wetlands of the Washington Island Wetland Complex are listed in Table 10-33.

Table 10-33. Mammalian Species of Washington Island Which May Utilize Wetlands[a]

Common name	Common name
masked shrew	muskrat
little brown bat	Gapper's red-backed mouse
big brown bat	coyote
red bat	red fox
snowshoe hare	raccoon
eastern cottontail	striped skunk
red squirrel	white-tailed deer
deer mouse	

[a] adapted from Long (1978)

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the ten wetlands comprising the Washington Island Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Washington Island Wetland Complex by the literature search.

Health

Site-specific information indicates that the environmental quality of Washington Island Wetland Complex is very good for birds and mammals. The Wisconsin Department of Natural Resources has designated all of the wetlands in this complex as Class I wildlife habitat, "most desirable" for waterfowl, shore birds, gulls, terns, songbirds, and white-tailed deer.

CULTURAL SETTING LM 216-225

Population

The Washington Island Wetland Complex is located in Washington Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-34 indicates that Door County and Washington Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-34. Population Data for the Vicinity of the Washington Island Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Washington Township	545	22.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within each of the ten wetlands in this complex is rural wooded space. All of the wetlands are privately owned. The areas surrounding the wetlands are primarily a mixture of agricultural and other rural open space uses, with shoreline residential development and scattered areas of residential development along the inland roads. The community of Washington Island, immediately north of Detroit Harbor Wetlands #1 and #2, represents the primary area of residential development on the island. Detroit Harbor Wetlands #1 and #2 are close to the community of Washington Island, Wisconsin, and features such as roads are present. A dredged channel and ferry docking facilities lie to the south of these wetlands (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

The Jackson Harbor Scientific Area lies just to the west of Jackson Harbor Wetland #2 and across Jackson Harbor from Jackson Harbor Wetland #1. This 27-acre scientific area is owned by Washington Township (Germain et al., 1977). Increasing use of Washington Island as a recreational area suggests that the wetlands are subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the ten wetlands of the Washington Island Wetland Complex. However, the Great Lakes Basin Commission (1975) has recommended the Door County Islands as a possible area for recreational development.

Mineral, Energy, and Forest Resources

The wetlands of the Washington Island Wetland Complex lie within an area of glaciolacustrine deposits of sand, silt, and clay underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). These deposits have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901), and there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland complex (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetlands. Commercially useful deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the Washington Island Wetland Complex.

Except for Detroit Harbor Wetlands #1 and #2, which are partially wooded, the wetlands of this complex are entirely wooded (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960). It was not determined through the literature search whether these areas are used for commercial wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of the Washington Island Wetland Complex (U.S.G.S. quadrangle map, Washington Island, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to the Washington Island Wetland Complex. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of the Washington Island Wetland Complex (Wisconsin Historic Preservation Division, 1977). The Wisconsin Inventory of Archaeology indicates that four archaeological sites (DR #50, #80, #109, #110) are present in the vicinity of Detroit Harbor Wetlands #1 and #2; one site (DR #60) is present in the vicinity of Coffee Swamp; two sites (DR #49, #109) are present in the vicinity of West Harbor Area Wetlands #1 and #2; and one site (DR #111) is present in the vicinity of South Point Wetlands #1 and #2. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 216-225

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 226

Setting

Gills Rock Wetland is located 0.2 mile from the Lake Michigan shoreline in Door County, Wisconsin, near the northern tip of Door Peninsula. The community of Gills Rock, Wisconsin, is situated 0.2 mile to the northwest. The wetland is a low, wooded Palustrine System (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

Topography

Gills Rock Wetland has a total relief of approximately five feet; elevations range from 595 to 600 feet above sea level, 15 to 20 feet above the approximate mean elevation of Lake Michigan. The wetland lies in a low area forming a short gap in the Niagara Escarpment, which roughly parallels the western shoreline of Door Peninsula.

The non-erodible lakeshore bluffs in this area are as high as 100 feet above lake level (Great Lakes Basin Commission, 1975). The topography inland from the wetland is rolling, with elevations ranging up to 720 feet above sea level.

Surficial Geology

The surficial geology of Gills Rock Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Gills Rock Wetland is Clyde loam, which consists of silt and organic matter underlain by grayish fine sand loam. This soil is poorly drained and may have a thin layer of peat on the surface when present in depressions (Whitson et al., 1919).

Hydrology

There are no streams flowing through Gills Rock Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Gills Rock Wetland.

Climate

The closest weather station providing climatic data for Gills Rock Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Gills Rock Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

BIOTIC SETTING

LM 226

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Gills Rock Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Gills Rock Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Gills Rock Wetland.

Reptiles and Amphibians

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians present in Gills Rock Wetland.

Avifauna

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Gills Rock Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Gills Rock Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Gills Rock Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, numerous dairy and orchard operators dispose of process waste-water in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 226

Population

Gills Rock Wetland is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-35 indicates that Door County and Liberty Grove Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-35. Population Data for the Vicinity of Gills Rock Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Gills Rock Wetland is rural wooded space. The surrounding area is characterized by residential and commercial development immediately to the west of the wetland, with a mixture of agricultural and other rural open space uses inland. A secondary highway lies to the west of Gills Rock Wetland, and orchards are located nearby (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is situated within the community of Gills Rock (Schinkten, 1975). Ownership of the wetland is assumed to be private, and because of the wetland's proximity to residential and commercial areas, development pressures may be high.

Recreation

There are no known state or federal recreational facilities in the vicinity of Gills Rock Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Gills Rock Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). There are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

Gills Rock Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of mile of Gills Rock Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Gills Rock Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Gills Rock Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 226

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

PHYSIOGRAPHIC SETTING LM 227

Setting

Garret Bay Wetland is located 0.2 mile from the Lake Michigan shoreline near the northern tip of Door Peninsula in Door County, Wisconsin, 1.3 miles west of the community of Gills Rock. The wetland is located on Garret Bay, a portion of Hedgehog Harbor, which lies between Deathdoor Bluff and Table Bluff. The wetland lies on a low bluff and is wooded; it is a Palustrine System (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

Topography

Garret Bay Wetland has very slight relief; elevations of the wetland are close to 600 feet above sea level, 20 feet above the approximate mean elevation of Lake Michigan. The wetland lies in a slight depression in a short gap in the Niagara Escarpment, which roughly parallels the western shoreline of Door Peninsula. The wetland is situated at the base of the escarpment on a non-erodible low plain (Great Lakes Basin Commission, 1975). Lakeshore bluffs in this area are as high as 100 feet above lake level. The topography inland from the wetland is rolling, with elevations ranging up to 720 feet above sea level.

Surficial Geology

The surficial geology for Garret Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Garret Bay Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Garret Bay Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Garret Bay Wetland.

Climate

The closest weather station providing climatic data for Garret Bay Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Garret Bay Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

BIOTIC SETTING

LM 227

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Garret Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Garret Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Garret Bay Wetland.

Reptiles and Amphibians

The red-backed salamander (Plethodon cinereus) has been reported from the vicinity of Garret Bay (Suzuki, 1950). The species is entirely terrestrial but may be found on non-flooded, raised portions of wetlands.

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Garret Bay Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Garret Bay Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Garret Bay Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Garret Bay Wetland has been classified as most desirable habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Garret Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Garret Bay Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 227

Population

Garret Bay Wetland is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-36 indicates that Door County and Liberty Grove Township

experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-36. Population Data for the Vicinity of Garret Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Garret Bay Wetland and most of the surrounding area is rural wooded space. Residential development is present along the shoreline. A stone quarry is situated east of the wetland and an access road lies to the north and west. Orchards are present to the east, south, and west of the wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and the presence of residential areas along the shoreline suggests that the wetland may be subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Garret Bay Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in the wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). There are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970), but an abandoned quarry pit is situated east of the wetland. No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

Garret Bay Wetland lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of mile of Garret Bay Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Garret Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Garret Bay Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 227

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

ELLISON BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 228-229

Setting

The Ellison Bay Wetland Complex, comprised of Ellison Bay Wetlands #1 and #2, is located near the northern tip of Door Peninsula in Door County, Wisconsin. Ellison Bay Wetland #1 lies adjacent to the northern portion of the community of Ellison Bay, approximately 0.1 mile from the shoreline of Lake Michigan, on Green Bay. The wetland is a Palustrine System. It lies on a low bluff and is wooded (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

According to the most recent U.S.G.S. quadrangle map (Ellison Bay, Wisconsin-Michigan, 1960), Ellison Bay Wetland #2 is situated 0.1 mile to the west of the community of Ellison Bay and 0.1 mile from the shoreline. However, aerial reconnaissance (Indiana University, Environmental Systems Application Center, 1978) of the area revealed that the wetland is filled and that an athletic field now occupies the site. Therefore, Ellison Bay Wetland #2 will receive no further consideration in this study.

Topography

Ellison Bay Wetland #1 has a total relief of 10 feet. Its elevations range from 590 to 600 feet above sea level, 10 to 20 feet above the approximate mean elevation of Lake Michigan. Traces of abandoned shore lines and beach ridges are found near the community of Ellison Bay, indicating that the waters of Green Bay and of Lake Michigan were once joined by the Mink River, which lies to the east of the wetland (Kowalke and Kowalke, 1938). The west-facing slope of the Niagara Escarpment is briefly interrupted by a relatively low area at Ellison Bay, where Ellison Bay Wetland #1 is located. The Great Lakes Basin Commission (1975) has described this shoreline as an erodible low plain. Inland topography is rolling, with hills reaching elevations of over 700 feet above sea level.

Surficial Geology

The surficial geology of Ellison Bay Wetland #1 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Ellison Bay Wetland #1 is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Ellison Bay Wetland #1 (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Ellison Bay Wetland #1.

Climate

The closest weather station providing climatic data for Ellison Bay Wetland #1 is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Ellison Bluff, an outstanding shoreline bluff with a maximum elevation of 770 feet above sea level, lies to the west of Ellison Bay Wetland #1 (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

BIOTIC SETTING

LM 228-229

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Ellison Bay Wetland #1.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Ellison Bay Wetland #1.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Ellison Bay Wetland #1.

Reptiles and Amphibians

The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Ellison Bay Wetland #1.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Ellison Bay Wetland #1 as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976). Historically, spotted sandpipers (Actitis macularia) were plentiful along Ellison Bay (Jackson, 1927). Jackson also observed red-breasted mergansers (Mergus serrator) feeding in Ellison Bay and reported that 40-50 herring gulls (Larus argentatus) followed the fishing boats into the harbor there.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Ellison Bay Wetland #1.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Ellison Bay Wetland #1 has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Ellison Bay Wetland #1.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Ellison Bay Wetland #1 by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 227

Population

Ellison Bay Wetland #1 is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-37 indicates that Door County and Liberty Grove Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-37. Population Data for the Vicinity of the Ellison Bay Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Ellison Bay Wetland #1 has been partially filled and developed. Land use within the wetland is primarily low-density residential development. The surrounding area is primarily a mixture of agricultural and other rural open space uses. An area of residential and commercial development (the community of Ellison Bay) lies to the south of Ellison Bay Wetland #1. Ellison Bay Wetland #1 is located near the community of Ellison Bay, Wisconsin, and man-made special features are common. Secondary highways and access roads are close to the

wetlands, as are lakeshore boat docks and breakwalls (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and the location of the wetland within an area that is already developed suggests that it is subject to severe development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Ellison Bay Wetland #1.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Ellison Bay Wetland #1 have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Ellison Bay Wetland #1.

Ellison Bay Wetland #1 lies within a wooded area that extends, with only a few interruptions, along the Lake Michigan shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Ellison Bay Wetland #1 (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960).

Pollution Sources

The Krier Preserving Company is located near Ellison Bay Wetland #1 (T32N, R28E, NE¼, NW¼, Sec. 14). This is a cherry processing plant which discharges contact cooling water to a seepage pond and then to the groundwater (Wisconsin Industrial Discharge Section, 1978). The impact of this NPDES permit holder on Ellison Bay Wetland #1 is unknown. In addition, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

"The Clearing" is a private home with outstanding landscape architecture on 128 acres. Simple rustic structures and Jens Jensen's home, studio, and school sit in a meadow overlooking Green Bay. Ellison Bay Wetland #1 lies directly south of this site (Wisconsin Historic Preservation Division, 1978).

The Wisconsin Inventory of Archaeology indicates that four archaeological sites (DR #27, #96,#97, and #99) are present in the vicinity of Ellison Bay Wetland #1. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 228-229

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

CHAMBERS ISLAND WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 230-231

Setting

The Chambers Island Wetland Complex, comprised of Chambers Island Wetlands #1 and #2, is located in Door County, Wisconsin, on Chambers Island. The island lies to the west of Door Peninsula in Green Bay. Chambers Island Wetland #1 is located in the northwestern portion of the island, 0.2 mile from the Green Bay shoreline. Chambers Island Wetland #2 lies 0.1 mile from the shoreline, between Mackaysee Lake and the Green Bay shoreline, in the northeastern portion of the island. Mackaysee Lake has a surface area of 354 acres and it is the deepest lake in Door County, reaching a maximum depth of 26 feet (Poff and Threinen, 1965). Both of the wetlands in this complex are Lacustrine Systems; they occupy low, partially wooded sites (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Topography

Chambers Island Wetlands #1 and #2 have slight relief. Their elevations range from 595 to 600 feet above sea level, 15 to 20 feet above the approximate mean elevation of Lake Michigan. All of Chambers Island is low and fairly flat; the island's highest elevation is approximately 620 feet above sea level.

Surficial Geology

The surficial geology of Chambers Island Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Chambers Island Wetlands #1 and #2 is Beach sand, which is comprised of grayish fine or very fine sand with little or no organic matter. It is derived from material washed onto the shore by waves (Whitson et al., 1919).

Hydrology

There are no streams flowing through Chambers Island Wetlands #1 and #2 (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetlands.

Climate

The closest weather station providing climatic data for the Chambers Island Wetland Complex is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Chambers Island Wetland Complex (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

BIOTIC SETTING

LM 230-231

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Chambers Island Wetlands #1 and #2.

Fish

Northern pike (Esox lucius), bluegill (Lepomis macrochirus), largemouth bass (Micropterus salmoides), and smallmouth bass (Micropterus dolomieui) constitute the fishery in Mackoysee Lake (Wisconsin Department of Natural Resources, 1965), adjacent to Chambers Island Wetland #2, and these species may utilize that wetland. A search of the literature provided no site-specific information pertaining to species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Chambers Island Wetlands #1 and #2, or to major species in Chambers Island Wetland #1.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Chambers Island Wetlands #1 and #2.

Reptiles and Amphibians

A few species of amphibians and reptiles are known to occur on Chambers Island (Long and Long, in press), which supports two shallow lakes and a wetland not included in the study area. These species are the central newt

(Notophthalmus viridescens louisianensis), northern spring peeper (Hyla c. crucifer), painted turtle (Chrysemys picta), northern water snake (Natrix s. sipedon), eastern garter snake (Thamnophis s. sirtalis), brown snake (Storeria dekayi), northern red-bellied snake (S. occipitomaculata), eastern milk snake (Lampropeltis triangulum) and western fox snake (Elaphe v. vulpina).

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the Chambers Island Wetland Complex.

Avifauna

Appendix C-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Chambers Island Wetlands #1 and #2.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

Mammalian species which may be found on the two wetlands of the Chambers Island Wetland Complex are listed in Table 10-38.

Table 10-38. Mammalian Species of Chambers Island[a]

Common name	Common name
little brown bat	muskrat
snowshoe	coyote
red squirrel	red fox
deer mouse	raccoon
meadow vole	white-tailed deer

[a] Long, 1978

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the two wetlands comprising Chambers Island Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Chambers Island Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands.

CULTURAL SETTING LM 230-231

Population

Chambers Island Wetlands #1 and #2 are located in Gibraltar Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-39 indicates that both the county and the township experienced recent rapid population growth, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-39. Population Data for the Vicinity of Chambers Island Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Gibraltar Township	696	18.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Chambers Island Wetlands #1 and #2 and most of the surrounding area is primarily rural wooded space. There are a few residences scattered along the Lake Michigan shoreline. An unimproved road lies 800 feet to the east of Chambers Island Wetland #1, and another unimproved road lies adjacent to the western side of Chambers Island Wetland #2. A lighthouse is situated north of Chambers Island Wetland #1 and a landing strip lies to the southeast (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961;

Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975), but the sparse population of Chambers Island suggests that they are subject to low development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of the Chambers Island Wetland Complex. The Great Lakes Basin Commission (1975), however, has recommended Chambers Island as a possible area for recreational development.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Chambers Island Wetlands #1 and #2 have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations on Chambers Island (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetlands.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Chambers Island Wetlands #1 and #2.

The wetlands of this complex are partially wooded. Except for the cleared area in the northern portion of the island, on the periphery of which the wetlands are located, Chambers Island is almost entirely wooded (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). It was not determined through the literature search whether these wooded areas are used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Chambers Island Wetlands #1 and #2 (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Chambers Island Wetlands #1 and #2. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Chambers Island Wetlands #1 and #2, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

SISTER BAY WETLAND

PHYSIOGRAPHIC SETTING LM 232

Setting

Sister Bay Wetland is located 100 feet from the western shoreline of Door Peninsula in Door County, Wisconsin, adjacent to the village of Sister Bay. The wetland is narrow and long, roughly paralleling the shoreline for a distance of approximately 0.8 mile. Sister Bay forms a short gap in the coastal bluffs along this shoreline, and Sister Bay Wetland lies in this low gap. The wetland is a Lacustrine System; it is almost completely wooded (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Sister Bay Wetland has a total relief of approximately five feet. The wetland elevations range from 585 to 590 feet above sea level, 5 to 10 feet above the approximate mean elevation of Green Bay. Shoreline bluffs up to 180 feet high are formed by the Niagara Escarpment in the vicinity, although Sister Bay Wetland lies at the base of a more gentle slope. The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The inland topography of the Niagara Upland is rolling, with elevations reaching heights of 780 feet above sea level.

Surficial Geology

The surficial geology of Sister Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Sister Bay Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Sister Bay Wetland (U.S.G.S. quadrangle map, Ellison Bay, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Sister Bay Wetland is located on Washington Island, Wisconsin. In 1975, the average monthly temperature was 43.6°F, the average daily low for January was 13.8°F and the average daily high in July was 78.9°F. The average annual precipitation is 29.03 inches, with a mean monthly precipitation of 2.00 inches in January and 1.66 inches in July based on the normal period from 1941-1970. The growing season is approximately six months long, with the last killing frost (28°F) in 1975 occurring on April 26 and the first killing frost on October 30 (National Oceanic and Atmospheric Administration, 1975).

Special Features

The most prominent natural special feature in the area is the steep coastal bluff line (Sister Bluffs) west of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin-Michigan, 1960).

BIOTIC SETTING LM 232

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Sister Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Sister Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Sister Bay Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Sister Bay Wetland.

Avifauna

The Sister Islands, which lie within Sister Bay about two miles northwest of the village of Sister Bay, lie within a Wisconsin State Scientific Area. The

islands are considered to be important gulleries, with an estimated 1,350-1,650 breeding pairs of herring gulls (Larus argentatus) present in 1964. In that same year, the islands also supported 10-15 pairs of red-winged blackbirds (Agelaius phoeniceus) and one pair each of common tern (Sterna hirundo), pintail (Anas acuta), and mallard (A. platyrhynchos) (Keith, 1966). In May, 1976, 102 herring gull nests were found on Little Sister Island, from which 98 young were fledged. At that same time, 471 herring gull nests were counted on Big Sister Island. An estimated 825 young were fledged from these nests (Scharf et al., 1977).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Sister Bay Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Sister Bay Wetland has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Sister Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Sister Bay Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

Population

Sister Bay Wetland is located in Liberty Grove Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-40 indicates that Door County and Liberty Grove Township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-40. Population Data for the Vicinity of Sister Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Liberty Grove Township	1,251	6.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

The primary land use within Sister Bay Wetland is urban wooded space. Areas of residential development exist around the periphery of the wetland and there is some agricultural open space in the southern portion. The surrounding area is characterized by residential development to the south and west (the village of Sister Bay) and agricultural open space to the east. Several access roads and highways cross the wetland. Residential development almost completely surrounds the wetland, and a series of small breakwalls and boat docks are located along shoreline (U.S.G.S. quadrangle map, Sister Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland lies largely within the corporate limits of Sister Bay. The wetland is under private ownership (Schinkten, 1975), and its proximity to the village of Sister Bay suggests that it may be subject to high development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Sister Bay Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Sister Bay Wetland have low potential for containing commercial quantities of sand and

gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Sister Bay Wetland.

Sister Bay Wetland lies within a wooded area that extends, with only a few interruptions, along the Green Bay shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin-Michigan, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Sister Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin-Michigan, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Sister Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Sister Bay Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 232

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

TENNISON BAY WETLAND

PHYSIOGRAPHIC SETTING

LM 233

Setting

Tennison Bay Wetland is located 0.2 mile from the western shoreline of Door Peninsula in Door County, Wisconsin, 2.7 miles north of the community of Fish Creek. The wetland is a Lacustrine System; it lies in a low, non-wooded location at the base of a small peninsula separating Tennison Bay and Shanty Bay. Tennison Bay Wetland is part of Peninsula State Park (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Topography

Tennison Bay Wetland has a total relief of less than five feet; wetland elevations range from roughly 585 to 589 feet above sea level, 5 to 9 feet above the approximate mean elevation of Green Bay. The Niagara Escarpment forms steep bluffs along much of the western shoreline of Door Peninsula, and Tennison Bay Wetland lies lakeward of the coastal bluff line. The shoreline at Tennison Bay and Shanty Bay has been described by the Great Lakes Basin Commission (1975) as an erodible low plain. The inland topography in this area is hilly, with elevations ranging as high as 740 feet above sea level.

Surficial Geology

The surficial geology of Tennison Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Tennison Bay Wetland is Miami loam, which is derived from glacial material which has weathered. It contains considerable amounts of limestone as well as boulders and stones. Miami loam holds moisture well and has good natural drainage except when found in depressions, where the drainage is poor (Whitson et al., 1919).

Hydrology

There are no streams flowing through Tennison Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin-Michigan, 1960). Groundwater quality data are available from September 24, 1976, for an area near Tennison Bay Wetland (T31N, R27E, Sec. 16). The recorded pH value was 7.3 and dissolved solids were 377 milligrams per liter (U.S. Geological Survey, Water Resources Division, 1977).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Tennison Bay Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Tennison Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photographs, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

BIOTIC SETTING LM 233

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Tennison Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Tennison Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Tennison Bay Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Tennison Bay Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Tennison Bay Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus), with "supplemental" value for pheasant (Phasanius colchicus) (Thompson et al., 1976).

The Strawberry Island Group, consisting of Big Strawberry, Little Strawberry, and Jack Islands, lies approximately 1.5 miles west of Tennison Bay Wetland. Jackson (1927) reports that Jack Island had up to 1,000 nesting herring gulls (Larus argentatus), the largest gullery in the region. He also recorded a great blue heron (Ardea herodias) colony of 60 nests on Big Strawberry Island and five great blue heron nests on little Strawberry Island. Scharf et al. (1977) report that a colony of 40-50 black-crowned night herons (N. nycticorax) existed on Little Strawberry Island in 1973 but deserted the island in 1974, possibly due to human disturbance. Mallards (Anas platyrhynchos), pintails (A. acuta), gadwalls (A. strepera), and herring gulls nested on the island in 1975. Scharf also reports that an estimated 800 pairs of herring gulls nested on Jack Island in 1976 along with lesser numbers of mallards, gadwalls, and red-breasted mergansers (Mergus serrator). Double-crested cormorants (Phalacrocorax auritus), an endangered species in Wisconsin (Hine et al., 1975), visited Jack Island during the summers of 1974-76 but did not attempt to nest there.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Tennison Bay Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Tennison Bay Wetland has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Tennison Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Tennison Bay Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 233

Population

Tennison Bay Wetland is located in Gibraltar Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-41 indicates that both the county and the township experienced recent rapid population growth, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-41. Population Data for the Vicinity of Tennison Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Gibraltar Township	696	18.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Tennison Bay Wetland is rural open space. The surrounding area is primarily in rural open space use, with camping areas just to the south of the wetland, east along Shanty Bay, and northeast of the wetland. Camping facilities are located northeast, east, and south of Tennison Bay Wetland. A gravel pit lies to the south, and access roads are adjacent to the wetland on the east. A small pond lies north of the wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photographs, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). The location of the wetland within Peninsula State Park suggests that it is subject to minimal development pressure.

Recreation

Tennison Bay Wetland is located within the 3,763-acre Peninsula State Park. Activities within the park include fishing, boating, swimming, and water skiing, with trails for nature study, hiking, snowmobiling, bicycling, and cross-country skiing. Camping facilities are available within the park (Wisconsin Department of Natural Resources, 1978).

Mineral Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Tennison Bay Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

There are no forest resources in Tennison Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Tennison Bay Wetland (U.S.G.S. quadrangle map, Sister Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Tennison Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Tennison Bay Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 233

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

JUDDVILLE BAY WETLAND

PHYSIOGRAPHIC SETTING

LM 234

Setting

Juddville Bay Wetland is located approximately 100 feet from the western shoreline of the Door Peninsula in Door County, Wisconsin, 1.5 miles north of the town of Egg Harbor. The wetland is a low, partially wooded, Lacustrine System; it lies lakeward of a steep coastal bluffline. Strawberry Channel lies offshore of this wetland between Hat Island and the mainland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Topography

Juddville Bay Wetland has a total relief of approximately 10 feet. Elevations range from 585 to 595 feet above sea level, 5 to 15 feet above the approximate mean elevation of Lake Michigan. The Niagara Escarpment forms a steep (170 feet high) bluff which lies just inland from the wetland. The area south of Juddville Bay, including the wetland, is erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland, which lies beyond the coastal bluffline, is rolling, with elevations ranging to 800 feet above sea level.

Surficial Geology

The surficial geology of Juddville Bay Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Juddville Bay Wetland is Miami fine sandy loam, which is derived from weathering of glacial drift and the underlying limestone. This soil consists of brown to grayish-brown fine sandy loam to a depth of 8 inches. Miami fine sandy loam has good drainage, except in sandy areas, where drainage is excessive (Whitson et al., 1919).

Hydrology

There are no streams flowing through Juddville Bay Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Juddville Bay Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Juddville Bay Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Wisconsin Coastal Zone Management Development Program aerial photographs, 1975).

BIOTIC SETTING

LM 234

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Juddville Bay Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Juddville Bay Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Juddville Bay Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Juddville Bay Wetland.

Avifauna

The avifauna of Hat Island, located approximately three miles northwest of Juddville Bay Wetland, has been well studied. Double-crested cormorants (Phalacrocorax auritus) nested on the island until fishermen raided the colony in 1954. Cormorants were observed on the island in 1975 and 1976; however, they have only used it for resting and fishing. Hat Island has the largest active herring gull (Larus argentatus) colony in Wisconsin. During 1976, 800-1,000 pairs nested throughout the island, fledging an estimated 800 young. In addition, there were 50-60 pairs of ring-billed gulls (Larus delawarensis) nesting within the herring gull colony. A colony of 32-40 pairs of black-crowned night herons (N. nycticorax) also exists on Hat Island. Mallards (Anas platyrhynchos), gadwalls (A. strepera), and red-breasted mergansers (Mergus serrator) use the island for nesting (Scharf, 1976).

Since Hat Island has no wetlands, it is probable that some of the many species nesting on the island use the Juddville Bay Wetland for feeding. Black-crowned night herons, in particular, often fly several miles from a nesting colony to forage in a suitable wetland area (Pearson, 1917).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Juddville Bay Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5). However, the literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Juddville Bay Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Juddville Bay Wetland by the literature search. However, the double-crested cormorant, an endangered species in Wisconsin, nested on Hat Island, located approximately three miles northwest of Juddville Bay Wetland, until 1954. At that time, fishermen raided the colony, knocking down all of the tree nests and turning over the ground nests. Cormorants were observed resting and fishing on the island during 1975 and 1976, but they did not nest there (Scharf et al., 1976).

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 234

Population

Juddville Bay Wetland is located in Egg Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-42 indicates that both the county and the township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-42. Population Data for the Vicinity of Juddville Bay Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Egg Harbor Township	748	7.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within this wetland is rural open space. The surrounding area is characterized primarily by rural open space uses, with residential and commercial development located along the shoreline south of the wetland (the town of Egg Harbor). Unimproved roads lie within and adjacent to portions of Juddville Bay Wetland. A quarry and orchards are located inland from the wetland, above the coastal bluffs (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michgan, 1961; Wisconsin Coastal Zone Management Development Program aerial photographs, 1975). The wetland is under private ownership (Schinkten, 1975), and its location suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Juddville Bay Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Juddville Bay Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), and there is an active quarry producing crushed limestone approximately one mile east of the wetland. There are no active clay or sand and gravel operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

Juddville Bay Wetland is partially wooded and is part of a wooded area that extends both north and south of the wetland along Green Bay (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Juddville Bay Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Juddville Bay Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Juddville Bay Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 234

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

EGG HARBOR WETLAND

PHYSIOGRAPHIC SETTING

LM 235

Setting

Egg Harbor Wetland is located 0.2 mile from the western shoreline of Door Peninsula in Door County, Wisconsin, west of the town of Egg Harbor. Egg Harbor Wetland is a Palustrine System; it is raised above the shoreline and wooded. The wetland may have been partially drained to accommodate residential and highway development, which has occurred in the area between the wetland and the lakeshore. This lakeshore development lies on a small peninsula which forms the western boundary of Egg Harbor (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Topography

Egg Harbor Wetland has only slight slope, with a total relief of less than 5 feet. Elevations range from approximately 607 to 611 feet above sea level, 27 to 31 feet above the approximate mean elevation of Lake Michigan. The Niagara Escarpment forms a steep (180 feet high) bluff which lies nearly 600 feet inland from the wetland. The wetland lies on a non-erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland, which lies beyond the coastal bluffline, is rolling, with elevations up to 800 feet above sea level.

Surficial Geology

The surficial geology of Egg Harbor Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Egg Harbor Wetland is Miami loam, which is derived from weathered glacial material which contains considerable amounts of limestone as well as boulders and stones. This yellowish-brown to grayish-brown loam holds moisture well and has good natural drainage except when found in depressions, where drainage is poor (Whitson et al., 1919).

Hydrology

There are no streams flowing through Egg Harbor Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Egg Harbor Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Egg Harbor Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 235

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Egg Harbor Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Egg Harbor Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Egg Harbor Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Egg Harbor Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Egg Harbor Wetland as Class I wildlife habitat, "most desirable" for songbirds (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Egg Harbor Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Egg Harbor Wetland has been classified as "most desirable" habitat for squirrels (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Egg Harbor Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Egg Harbor Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 235

Population

Egg Harbor Wetland is situated near the town of Egg Harbor in Egg Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-43 indicates that the county, township, and town experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-43. Population Data for the Vicinity of Egg Harbor Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Egg Harbor Township	748	7.9	--
Town of Egg Harbor	195	6.0	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Egg Harbor Wetland is rural open space. The wetland is surrounded on the inland side by agricultural open space uses and on the lake side by an area of residential development, part of the town of Egg Harbor. The wetland lies immediately adjacent to a secondary highway, and homes and access roads are located on the opposite side of this road. Small bay mouth bars lie to the north, on Egg Harbor. Orchards are common in the area (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and its location between an agricultural area and a residential area suggests that it may be subject to high development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Egg Harbor Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Egg Harbor Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970). No oil, gas, or coal resources are known to be present in the wetland.

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

Egg Harbor Wetland is partially wooded and is on the periphery of a large wooded area extending south on the Green Bay shoreline (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Egg Harbor Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Egg Harbor Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Egg Harbor Wetland (Wisconsin Historic Preservation Division, 1977). The Wisconsin Inventory of Archaeology indicates that an archaeological site (DR #90) is present in the vicinity of Egg Harbor Wetland. Information regarding the specific site location as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 235

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

LEROYS POINT WETLAND

PHYSIOGRAPHIC SETTING

LM 236

Setting

Leroys Point Wetland is located 100 feet from the western shoreline of Door Peninsula in Door County, Wisconsin, 1.6 miles southwest of the town of Egg Harbor. The wetland is a low, wooded Lacustrine System (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Topography

Leroys Point Wetland has very little slope, with a total relief of less than 5 feet; elevations range from roughly 582 to 587 feet above sea level, 2 to 7 feet above the approximate mean elevation of Lake Michigan. The Niagara Escarpment forms a steep (160 feet high) bluff which lies 1,600 feet inland from the wetland. The wetland lies on a non-erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland, which lies beyond the coastal bluffline, is rolling, with elevations ranging to 800 feet above sea level.

Surficial Geology

The surficial geology for Leroys Point Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Leroys Point Wetland is Miami loam, which is derived from weathered glacial material which contains considerable amounts of limestone as well as boulders and stones. This yellowish-brown to grayish-brown loam holds moisture well and has good natural drainage except when found in depressions, where drainage is poor (Whitson et al., 1919).

Hydrology

There are no streams flowing through Leroys Point Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Leroys Point Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Leroys Point forms a small headland area north of the wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 236

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Leroys Point Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Leroys Point Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Leroys Point Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Leroys Point Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, has designated Leroys Point Wetland as Class I wildlife habitat, "most desirable" for songbirds (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Leroys Point Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Leroys Point Wetland has been classified as "most desirable" habitat for squirrels (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Leroys Point Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Leroys Point Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 236

Population

Leroys Point Wetland is located in Egg Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-44. indicates that both the county and the township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-44. Population Data for the Vicinity of Leroys Point Wetland

	Estimated Population 1975[a]	Estimated % Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Egg Harbor Township	748	7.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Leroys Point Wetland is rural open space. The surrounding area is characterized by shoreline residential development between the wetland and Lake Michigan, and agricultural open space uses inland of the wetland. A secondary highway lies to the east of the wetland, and access roads lie to the north and south. Orchards are common in the area (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and its location suggests that it is subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Leroys Point Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Leroys Point Wetland have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). These deposits are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Leroys Point Wetland.

Leroys Point Wetland lies within a wooded area that extends, with only a few interruptions, along the Green Bay shoreline in the vicinity of the wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Leroys Point Wetland (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Leroys Point Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Leroys Point Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 236

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

HORSESHOE POINT WETLAND COMPLEX

PHYSIOGRAPHIC SETTING LM 237-239

Setting

The Horseshoe Point Wetland Complex, comprised of Horseshoe Point Wetland and Monument Point Wetlands #1 and #2, is located on the western side of Door Peninsula in Door County, Wisconsin, roughly seven miles north of the city of Sturgeon Bay. Horseshoe Bay and Horseshoe Point are to the north of the wetlands, and Monument Shoal is offshore. The locations of the wetlands relative to the Green Bay shoreline and the nearest city are presented in Table 10-45.

Table 10- 45. Location of Wetlands in the Horseshoe Point Wetland Complex

	Distance to shoreline	Distance to nearest city
Horseshoe Point Wetland	0.1 mile	3.3 miles south of Egg Harbor
Monument Point Wetland #1	250 feet	4.2 miles south of Egg Harbor
Monument Point Wetland #2	150 feet	3.8 miles south of Egg Harbor

All of the wetlands in the complex are raised, Palustrine Systems (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Topography

Horseshoe Point Wetland has a total relief of 15 feet; elevations range from 585 to 600 feet above sea level (5 to 20 feet above lake level). Monument Point Wetland #1 has little relief, and its elevation is 620 feet above sea level. Monument Point Wetland #2 has a more varied relief of 45 feet with elevations ranging from 585 to 630 feet above sea level. The Niagara Escarpment forms a steep (140 feet high) bluff which lies roughly 0.5 mile inland from the shoreline. The wetlands lie on a non-erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland, which lies beyond the coastal bluffline, is rolling, with elevations up to 830 feet above sea level.

Surficial Geology

The surficial geology of the three wetlands of the Horseshoe Point Wetland Complex is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

There are three types of soil found in the Horseshoe Point Wetland Complex. Miami loam is present in Horseshoe Point Wetland and Miami fine sand is found in Monument Point Wetland #1. Monument Point Wetland #2 is comprised of Miami fine sandy loam (Whitson et al., 1919).

Miami loam and Miami fine sandy loam are derived from weathered glacial material and contain limestone. The former, a yellow-brown to grayish-brown loam, holds moisture well and has good natural drainage except when found in depressions, where drainage is poor. Miami fine sandy loam consists of brown to grayish-brown fine sandy loam to a depth of 8 inches. The drainage of Miami fine sandy loam is good and in sandy areas it is excessive. Miami fine sand consists of yellowish-brown fine sand underlain by a coarser pale-yellow fine sand; it is low in organic matter, low in water-holding capacity, and is easily eroded (Whitson et al., 1919).

Hydrology

There are no streams flowing through the Horseshoe Point Wetland Complex (U.S.G.S. quadrangle map, Chambers Island, Wisconsin-Michigan, 1961; Sturgeon Bay, Wisconsin, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the three wetlands.

Climate

The closest weather station providing climatic data for Horseshoe Point Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Horseshoe Point Wetland Complex (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING

LM 237-239

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of the Horseshoe Point Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Horseshoe Point Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Horseshoe Point Wetland Complex.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the Horseshoe Point Wetland Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Horseshoe Point Wetland and Monument Point Wetlands #1 and #2 as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to the wetlands in the Horseshoe Point Wetland Complex. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

The Horseshoe Point Wetland Comp x has been classified as "most desirable" habitat for squirrels and white ailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Departm nt of Natural Resources, open file report). A survey of the mammals of the Gr n Bay Islands (Long, 1978) provides some general information which may be usef l in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, densi and productivity, recreational and commercial use, life histories, food source , or relationship to water levels of the mammals inhabiting the three wetlar s comprising the Horseshoe Point Wetland Complex.

Endangered Species

No plants or animals appearing on the ederal or state lists of endangered or threatened species (U.S. Fish and Wildli Service, 1978; Hine, et al., 1975) were documented in the Horseshoe Point Wetl d Complex by the literature search.

Health

The available information is not suff cient to allow an evaluation of the environmental quality of this wetland. H vever, the Wisconsin Department of Natural Resources has designated this we and as Class I wildlife habitat. Numerous dairy and orchard operators dis ose of process wastewater in the vicinity of the wetland and this may have me effect on its health.

CULTURAL SETTING

LM 237-239

Population

The Horseshoe Point Wetland Complex i located in Egg Harbor Township of Door County, Wisconsin. The county is spa ely populated and has a density of 41 persons per square mile. Table 10-46 ir icates that both the county and the township experienced rapid population g wth between 1970 and 1975, but population projections for 1990 indicate th t Door County may experience a slow population decline in the future.

Table 10-46. Population Data for the Vicinity of the Horseshoe Point Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Egg Harbor Township	748	7.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

The Horseshoe Point Wetland Complex and the surrounding area are characterized by rural wooded space uses, with areas of residential development along the Lake Michigan shoreline. An access road lies between the shoreline and the three wetlands in the Horseshoe Point Wetland Complex. Two roads cross Horseshoe Point Wetland. A county park is located north of the wetlands, and there are gravel pits to the east. Shoals lie offshore of the wetlands. All three wetlands in the complex are privately owned (U.S.G.S. quadrangle map, Sutrgeion Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975), but the rural nature of this area suggests that the wetlands are subject to low development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of the Horseshoe Point Wetland Complex.

Mineral, Energy, and Forest Resources

Although the Horseshoe Point Wetland Complex is situated within an area of Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the wetlands (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetlands, but have little potential for containing commercial quantities of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no sand and gravel or clay operations active within the wetlands (Ostrom, 1970).

End moraines, present to the east of the wetlands, have a low potential for containing large deposits of sand and gravel. However, the outwash fans and other ice contact deposits often found in association with end moraines have a high potential of containing moderate to small deposits of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976), and an abandoned sand and gravel pit is located immediately to the east of the wetlands (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in these wetlands.

The Horseshoe Point Wetland Complex lies within a wooded area that extends, with only a few interruptions, along the Green Bay shoreline in the vicinity of the wetlands (U.S.G.S. quadrangle maps, Chambers Island, Wisconsin-Michigan, 1961, and Sturgeon Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Horseshoe Point Wetland or Monument Point Wetlands #1 and #2 (U.S.G.S. quadrangle maps, Chambers Island, Wisconsin-Michigan, 1961; Sturgeon Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to the three wetlands of the Horseshoe Point Wetland Complex. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Horseshoe Point Wetland or Monument Point Wetlands #1 and #2, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 237-239

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

EGG HARBOR TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING LM 240

Setting

Egg Harbor Township Wetland is adjacent to the Green Bay shoreline on the western side of Door Peninsula in Door County, Wisconsin, seven miles north of the city of Sturgeon Bay. This low Lacustrine wetland is wooded and lies lakeward of a high coastal bluff (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin-Michigan, 1960).

Topography

Egg Harbor Township Wetland has slight slope, with a total relief of 20 feet. The wetland elevations range from 580 feet to 600 feet above sea level, lake level to 20 feet above the approximate mean elevation of Lake Michigan. The Niagara Escarpment forms a steep bluff (100 feet high) 0.5 mile inland from the lakeshore. The wetland lies on a non-erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland, which lies beyond the coastal bluffline, is rolling, with elevations up to 830 feet above sea level.

Surficial Geology

The surficial geology of Egg Harbor Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Egg Harbor Township Wetland is Clyde loam, which consists of silt and organic matter underlain by grayish fine sand. When found in depressions, this soil may have a thin layer of peat on the surface. Clyde loam is poorly drained (Whitson et al., 1919).

Hydrology

There are two unnamed, intermittent ponds located in the southern portion of Egg Harbor Township Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin-Michigan, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific information pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Egg Harbor Township Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Egg Harbor Township Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 240

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Egg Harbor Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Egg Harbor Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Egg Harbor Township Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Egg Harbor Township Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Egg Harbor Township Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Egg Harbor Township Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Egg Harbor Township Wetland has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A survey of the mammals of the Green Bay Islands (Long, 1978) provides some general information which may be useful in characterizing the wetlands of Door County, Wisconsin (Appendix E-5).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Egg Harbor Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Egg Harbor Township Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 240

Population

Egg Harbor Township Wetland is located in Egg Harbor Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-47 indicates that both the county and the township experienced rapid population growth between 1970 and 1975, but

population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-47. Population Data for the Vicinity of Egg Harbor Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Egg Harbor Township	748	7.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Egg Harbor Township Wetland is rural wooded space, with residential development along the Lake Michigan shoreline. The surrounding area is in rural open space uses. An access road crosses Egg Harbor Township Wetland, and a second access road lies adjacent to the wetland on the south. The wetland lies lakeward of a steep coastal bluff, and orchards are common in the upland areas (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin-Michigan, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and the presence of residential development in the vicinity indicates that moderate development pressures may exist.

Recreation

There are no known state or federal recreational facilities in the vicinity of Egg harbor Township Wetland.

Mineral, Energy, and Forest Resources

Although Egg Harbor Township Wetland is situated within an area of Niagara limestone (Hotchkiss and Steidtmann, 1914), there are no quarrying operations in the wetland (Ostrom, 1970). Glaciolacustrine deposits of sand, silt, and clay are present in the wetland, but have little potential for containing commercial quantities of sand and gravel (Buckley, 1901; Hadley and Pelham, 1976). There are no sand and gravel or clay operations active within the wetlands (Ostrom, 1970).

End moraines, present to the east of the wetland, have a low potential for containing large deposits of sand and gravel. However, the outwash fans and other ice contact deposits often found in association with end moraines have a high potential of containing moderate to small deposits of sand and gravel

(Buckley, 1901; Hadley and Pelham, 1976), and active sand and gravel operations do exist to the east of the wetland (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetland.

Egg Harbor Township Wetland lies within a wooded area that extends north of the wetland along the Green Bay shoreline (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Egg Harbor Township Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Egg Harbor Township Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Egg Harbor Township Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 240

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

SAWYER HARBOR WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 241-244

Setting

The Sawyer Harbor Wetland Complex, comprised of Sawyer Harbor Wetlands #1-#4, is located on the western side of Door Peninsula in Door County, Wisconsin, just south of Sturgeon Bay. Sturgeon Bay is connected to Lake Michigan by the Sturgeon Bay Canal. These wetlands are included in a single complex because they are located in close proximity to one another on Sawyer Harbor and because they exhibit similar physiographic characteristics. The wetlands are located to the northwest of Potawatomi State Park, which lies on the west side of Sturgeon Bay near its junction with Green Bay. The locations of the wetlands relative to the Green Bay shoreline and the nearest city are given in Table 10- 48.

Table 10-48. Location of Sawyer Harbor Wetlands #1-#4

	Distance to shoreline	Distance to nearest city
Sawyer Harbor Wetland #1	250 feet	4 miles northwest of Sturgeon Bay
Sawyer Harbor Wetland #2	adjacent	3.5 miles northwest of Sturgeon Bay
Sawyer Harbor Wetland #3	100 feet	3.5 miles northwest of Sturgeon Bay
Sawyer Harbor Wetland #4	adjacent	3.5 miles northwest of Sturgeon Bay

All of the wetlands in this complex are low Lacustrine Systems. Sawyer Harbor Wetlands #1-#3 are wooded, while Sawyer Harbor Wetland #4 is partially wooded (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Topography

Sawyer Harbor Wetlands #1 and #3 have a total relief of five feet or less, and elevations in these wetlands range from roughly 581 to 585 feet above sea level (1 to 5 feet above lake level). Sawyer Harbor Wetlands #2 and #4 also have relief of less than 5 feet, with elevations ranging from lake level to 5 feet above lake level.

A large bay mouth bar forms Sawyer Harbor at the northern end of Sturgeon Bay. The Sturgeon Bay Gap represents the preglacial course of the Menominee River. The preglacial river valley was deepened by glacial sculpture and became

submerged beneath the waters of Lake Michigan (Martin, 1965). Government Bluff lies to the south of the wetlands within the Potawatomi State Park. This bluff, which stands 150 feet above the waters of Sturgeon Bay, is part of the Niagara Escarpment, which roughly parallels the western shoreline of the Door Peninsula. Abandoned shorelines of glacial Lake Algonquin and the Nipissing Great Lakes are also found in the area (Martin, 1965).

Sawyer Harbor Wetlands #1-#4 lie on a non-erodible low plain (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland beyond the coastal bluffs is rolling, with eleavtions up to 730 feet above sea level.

Surficial Geology

The surficial geology of Sawyer Harbor Wetlands #1-#4 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

Clyde silt loam, a wet soil occupying swampy depressions, is found in Sawyer Harbor Wetland #4. This soil has a high content of organic matter and is dark in color. It is formed from glacial and water deposits and may have a shallow layer of peat on the surface.

Peat soil, consisting of organic material derived from sedges, reeds, wood, and mosses, is found in Sawyer Harbor Wetlands #1-#3. This soil is poorly drained and is generally found in level areas (Geib et al., 1916).

Hydrology

An unnamed intermittent creek flows through Sawyer Harbor Wetland #4 on its way to Sawyer Harbor. There is little elevational change in the stream as it travels through the wetland. There are no streams flowing through Sawyer Harbor Wetlands #1-#3 (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Sawyer Harbor Wetlands #1-#4.

Climate

The closest weather station providing climatic data for Sawyer Harbor Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3^{o}F, the average daily low for January was 14.9^{o}F and the average daily high in July was 81.5^{o}F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost

(28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Sawyer Harbor Wetland #1 lies on a bay mouth bar which forms Sawyer Harbor at the end of Sturgeon Bay. A secondary highway lies to the north of this wetland and west of Sawyer Harbor Wetlands #2-#4 (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 241-244

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Sawyer Harbor Wetlands #1-#4.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Sawyer Harbor Wetlands #1-#4.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Sawyer Harbor Wetlands #1-#4.

Reptiles and Amphibians

Suzuki (1950) reported the mudpuppy (Necturus maculosus) from Sturgeon Bay, and presumably it could occur in Sawyer Harbor, which includes the Sawyer Harbor Wetland Complex as its landward border.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Sawyer Harbor Wetlands #1-#4 as Class I wildlife habitat. Sawyer Harbor Wetlands #1 and #2 are "most desirable" for waterfowl, shore birds, and gulls and terns, while Sawyer Harbor Wetlands #3 and #4 are "most desirable" for waterfowl (Thompson et al., 1976). In an

environmental report for the proposed Idlewild Recreational Development (Willard and Tishler, 1973), the area in and around Sawyer Harbor Wetland #4 was identified as being of particular value for ducks and other aquatic species.

Potawatomi State Park, which lies along the southern edge of Sawyer Harbor, is noted for the great horned owl (Bubo virginianus) and barred owl (Strix varia) which inhabit the lowland forest areas. Pileated woodpeckers (Dryocopus pileatus) are known to nest within the park (Tessen, 1976).

Appendix D-9 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Sawyer Harbor Wetlands #1-#4.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

Sawyer Harbor Wetland #3 and #4 have been classified as "most desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Sawyer Harbor Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Sawyer Harbor Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 241-244

Population

Sawyer Harbor Wetlands #1-#4 are located in Nausewaupee Township of Door County, Wisconsin. The County is sparsely populated and has a density of 41 persons per square mile. Table 10-49 indicates that both the county and township experienced rapid population growth between 1970 and 1975, but

population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-49. Population Data for the Vicinity of Sawyer Harbor Wetlands #1-#4

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Nausewaupee Township	1,470	22.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Sawyer Harbor Wetlands #1-#4 and the surrounding areas are characterized by primarily rural wooded space uses, with shoreline residential development and the town of Idlewild on the northern shore of Sawyer Harbor. A secondary highway lies to the north of this wetland and west of Sawyer Harbor Wetlands #2-#4. Several limestone quarries which were held for many years by the U.S. War Department are located to the southeast of Sawyer Harbor Wetlands #1-#4 within the Potawatomi State Park. All four wetlands are privately owned (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Schinkten, 1975).

The 650-acre Idlewild Resort Development encompasses the four wetlands of this complex. The proposed facilities of the project include a 118-room resort-hotel, a restaurant, a golf course, 200 condominiums, and 700 lots from one-third to one acre each. All shore frontage, wetlands, and the golf course are to be held in common. A proposed marina facility for the resort has not received the requisite governmental permits, but seven areas have been platted for the resort development (Prentice, 1976; Door County Resources Planning Committee, personal communication).

While no specific development is planned for the wetlands, their proximity to the large Idlewild Resort Development implies the existence of high development pressures.

Recreation

There are no state or federal recreational facilities within Sawyer Harbor Wetlands #1-#4. However, the wetlands lie just to the northwest of 1,126-acre Potawatomi State Park. Recreational opportunities available at the park

include fishing, water skiing, boating, and canoeing. Trails for hiking, snowmobiling, cross country skiing, and bicycling are also provided, as are camping facilities (Wisconsin Department of Natural Resources, 1978).

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Sawyer Harbor Wetlands #1-#4 have low potential for containing commercially viable quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The wetlands are underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). Although there are a number of inactive quarrying operations across Sturgeon Bay from the wetlands (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960), there are no active clay, sand and gravel, or quarrying operations near the wetlands (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Sawyer Harbor Wetlands #1-#4. There are no known oil, gas, or coal resources present in the wetlands.

Sawyer Harbor Wetlands #1 and #3 are entirely wooded, while Sawyer Harbor Wetlands #2 and #4 are partially wooded. The wetlands are part of a wooded area extending primarily along Sturgeon Bay to the east of the wetlands (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Sawyer Harbor Wetlands #1-#4 (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Sawyer Harbor Wetlands #1-#4. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Sawyer Harbor Wetlands #1-#4, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

SAND BAY AREA WETLAND

PHYSIOGRAPHIC SETTING

LM 245

Setting

Sand Bay Area Wetland is located 200 feet from the Green Bay shoreline on the western side of Door Peninsula in Door County, Wisconsin, four miles west of the City of Sturgeon Bay. The wetland is situated between Sand Bay and Sturgeon Bay. Potawatomi State Park is less than 0.5 mile to the east of the wetland. Sand Bay Area Wetland is a low, Lacustrine System (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Topography

Sand Bay Area Wetland has a total relief of less than 10 feet; elevations within the wetland range from roughly 580 to 589 feet above sea level, 0 to 9 feet above the approximate mean elevation of Lake Michigan. The wetland lies to the south of the Sturgeon Bay Gap, which represents the preglacial course of the Menominee River. The preglacial river valley was deepened by glacial sculpture and became submerged beneath the waters of Lake Michigan (Martin, 1965). The Niagara Escarpment forms a bluffline which lies less than one mile inland from the wetland. The bluffline in this area is dissected by intermittent streams and features variable slope. Sand Bay Area Wetland lies on an erodible low plain lakeward of the bluffline (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland beyond the coastal bluffs is rolling, with elevations up to 740 feet above sea level.

Surficial Geology

The surficial geology of Sand Bay Area Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Sand Bay Area Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

An unnamed, intermittent stream flows through the middle of Sand Bay Area Wetland. There is a change in elevation of approximately 10 feet in the stream as it travels through the wetland on its way to Green Bay. Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Sand Bay Area Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Sand Bay Area Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 245

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Sand Bay Area Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Sand Bay Area Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Sand Bay Area Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Sand Bay Area Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Sand Bay Area Wetland as Class I wildlife habitat, "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shore birds (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Sand Bay Area Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Sand Bay Area Wetland has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and "desirable" for squirrels (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Sand Bay Area Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Sand Bay Area Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 245

Population

Sand Bay Area Wetland is located in Nausewaupee Township of Door County, Wisconsin. The County is sparsely populated and has a density of 41 persons per square mile. Table 10-50 indicates that both the county and township

experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10- 50. Population Data for the Vicinity of Sand Bay Area Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Nausewaupee Township	1,470	22.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Sand Bay Area Wetland is rural open space. The surrounding area is predominantly in agricultural open space uses, with some residential development present along the shoreline. A secondary highway lies adjacent to the wetland near the shoreline, and a gravel pit lies to the east (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and its location suggests that it may be subject to moderate developmental pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Sand Bay Area Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Sand Bay Area Wetland have low potential for containing commercially significant quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). This area is underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914). Although there is a sand and gravel pit immediately east of the wetland, there are no active clay, sand and gravel, or quarrying operations in the wetland itself (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Sand Bay Area Wetland. There are no known oil, gas, or coal resources present.

Sand Bay Area Wetland is almost entirely wooded. Further wooded areas exist along Green Bay to the north of the wetland as well as to the south and southwest (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Sand Bay Area Wetland (U.S.G.S. quadrangle map, Sturgeon Bay, Wisconsin, 1960).

Pollution Sources

There are no NPDES permit holders adjacent to Sand Bay Area Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Sand Bay Area Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 245

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

SAND BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 246-248

Setting

The Sand Bay Wetland Complex, comprised of Sand Bay Wetlands #1-#3, is located on the western side of Door Peninsula in Door County, Wisconsin, four miles southwest of Sturgeon Bay. These wetlands are included in a single complex because all three are situated on Sand Bay and exhibit similar physiographic characteristics. Sand Bay Wetland #1 lies 350 feet from the Green Bay shoreline and 4.5 miles west of the city of Sturgeon Bay. Sand Bay Wetland #2 lies 250 feet from the Green Bay shoreline, 5.0 miles west of Sturgeon Bay. Sand Bay Wetland #3 lies 0.5 mile from the lakeshore, 5.0 miles from Sturgeon Bay. All of these wetlands occupy low sites. Sand Bay Wetlands #1 and #2 are wooded, and Sand Bay Wetland #3 is partially wooded. Sand Bay Wetland #1 is an Intermittent Riverine wetland and Sand Bay Wetlands #2 and #3 are Palustrine Systems (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960; Little Sturgeon, Wisconsin, 1961).

Topography

Sand Bay Wetland #1 has a total relief of 5 feet, with elevations ranging from 585 to 590 feet above sea level (5 to 10 feet above the approximate mean elevation of Lake Michigan). Sand Bay Wetlands #2 and #3 have total relief of less than 5 feet, with elevations ranging from roughly 583 to 587 feet above sea level. The Niagara Escarpment forms a bluffline which lies one mile to the southeast of the wetlands. The bluffline in this area is dissected by intermittent streams and features variable slope. The wetlands lie on an erodible low plain lakeward of the bluffline (Great Lakes Basin Commission, 1975). The topography of the Niagara Upland beyond the coastal bluffs is moderate, with glacial deposits forming the greatest irregularities. Upland elevations in the vicinity of Sand Bay Wetlands #1-#3 range to a height of 740 feet above sea level.

Surficial Geology

The surficial geology of Sand Bay Wetlands #1-#3 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

Peat and Muck are the two types of soil found in the Sand Bay Wetland Complex. Muck soil is poorly drained, and consists of vegetated matter in varying states of decomposition and large amounts of mineral material. Muck soil is more thoroughly decomposed than Peat and contains more mineral matter.

Peat soil consists of organic material derived from sedges, reeds, wood, and mosses. It is poorly drained and is generally found in level areas (Whitson et al., 1919). Sand Bay Wetlands #1 and #2 have Peat soils and Sand Bay Wetland #3 has Muck soil.

Hydrology

An unnamed, intermittent stream flows through the middle of Sand Bay Wetland #1. This stream has an elevational change of 5 feet as it travels through the wetland on its way to Green Bay. An unnamed intermittent lake is located in the eastern portion of Sand Bay Wetland #3. There are no streams flowing through Sand Bay Wetland #2 (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960; Little Sturgeon, Wisconsin, 1961).

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Sand Bay Wetlands #1-#3.

Climate

The closest weather station providing climatic data for the Sand Bay Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3^{o}F, the average daily low for January was 14.9^{o}F and the average daily high in July was 81.5^{o}F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

The wetlands lie at the base of a narrow peninsula; Snake Island is located off the tip of this peninsula (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960, and Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 246-248

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Sand Bay Wetlands #1-#3.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Sand Bay Wetlands #1-#3.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Sand Bay Wetlands #1-#3.

Reptiles and Amphibians

Suzuki (1950) reported the mudpuppy (Necturus maculosus) from Sand Bay. This species frequents permanent lakes and is not likely to be found within the three small wetlands of the Sand Bay Wetland Complex.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Sand Bay Wetlands #1-#3 as Class I wildlife habitat. Sand Bay Wetlands #1 and #3 are "most desirable" for songbirds and ruffed grouse (Bonasa umbellus) and "desirable" for shore birds, while Sand Bay Wetland #2 is "most desirable" for waterfowl, gulls and terns, and shore birds (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Sand Bay Wetlands #1-#3. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

Sand Bay Wetland #1 has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" for squirrels (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no other site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the Sand Bay Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Sand Bay Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 246-248

Population

Sand Bay Wetlands #1-#3 are located in Nausewaupee Township of Door County, Wisconsin. The County is sparsely populated and has a density of 41 persons per square mile. Table 10-51 indicates that both the county and township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-51. Population Data for the Vicinity of the Sand Bay Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Nausewaupee Township	1,470	22.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the Sand Bay Wetland Complex is rural wooded space. The surrounding area is predominantly in agricultural open space uses, with some residential development present along the shoreline. An access road lies between Sand Bay Wetlands #1-#3 and the shoreline of Green Bay. A secondary highway cuts directly through Sand Bay Wetland #2 (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960, and Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Schinkten, 1975), and their location suggests that they may be subject to moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of the Sand Bay Wetland Complex.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in the Sand Bay Wetland Complex have low potential for containing commercially significant deposits of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). This area is underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand, and gravel, or quarrying operations in close proximity to the wetlands (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Sand Bay Wetlands #1-#3. There are no known oil, gas, or coal resources present.

Sand Bay Wetlands #1-#3 are almost entirely woodedand are within a larger wooded area extending east and west along Green Bay (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960; Little Sturgeon, Wisconsin, 1961). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of the Sand Bay Wetland Complex (U.S.G.S. quadrangle maps, Sturgeon Bay, Wisconsin, 1960; Little Sturgeon, Wisconsin, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Sand Bay Wetlands #1-#3. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Sand Bay Wetlands #1-#3, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 246-248

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

SNAKE ISLAND WETLAND

PHYSIOGRAPHIC SETTING

LM 249

Setting

Snake Island Wetland is located on Snake Island (also referred to as Basin Island), which lies off the western shoreline of Door Peninsula in Door County, Wisconsin. The wetland is adjacent to the Green Bay shoreline, 7.0 miles west of the city of Sturgeon Bay. This Lacustrine wetland is low and non-wooded. Snake Island lies at the tip of a narrow peninsula which separates Sand Bay and Rileys Bay, and at least half of the total area of the island is wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Topography

Snake Island Wetland has very slight relief; elevations of the wetland range from lake level to five feet above the mean elevation of Lake Michigan (580 to approximately 585 feet above sea level). The Niagara Escarpment forms a bluffline three miles to the southeast of the wetland on Door Peninsula. The bluffline is dissected by intermittent streams and features variable slope. Snake Island Wetland lies on an erodible low plain lakeward of the bluffline (Great Lakes Basin Commission, 1975). The wetland is located in part of the Green Bay-Lake Winnebago-Rock River Lowland, which lies to the west of the Niagara Upland. Inland topography is rolling, with elevations ranging up to 670 feet above sea level.

Surficial Geology

The surficial geology of Snake Island Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Snake Island Wetland is Miami loam, derived from glacial material which has weathered. It contains considerable amounts of limestone as well as boulders and stones. Miami loam holds moisture well and has good natural drainage except when found in depressions, where the drainage is poor (Whitson et al., 1919).

Hydrology

There are no streams flowing through Snake Island Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961). The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in the wetland.

Climate

The closest weather station providing climatic data for Snake Island Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Snake Island lies at the tip of a small peninsula that forms the east side of Rileys Bay. A bay mouth bar lies at the opposite side of the bay, at Rileys Point (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 249

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Snake Island Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Snake Island Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Snake Island Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Snake Island Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Snake Island Wetland as Class I wildlife habitat, "most desirable" for songbirds, gulls and terns, and waterfowl (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Snake Island Wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

Snake Island Wetland has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" habitat for squirrels (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Snake Island Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Snake Island Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat.

CULTURAL SETTING LM 249

Population

Snake Island Wetland is located in Nausewaupee Township of Door County, Wisconsin. The County is sparsely populated and has a density of 41 persons per square mile. Table 10-52 indicates that both the county and township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-52. Population Data for the Vicinity of Snake Island Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Nausewaupee Township	1,470	22.9	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Snake Island Wetland is rural open space. The wetland covers essentially the entire island (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975) and is under private ownership (Schinkten, 1975). Since the island is undeveloped, the wetland appears to be under minimal development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Snake Island Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Snake Island Wetland have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The wetland is underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations on Snake Island (Ostrom, 1970).

There are no significant forest resources within Snake Island Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Snake Island Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Snake Island Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Snake Island Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 249

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

RILEYS POINT WETLAND

PHYSIOGRAPHIC SETTING

LM 250

Setting

Rileys Point Wetland is located on the western shoreline of Door Peninsula in Door County, Wisconsin, 1.6 miles northeast of the community of Little Sturgeon. The wetland lies adjacent to Green Bay on a narrow point of land that juts into the bay between Rileys Bay and Little Sturgeon Bay. This is a low, non-wooded Lacustrine wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Topography

Rileys Point Wetland has very slight relief; elevations of the wetland range from 580 feet (lake level) to approximately 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The Niagara Escarpment forms a bluffline which lies 3.5 miles to the southeast of the wetland. The bluffline in this area is dissected by intermittent streams and features variable slope. Rileys Point Wetland lies on an erodible low plain lakeward of the bluffline (Great Lakes Basin Commission, 1975). The wetland is in the northern part of the Green-Bay-Lake Winnebago-Rock River Lowland, which is located west of the Niagara Upland. Inland topography is rolling, with elevations ranging up to 670 feet above sea level.

Surficial Geology

The surficial geology of Rileys Point Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

There are two types of soil present in Rileys Point Wetland, Poygan loam in the western half of the wetland and Miami loam in the eastern half. Poygan loam consists of heavy black loam which is high in silt and organic matter and often contains limestone. This soil is largely lacustrine in origin, but has been influenced by glacial action. Miami loam is derived from weathered glacial material and contains considerable amounts of limestone, as well as boulders and stones. Miami loam holds moisture well and has good natural drainage except when found in depressions, where the drainage is poor (Whitson et al., 1919).

Hydrology

There are no streams flowing through Rileys Point Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961). Generalized groundwater

information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Rileys Point Wetland.

Climate

The closest weather station providing climatic data for Rileys Point Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Rileys Point is a bay mouth bar separating Rileys Bay and Little Sturgeon Bay (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 250

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Rileys Point Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Rileys Point Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Rileys Point Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Rileys Point Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Rileys Point Wetland as Class I wildlife habitat (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Rileys Point Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Rileys Point Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Rileys Point Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING

LM 250

Population

Rileys Point Wetland is located in Gardner Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-53 indicates that both the county and the township

experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may experience a slow population decline in the future.

Table 10-53. Population Data for the Vicinity of Rileys Point Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Gardner Township	948	8.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Rileys Point Wetland is rural open space. The primary land use in the surrounding area is also rural open space, with areas of residential development along the shorelines of Rileys Bay immediately east of the wetland and Little Sturgeon Bay immediately to the west. The wetland has been partially dredged to accommodate boat motoring. An access road crosses the wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and its location suggests that it is under moderate development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Rileys Point Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Rileys Point Wetland have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The wetland is underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Rileys Point Wetland.

There are no significant forest resources in Rileys Point Wetland, nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Rileys Point Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Rileys Point Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Rileys Point Wetland (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #8, #9) are present in the vicinity of Rileys Point Wetland. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 250

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

LITTLE STURGEON BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 251-254

Setting

The Little Sturgeon Bay Wetland Complex is comprised of Little Sturgeon Bay Wetlands #1 and #2, Keyes Creek Wetland, and Henderson Point Wetland. The wetland complex is located on Little Sturgeon Bay, which is on the west side of Door Peninsula, in Door County, Wisconsin. These wetlands are grouped as a complex because they are all on Little Sturgeon Bay and exhibit similar physiographic characteristics. The locations of the wetlands relative to the shoreline and the nearest city are presented in Table 10-54.

Table 10-54. Location of the Wetlands in the Little Sturgeon Bay Wetland Complex

	Distance to shoreline	Distance to nearest city
Little Sturgeon Bay Wetland #1	100 feet	1.1 miles east of Little Sturgeon
Little Sturgeon Bay Wetland #2	250 feet	1.0 mile south of Little Sturgeon
Keyes Creek Wetland	adjacent	0.6 mile south of Little Sturgeon
Henderson Point Wetland	adjacent	0.3 mile north of Little Sturgeon

Little Sturgeon Bay Wetland #1 appears to have been contiguous with Little Sturgeon Bay at one time, but it is now separated from the lakeshore by an access road.

All of the wetlands in the Little Sturgeon Bay Wetland Complex are low, Lacustrine wetlands. Little Sturgeon Bay Wetland #1 and Keyes Creek Wetland are partially wooded; Little Sturgeon Bay Wetland #2 and Henderson Point Wetland are non-wooded. The western portion of Little Sturgeon Bay Wetland #1 has been drained (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

Topography

Elevations in the wetland complex range from 580 to 590 feet above sea level, 0 to 10 feet above the approximate mean elevation of Lake Michigan. Sturgeon Bay Wetland #2 has a maximum elevation of approximately 587 feet above sea level; the remainder of the wetlands in the complex have maximum elevations

of 590 feet. The shoreline of Little Sturgeon Bay is an erodible low plain (Great Lakes Basin Commission, 1975). Little Sturgeon Bay lies in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland. Inland topography is low and rolling (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Surficial Geology

The surficial geology of the four wetlands in the Little Sturgeon Bay Wetland Complex is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

There are three types of soil present in the Little Sturgeon Bay Wetland Complex. Table 10-55 identifies the soil type in each of the wetlands.

Table 10-55. Soil Types for Little Sturgeon Bay Wetland Complex[a]

Wetland	Soil
Little Sturgeon Bay Wetland #1	Peat
Little Sturgeon Bay Wetland #2	Peat
Keyes Creek Wetland	Poygan loam and Peat
Henderson Point Wetland	Muck

[a] Whitson et al. (1919)

Hydrology

There are no streams flowing through Little Sturgeon Bay Wetlands #1 and #2 and Henderson Point Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

An unnamed, intermittent stream flows eastward through the northern part of Keyes Creek Wetland and Keyes Creek flows through the western edge of this wetland. Keyes Creek is a small stream which originates in several spring-fed tributaries and flows northward to Little Sturgeon Bay (Poff and Threinen, 1965). Hydrologic data for Keyes Creek, presented in Table 10-56 may reflect conditions in Keyes Creek Wetland.

Table 10-56. Hydrologic Data for Keyes Creek[a]

Drainage area (sq.mi.)	Gradient	pH	Alkalinity (mg/l)
13.0	8.0	8.1	300

[a] Poff and Threinen (1965)

Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973). However, the literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, depth, or seasonal changes in these wetlands, or to water quality in Little Sturgeon Bay Wetlands #1 and #2 and Henderson Point Wetland.

Climate

The closest weather station providing climatic data for the Little Sturgeon Bay Wetland Complex is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Little Sturgeon Bay Wetland Complex (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 251-254

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of the Little Sturgeon Bay Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Little Sturgeon Bay Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Little Sturgeon Bay Wetland Complex.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the Little Sturgeon Bay Wetland Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated the western half of Little Sturgeon Bay Wetland #1, as well as all of Little Sturgeon Bay Wetland #2, Keyes Creek Wetland, and Henderson Point Wetland, as Class II wildlife habitat. The western half of Little Sturgeon Bay Wetland #1 is "most desirable" for waterfowl and has "supplemental" value for pheasant (Phasianus colchicus). Little Sturgeon Bay Wetland #2 is "desirable" for waterfowl, songbirds, gulls and terns, and shore birds. Keyes Creek Wetland is "most desirable" for waterfowl and "desirable" for songbirds and waterfowl. The eastern half of Little Sturgeon Bay Wetland was designated as Class I wildlife habitat, "most desirable" for ruffed grouse (Bonasa umbellus) and songbirds (Thompson et al., 1976).

Gardner Swamp, a 2,000-acre wetland complex, is an important wildlife habitat resource that lies one mile to the south of Little Sturgeon Bay. The swamp has been classified as a Natural Area II by the Wisconsin Scientific Areas Preservation Council (1976). This designation means that the area has significant value as an "ecological zone" and for educational purposes. Many species of waterfowl, including pintails, (Anas acutei), mallards (A. platyrhynchos), and black ducks (A. rubripes), use this swamp (Wisconsin Scientific Areas Preservation Council files). Keyes Creek, which drains Gardner Swamp, runs through Keyes Creek Wetland before emptying into Little Sturgeon Bay.

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance

of these data to the Little Sturgeon Bay Wetland Complex. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing these wetlands.

Mammals

Little Sturgeon Bay Wetland #1 and #2 and Henderson Point Wetland have been classified as "desirable" habitat for muskrat (Ondatra zibethicus). A portion of Little Sturgeon Bay Wetland #1 also has been classified as "supplemental" habitat for squirrels and white-tailed deer (Odocoileus virginianus). Keyes Creek Wetland has been classified as "most desirable" habitat for muskrat (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the four wetlands comprising the Little Sturgeon Bay Wetland Complex.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in the Little Sturgeon Bay Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I and Class II wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of these wetlands and this may have some effect on its health.

CULTURAL SETTING LM 251-254

Population

The Little Sturgeon Bay Wetland Complex is located in Gardner Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-57 indicates that both the county and the township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-57. Population Data for the Vicinity of the Little Sturgeon Bay Wetland Complex

	Estimated Population 1975[a]	Estimated % Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Gardner Township	948	8.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

The four wetlands comprising the Little Sturgeon Bay Wetland Complex are privately owned. Little Sturgeon Bay Wetland #2 is in mixed urban and rural open space uses; the remaining three are all rural open space. The surrounding area is primarily in agricultural and rural open space uses, with some residential development including the town of Little Sturgeon Bay. An access road lies between Little Sturgeon Bay Wetland #1 and the lakeshore. A secondary highway cuts through Keyes Creek Wetland, and a gravel pit lies to the north of this wetland. Fill has been added for piers at Henderson Point, and the wetland located here may be partially dredged. A gravel pit lies adjacent to this wetland. A small boat canal has been excavated adjacent to Little Sturgeon Bay Wetland #2 (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Schinkten, 1975).

The location of Little Sturgeon Bay Wetland #2 near residential areas suggests that the wetland may be subject to high development pressure. The remaining wetlands appear to be under moderate development pressure since they are situated in primarily agricultural areas.

Recreation

There are no known state or federal recreational facilities in the vicinity of the Little Sturgeon Bay Wetland Complex.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in the Little Sturgeon Bay Wetland Complex have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The wetland complex is underlain by Niagara limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or quarrying operations in close proximity to the wetland (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in the wetlands. There are no known oil, gas, or coal resources present in the wetlands.

Little Sturgeon Bay Wetland #1 and Keyes Creek Wetland are partially wooded. It was not determined through the literature search whether these areas are used for wood production. No forest resources are present in Little Sturgeon Bay Wetland #2 and Henderson Point Wetland.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Little Sturgeon Bay Wetlands #1 and #2, Keyes Creek Wetland, or Henderson Point Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Little Sturgeon Bay Wetlands #1 and #2, Keyes Creek Wetland, or Henderson Point Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of the Little Sturgeon Bay Wetland Complex (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #132, #133) are present in the vicinity of the Little Sturgeon Bay Wetland Complex. Information regarding the specific site locations as well as field findings and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS LM 251-254

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

GARDNER TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING LM 255

Setting

Gardner Township Wetland is located near Little Sturgeon Bay on the western side of Door Peninsula in Door County, Wisconsin, 0.5 mile northwest of the community of Little Sturgeon. The wetland lies 0.3 mile from the Green Bay shoreline between a small hill and the shoreline, which features a low bluff. This Palustrine wetland is wooded and raised above the level of Lake Michigan (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

Topography

Gardner Township Wetland has slight relief; elevations of the wetland range from 600 to 603 feet above sea level, 20 to 23 feet above the approximate mean elevation of Lake Michigan. The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland. The shoreline in the vicinity of the wetland is non-erodible low bluff, less than 30 feet high (Great Lakes Basin Commission, 1975).

Surficial Geology

The surficial geology of Gardner Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Gardner Township Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Whitson et al., 1919).

Hydrology

There are no streams flowing through Gardner Township Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961). Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Gardner Township Wetland.

Climate

The closest weather station providing climatic data for Gardner Township Wetland is located in Sturgeon Bay, Wisconsin. In 1975, the average monthly temperature was 45.3°F, the average daily low for January was 14.9°F and the average daily high in July was 81.5°F. The average annual precipitation is 28.89 inches, with a mean monthly precipitation of 1.54 inches in January and 3.32 inches in July based on the normal period from 1941-1970. The growing season is approximately six and a half months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on November 14 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Gardner Township Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 255

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Gardner Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Gardner Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Gardner Township Wetland.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Gardner Township Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Gardner Township Wetland as Class I wildlife habitat (Thompson et al., 1976).

Appendix D-22 contains general information on wetland birds of Lake Section 10, but care should be exercised in the interpretation of the relevance of these data to Gardner Township Wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing this wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Gardner Township Wetland.

Endangered Species

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Gardner Township Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat. Numerous dairy and orchard operators dispose of process wastewater in the vicinity of the wetland and this may have some effect on its health.

CULTURAL SETTING LM 255

Population

Gardner Township Wetland is located in Gardner Township of Door County, Wisconsin. The county is sparsely populated and has a density of 41 persons per square mile. Table 10-58 indicates that both the county and the township experienced rapid population growth between 1970 and 1975, but population projections for 1990 indicate that Door County may undergo a slow population decline in the future.

Table 10-58. Population Data for the Vicinity of Gardner Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Door County	22,469	11.8	20,940
Gardner Township	948	8.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Gardner Township Wetland is rural wooded space. The surrounding area is agricultural, with some small areas of residential development along the Lake Michigan shoreline. A secondary highway lies to the north of Gardner Township Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Schinkten, 1975), and the agricultural nature of this area suggests that the wetland may be under moderate developmental pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Gardner Township Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Gardner Township Wetland have little potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976). The wetland is underlain by Richmond or "Cincinnati" shale (Hotchkiss and Steidtmann, 1915; Buckley, 1901), but there are no active clay, sand and gravel, or shale operations in close proximity to the wetland (Ostrom, 1970).

Commercially valuable deposits of manganese nodules exist within the Green Bay region, but are not currently exploited (Bertrand et al., 1976). It is not known whether these nodules are present in Gardner Township Wetland. There are no known oil, gas, or coal resources present in the wetland.

The wetland is entirely wooded and is part of a larger wooded area that extends north to Green Bay, east to the community of Little Sturgeon, and approximately one mile south of the wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Gardner Township Wetland (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1961).

Pollution Sources

There are no NPDES permit holders adjacent to Gardner Township Wetland. However, numerous dairy and orchard operators in the county dispose of process wastewaters by spreading them on the ground. The shallow soils of Door County, which overlie creviced limestone bedrock, make groundwater contamination from both point and non-point sources a problem throughout the county (Wisconsin Division of Environmental Protection, 1971).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Gardner Township Wetland (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #132, #133) exist in the vicinity of Gardner Township Wetland. Information regarding the specific site locations, field findings, and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1977).

RESEARCH PROJECTS

LM 255

A modern soil survey is being prepared for Door County by the Soil Conservation Service. The fieldwork for the soil survey has been completed, but the published report is not yet available (J.C. Hytry, Wisconsin State Conservationist, personal communication).

Table 10-59. Data Gaps - Lake Section 10

Data Gap*	Wetland Number	193-195	196	197-198	199	200-201	202	203	204-205	206	207-208	209	210	211	212-213	214	215	216-225	226	227	228-229	230-231
Physiographic Setting	Setting																					
	Topography																					
	Surficial Geology																					
	Soils																					
	Hydrology	*	*	*	*	*		*	*				*	*	*	*	*	*	*	*	*	*
	Groundwater	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
	Water Quality	*			*	*		*	*		*	*	*	*	*	*	*	*	*	*	*	*
	Depth	*	*	*	*	*		*	*		*	*	*	*	*	*	*	*	*	*	*	*
	Seasonal Changes	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Climate																					
	Special Features																					
Biotic Setting	Vegetation	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Major Species Composition	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Fish	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Spawning and Hatching Areas	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Commercial/Recreational Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Invertebrates	*	*	*	*	*		*	*		*	*	*	*	*	*	*	*	*	*	*	*
	Seasonal Distribution	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
	Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Amphibians/Reptiles	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*		*	*	*	*
	Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*
	Avifauna	*	*	*	*	*			*				*	*	*	*			*	*	*	*
	Seasonal Distribution	*	*	*	*	*		*	*			*	*	*	*	*	*	*	*	*	*	*
	Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Recreational/Commercial Use	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Mammals								*						*	*		*	*			
	Seasonal Distribution	*	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*	*	*
	Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Endangered Species																					
	Health	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*		*	*	*	*
Cultural Setting	Population																					
	Land Use and Ownership																					
	Recreation																					
	Mineral, Energy, Forest Resource																					
	Public Utilities/Facilities																					
	Point Pollution Sources																					
	Non-Point Pollution Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Historic Features																					
	Archaeologic Features					*			*				*	*			*		*	*		*

-continued-

Table 10-59. (concluded)

Data Gap*		Wetland Number	232	233	234	235	236	237-239	240	241-244	245	246-248	249	250	251-254	255
Physiographic Setting		Setting														
		Topography														
		Surficial Geology														
		Soils														
	Hydrology	Water Level Fluctuations	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Groundwater	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Water Quality	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Depth	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Changes	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Climate														
		Special Features														
Biotic Setting	Vegetation	Major Species Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Major Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Fish	Major species	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Spawning and Hatching Areas	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Commercial/Recreational Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Invertebrates	Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Amphibians/Reptiles	Major Species	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Avifauna	Major Species	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Mammals	Major Species			*							*		*		*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Endangered Species														
		Health	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cultural Setting		Population														
		Land Use and Ownership														
		Recreation														
		Mineral, Energy, Forest Resource														
		Public Utilities/Facilities														
		Point Pollution Sources														
		Non-Point Pollution Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Historic Features														
		Archaeologic Features	*	*	*		*		*	*	*	*	*			

LAKE SECTION 11

INTRODUCTION

Lake Section 11 extends along the Green Bay shoreline from the Brown County-Kewaunee County border on the western side of Door Peninsula to the Wisconsin-Michigan border along the Menominee River. The topography in the region is generally flat along the shoreline; further inland, it is rolling at higher elevations. The predominant shore type along this 75-mile stretch of shoreline is erodible low plain (Great Lakes Basin Commission, 1975).

Figures 11-1 and 11-2 show the approximate location of the 31 coastal wetlands in Lake Section 11. Latitude, longitude, acreage, and classification for each of these wetlands are presented in Table 11-1. With the exception of Oconto Marsh, all of the wetlands in Lake Section 11 have elevations ranging from 580 feet to 590 feet above sea level (lake level to ten feet above the approximate mean elevation of Lake Michigan). Thus, many of the wetlands are heavily influenced by water level fluctuations in Lake Michigan. The majority of the wetlands are Lacustrine Systems; however, Palustrine wetlands are also common.

Dredge and fill activity is prevalent along the shoreline, particularly near the city of Green Bay. Many of the wetlands in Lake Section 11 have been altered as a result of these activities, including Point au Sable Wetland, Whitney Slough, Fox River Wetland, Atkinson Marsh, Little Tail Point Wetland #1, Pensaukee River Wetland, and Peshtigo River Wetland. Portions of Oconto Marsh have been diked.

Information related to the physiographic and cultural features of the 31 coastal wetlands is summarized in the individual wetland narratives presented in this chapter. Published sources lack site-specific information related to the biotic characteristics of many of these wetlands. Overall, however, the wetlands in Lake Section 11 represent one of the most extensively studied areas along the Lake Michigan shoreline. In particular, Atkinson Marsh, Dead Horse Bay Wetland Complex, Long Tail Point Wetland Complex, Little Tail Point Wetland Complex, Oconto marsh, Peshtigo River Wetland, and Seagull Bar Wetland have been extensively studied by the Wisconsin Department of Natural Resources and others.

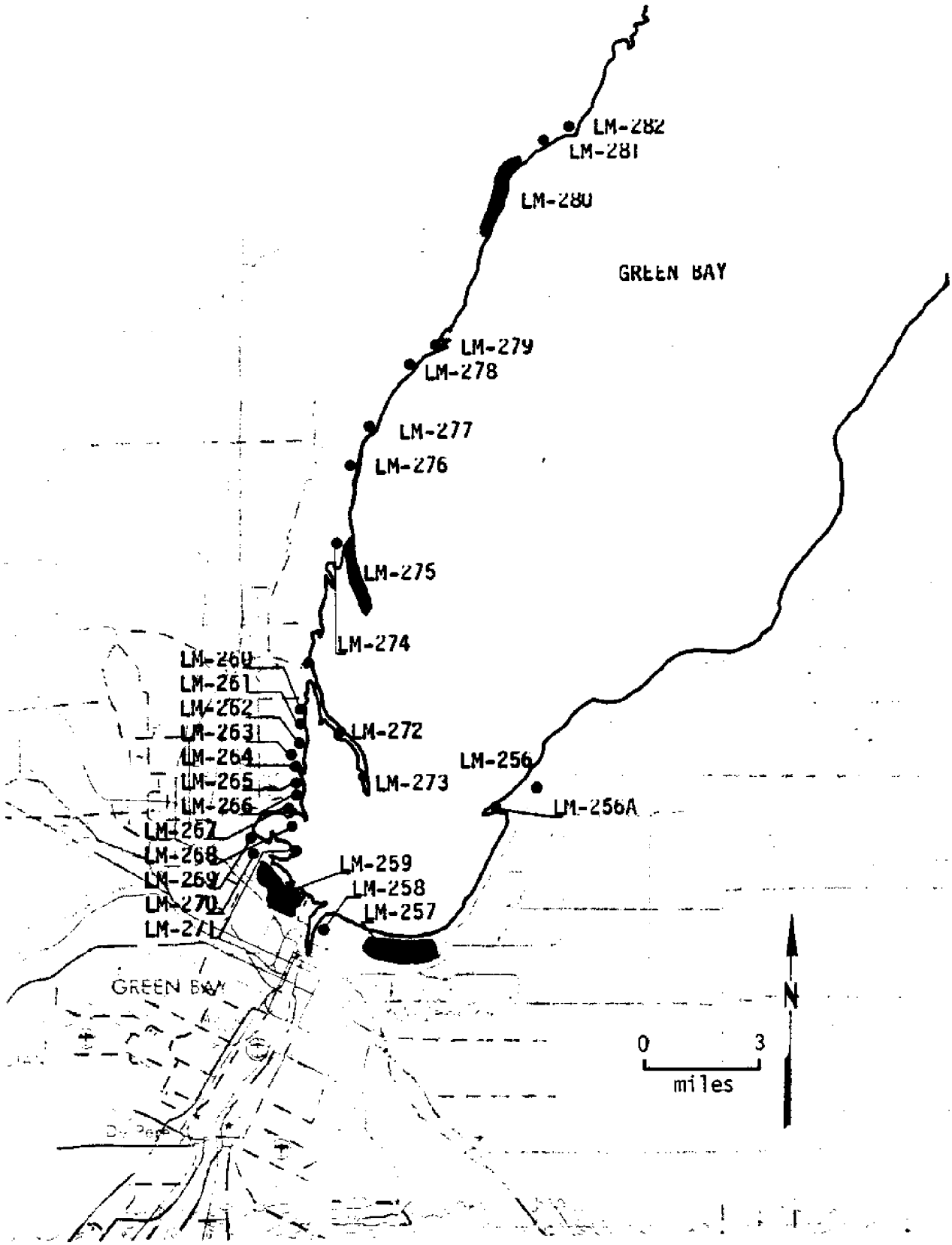

Figure 11-1. Lake Section 11 - South Green Bay Area

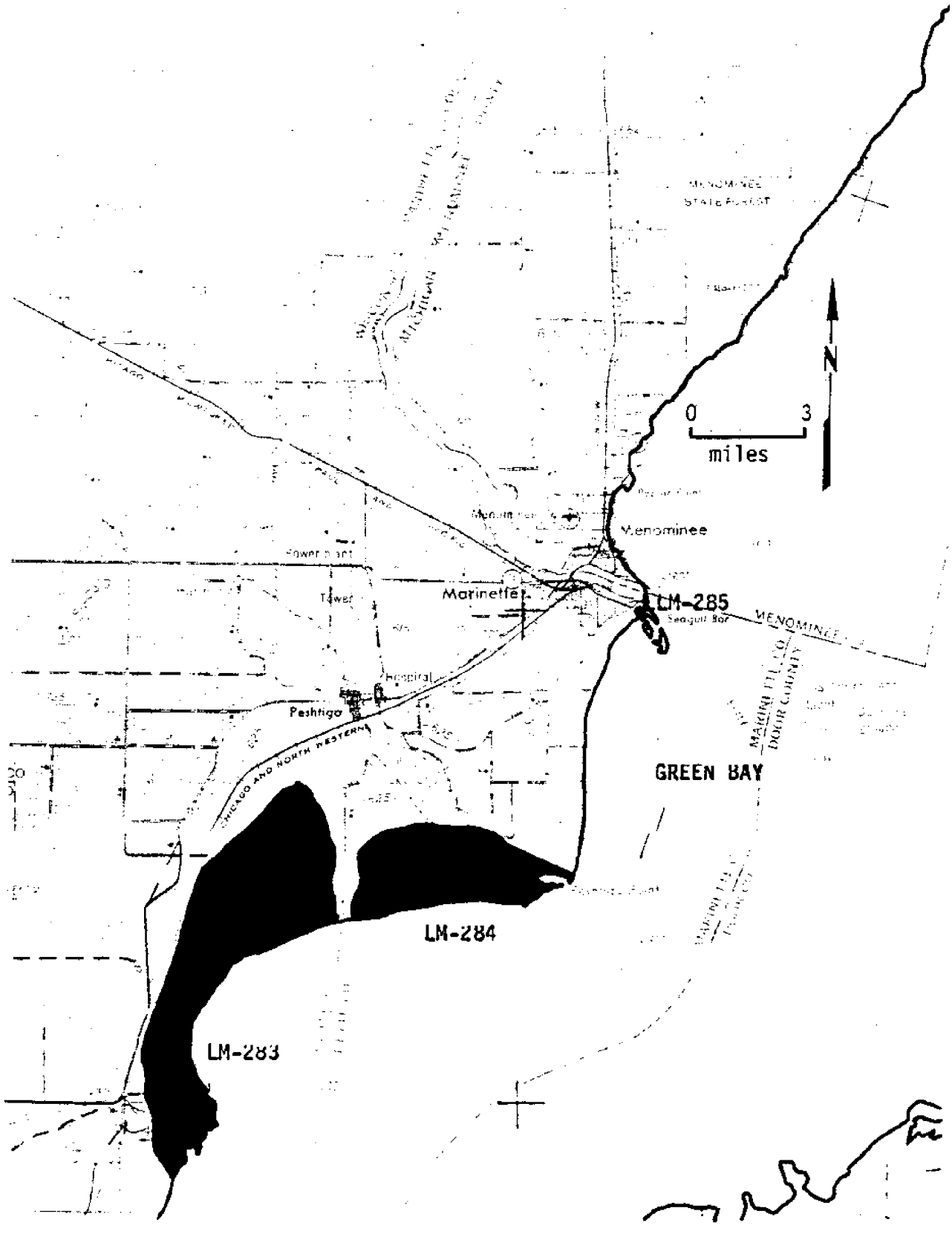

Figure 11-2. Lake Section 11 - North Green Bay Area

Table 11-1. Location, Acreage, and Classification of Wetlands in Lake Section 11

Wetland Number	Wetland	Latitude	Longitude	Acreage	Classification[a]
256	Scott Township Wetland	44°35'20"	87°53'25"	4	P
256 A	Point au Sable Wetland	44°34'40"	87°53'50"	112	L,P
257	Whitney Slough	44°31'25"	87°57'00"	457	P
258	Fox River Wetland	44°32'10	87°29'55"	30	P
	ATKINSON MARSH COMPLEX				
259	Atkinson Marsh	44°33'30"	88°02'10"	480	L,P,R
260	Peats Lake Wetland #1	44°33'30"	87°02'05"	17	L
261	Peats Lake Wetland #2	44°34'30"	87°02'10"	12	L
	DEAD HORSE BAY WETLAND COMPLEX				
262	Dead Horse Bay Wetland #1	44°33'10"	88°00'50"	20	L
263	Dead Horse Bay Wetland #2	44°33'30"	88°00'25"	20	L
264	Peter's Marsh	44°36'00"	88°01'00"	210	L
265	Dead Horse Bay Wetland #3	44°36'00"	88°01'50"	29	P
266	Dead Horse Bay Wetland #4	44°36'15"	88°00'50"	32	P
267	Dead Horse Bay Wetland #5	44°36'30"	88°00'52"	5	P
268	Dead Horse Bay Wetland #6	44°36'36"	88°01'05"	5	P
269	Dead Horse Bay Wetland #7	44°36'49"	88°01'00"	1	P
	LONG TAIL POINT WETLAND COMPLEX				
270	Dead Horse Bay Wetland #8	44°37'20"	88°00'40"	5	L
271	Dead Horse Bay Wetland #9	44°37'40"	88°00'05"	12	P
272	Long Tail Point Wetland #1	44°36'40"	88°00'05"	116	L
273	Long Tail Point Wetland #2	44°35'40"	87°31'05"	30	L
	LITTLE TAIL POINT WETLAND COMPLEX				
274	Little Tail Point Wetland #1	44°40'30"	88°59'50"	160	P
275	Little Tail Point Wetland #2	44°40'00"	88°59'10"	50	L
276	Little Suamico Township Wetland	44°42'40"	88°59'10"	1	P
277	Mud Creek Wetland	44°40'40"	88°59'10"	30	P
	CHARLES POND AREA WETLAND COMPLEX				
278	Kirchner Creek Area Wetland	44°44'50"	87°57'40"	10	P
279	Charles Pond Wetland	44°45'30"	87°56'10"	160	L
	PENSAUKEE RIVER WETLAND COMPLEX				
280	Pensaukee River Wetland	44°49'00"	87°54'30"	340	L
281	Pensaukee River Area Wetland #1	44°50'10"	87°53'00"	30	L
282	Pensaukee River Area Wetland #2	44°50'30"	87°52'20"	120	L
283	Oconto Marsh	44°54'30"	87°51'00"	9370	L,P,R
284	Peshtigo River Wetland	44°59'30"	87°41'00"	5040	L,P,R
285	Seagull Bar Wetland	45°05'40"	87°35'30"	8	P

[a] P=palustrine
L=lacustrine
R=riverine

SCOTT TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING

LM 256

Setting

Scott Township Wetland is located 250 feet from the western shoreline of Door Peninsula in Brown County, Wisconsin, midway between Vincent Point and Point au Sable, 2.1 miles southwest of the community of Red Banks, Wisconsin. This Palustrine wetland lies in a slight depression on a 2-6% slope extending downward to the bay shore. An area of open water lies to the south of the wetland. Scott Township Wetland occupies a raised, non-wooded site (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Topography

Scott Township Wetland has only slight relief; its elevation is 590 feet above sea level, 10 feet above the approximate mean elevation of Lake Michigan. The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland, where the topography is rolling to flat. A long escarpment is roughly 50 feet high, and the ground slopes gently from the base of the cliff to the shoreline. This slope is dissected by several intermittent streams in the vicinity of the wetland. The shoreline in the area has been described by the Great Lakes Basin Commission (1975) as an erodible low plain.

Surficial Geology

The surficial geology of Scott Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The western portion of Scott Township Wetland is Made Land; the eastern portion is Marsh (Link et al., 1974). Made land consists of areas that have been filled by man with various types of material, then leveled. Marsh soil consists of mineral and organic matter that is dark in color. It is found in depressions where drainage water accumulates and, in most areas, remains throughout the year.

Hydrology

There are no streams flowing through Scott Township Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971). However, an unnamed area of open water lies adjacent to the wetland. Generalized groundwater information for the Wisconsin portion of the Lake Michigan shore is available in Skinner and Borman (1973). Groundwater quality information, including total solids, inorganic constituents, and nutrients, is available for select deep well sites in Door County (Holt and Skinner, 1973).

The literature search provided no site-specific data pertaining to water level influences, groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Scott Township Wetland.

Climate

The closest weather station providing climatic data for Scott Township Wetland is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2°F, the average daily low for January was 12.2°F and the average daily high in July was 82.4°F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Scott Township Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 256

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Scott Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Scott Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Scott Township Wetland.

Reptiles and Amphibians

Judging from the presence of small, quiet, open-water areas in this wetland (Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), one can predict that the snapping turtle (Chelydra serpentina) and painted turtle (Chrysemya picta) occur in Scott Township Wetland. However, the literature search yielded no site-specific information

pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Scott Township Wetland as Class III wildlife habitat, having "supplemental value" for songbirds and pheasant (Phasianus colchicus) (Thompson et al., 1976).

Point au Sable, located immediately southwest of Scott Township Wetland, is known for its avian diversity. The area is heavily used by nesting and migratory waterfowl and is also important to shore birds and passerine birds in the spring. Green herons (Butorides striatus), black terns (Chlidonias nigra), and Forster's terns (Sterna forsteri) nest here (Scharf et al., 1977). During late summer and early autumn, this point serves as one of the largest red-winged blackbird roosts in the Green Bay vicinity (Tessen, 1976). Additional information on this area may be obtained from the Green Bay Bird Club.

Appendices D-23, D-24, D-25, D-26, D-27, and D-28 contain information on wetland birds. General studies on Lake Section 11 related to Scott Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Scott Township Wetland.

Mammals

The literature search provided no site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Scott Township Wetland.

Endangered Species

The piping plover (Charadrius melodus), a species threatened in Wisconsin, has been reported on Point au Sable, which lies directly southwest of Scott Township Wetland. Double-crested cormorants (Phalacrocorax auritus), endangered in Wisconsin, nest on islands in Green Bay. However, no plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Scott Township Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated it as Class III wildlife habitat. A dumping ground is located offshore of the wetland and may have some effect on its health.

CULTURAL SETTING

LM 256

Population

Scott Township Wetland is located in Scott Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Table 11-2 indicates that Brown County experienced a rapid rate of population growth between 1970 and 1975, but Scott Township underwent a rapid rate of population decline in the same time period. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-2. Population Data for the Vicinity of Scott Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Scott Township	1,808	-8.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Scott Township Wetland is rural open space. The primary land use in the surrounding area is agricultural, with a small area of residential development west of the wetland. A secondary highway is located between Scott Township Wetland and the Green Bay shoreline. Access roads and residential development lie to the west of the wetland. A dumping ground is located offshore from the wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1978).

Scott Township Wetland is situated within an area planned for agricultural and non-urban residential use. The major portion of the Point au Sable Peninsula, immediately west of the wetland, is designated as a conservation objective (Brown County Regional Planning Commission 1967). However, the location of the wetland in an area planned for agricultural and non-urban

residential uses suggests that developmental pressures on the wetland will be moderate if these plans are realized.

Recreation

There are no known state or federal recreational facilities in the vicinity of Scott Township Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Scott Township Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976). The wetland is underlain by Richmond or "Cincinnati" shale (Hotchkiss and Steidtmann, 1914; Buckley, 1901), but there are no active clay, sand and gravel, or shale operations in close proximity to the wetland (Ostrom, 1970).

There are no significant forest resources present in Scott Township Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971), nor are there any known oil, gas or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Scott Township Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Pollution Sources

There are no NPDES permit holders adjacent to Scott Township Wetland (Wisconsin Industrial Discharge Section, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Scott Township Wetland (Wisconsin Historic Preservation Division, 1978), but the Wisconsin Inventory of Archaeology indicates that two archaeological sites (DR #28, #156) are present in the vicinity. Information regarding the specific site locations, field findings, and interpretations can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 256

The literature search identified no on-going or impending research projects pertaining to Scott Township Wetland.

PHYSIOGRAPHIC SETTING LM 256A

Setting

Point au Sable Wetland is located adjacent to the western shoreline of Door Peninsula in Brown County, Wisconsin. The wetland occupies the hook-shaped peninsula which lies 5.5 miles northeast of the city of Green Bay. Scharf et al. (1977) report that Point au Sable has been considerably altered by fluctuations in the Green Bay water level. The wetland is a Lacustrine System and occupies a low, partially wooded site (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Topography

The total relief of Point au Sable Wetland is 10 feet; wetland elevations range from 580 to 590 feet above sea level, 0 to 10 feet above the approximate mean elevation of Lake Michigan. The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland, where the topography is rolling to flat. A long escarpment lies one mile inland from the wetland. The face of this escarpment is roughly 50 feet high, and the ground slopes gently from the base of the cliff to the shoreline. This slope is dissected by several intermittent streams in the vicinity of the wetland. The shoreline in this area has been described by the Great Lakes Basin Commission (1975) as an erodible low plain featuring a sand and gravel beach.

Surficial Geology

The surficial geology of Point au Sable Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Sand spits are discontinuous on the bed of Green Bay north of Whitney Slough, but are essentially continuous from Long Trail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

Markey muck is the dominant soil type in Point au Sable Wetland, with areas of Marsh located in the eastern portion and Roscommon loamy fine sand adjacent to the open water areas of the wetland. Markey muck consists of moderately deep, very poorly drained organic soils, which formed in organic material derived from decayed wetland sedges, grasses, and reeds. Markey muck is found in shallow glacial lake basins and depressions in stream valleys. Roscommon loamy fine sand is a deep, poorly drained soil comprised of black muck on the surface and black loamy fine sand underneath. This soil type has low natural fertility and a high amount of organic material, and is found in depressions on sandy lacustrine and outwash plains. Marsh soil consists of mineral and organic matter that is dark in color; it is found in depressions where drainage water accumulates and usually remains throughout the year (Link et al., 1974).

Hydrology

An unnamed stream, originating in the steep slopes to the east of Point au Sable Wetland, flows through the wetland. There are many areas of open water located in this wetland. Point au Sable Wetland is adjacent to Green Bay (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971); recent high water levels in Green Bay have altered the wetland to the extent that the area surrounding the open water is devoid of vegetation (Scharf et al., 1977). These water level fluctuations have become an integral part of the wetland ecology in Green Bay. There is little seiche movement above Whitney Slough in the Bay Beach area, because of the presence of shoals between Point au Sable and Grass Island.

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). The extent and effect of these pollutants on Point au Sable Wetland is not known. Water quality data for Green Bay, sampled off Point au Sable, are presented in Table 11-3. Additional water quality information on Green Bay is available in Patterson et al. (1975).

Table 11-3. Water Quality Data for Green Bay Sampled Off Point au Sable[a]

Date	Temperature (^{o}C)	Dissolved Oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/22/74	15.0	11.4	0.125	0.200
9/ 4/74	18.0	9.6	0.125	0.300

[a] Patterson et al. (1975)

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Point au Sable Wetland.

Climate

The closest weather station providing climatic data for Point au Sable Wetland is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2^{o}F, the average daily low for January was 12.2^{o}F and the average daily high in July was 82.4^{o}F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Point au Sable Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

BIOTIC SETTING

LM 256A

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Point au Sable Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Point au Sable Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Point au Sable Wetland.

Reptiles and Amphibians

Judging from the presence in this wetland of small, quiet, open-water areas, as well as extensive wet meadow and woodland areas (Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), one can predict that the gray tree frog (Hyla versicolor), northern leopard frog (Rana pipiens), common snapping turtle (Chelydra serpentina), and painted turtle (Chrysemys picta) occur in Point au Sable Wetland. However, the literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Scharf et al. (1977) report that recent high water destroyed most of the cattail (Typha sp.) areas on Point au Sable. In the 1960's, these areas supported about 25 pairs of black terns (Chlidonias nigra) and six or seven pairs of Forster's terns (Sterna forsteri); the latter species is currently being considered for endangered status in Wisconsin (Hine, Wisconsin Department of Natural Resources, Endangered Species Committee, personal communication).

Scharf et al. (1977) and Tessen (1976) indicate that Point au Sable Wetland and its surroundings support a diversity of birdlife. Waterfowl still heavily use this wetland area for nesting and migration, but published quantitative data are lacking. Scharf et al. observed an estimated six to nine pairs of black terns nesting in cattails and three pairs of green herons (Butorides striatus) nesting in flooded willows (Salix sp.). A large redwinged blackbird (Agelaius phoeniceus) night roost is present along the edge of this wetland through the late summer and autumn.

Numerous shore birds have been observed in Point au Sable Wetland, including the piping plover (Charadrius melodus), a threatened species in Wisconsin (Hine et al., 1975), dowitchers (Limnodromus griseus; L. scolopaceus), and the stilt sandpiper (Micropalama himantopus). The Caspian tern (Sterna caspia) is regularly observed during migration, and occasionally terns that breed in Door County appear this far south during the summer. Whistling swans (Olor columbianus) are sometimes observed here, but never in such great numbers as along the western shore of Green Bay.

A variety of songbirds utilize the wooded areas in or adjacent to Point au Sable Wetland during migration and in the summer. Noteworthy unusual species sighted here include the yellow-breasted chat (Icteria virens), black-billed magpie (P. pica) and sharp-tailed sparrow (Ammospiza caudacuta). Additional information regarding the bird community of Point au Sable Wetland can be obtained from the Green Bay Bird Club.

Appendices D-23 to D-28 contain general information on wetland birds. General studies on Lake Section 11 related to Point au Sable Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Point au Sable Wetland.

Mammals

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Point au Sable Wetland.

Endangered Species

The piping plover (Charadrius melodus) threatened in Wisconsin, has been observed in Point au Sable Wetland (Tessen, 1976) but no longer breeds anywhere on Lake Michigan.

Double-crested cormorants (Phalacrocorax auritus), a species endangered in Wisconsin, nest on islands in Green Bay; however, their use of Point au Sable Wetland has not been documented. The peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list, and the osprey (Pandion haliaetus), endangered in Wisconsin, are occassionally observed in southern Green Bay, especially during migration. The bald eagle and osprey

historically nested along the Green Bay shoreline (Dundas, 1968). No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Point au Sable Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, dumping grounds are offshore of the wetland and may have some effect on its health.

CULTURAL SETTING

LM 256A

Population

Point au Sable Wetland is located in Scott Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Table 11-4 indicates that Brown County experienced a rapid rate of population growth between 1970 and 1975, but Scott Township underwent a rapid rate of population decline in the same time period. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-4. Population Data for the Vicinity of Point au Sable Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Scott Township	1,808	-8.2	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Point au Sable Wetland and the surrounding area is rural open space. An access road crosses through Point au Sable Wetland, and a secondary highway lies landward. Dumping grounds are offshore. A series of parallel ditches, which are periodically flooded, have been dug into the wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). The wetland is under private ownership (Artcraft Company, 1978), but is within an area planned as a conservation objective (Brown County Regional Planning Commission 1967). If these plans are realized, development pressures on the wetland should be low.

Recreation

There are no known state or federal recreational facilities in the vicinity of Point au Sable Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Point au Sable Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976). The wetland is underlain by Richmond or "Cincinnati" shale (Hotchkiss and Steidtmann, 1914; Buckley, 1901), but there are no active clay, sand and gravel, or shale operations in close proximity to the wetland (Ostrom, 1970).

There are no significant forest resources present in the wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971), nor are there any known oil, gas or coal resources.

Public Utilities and Facilities

No public utilities are situated within 0.5 mile of Point au Sable Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Pollution Sources

There are no NPDES permit holders adjacent to Point au Sable Wetland (Wisconsin Industrial Discharge Section, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Point au Sable Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 256A

The literature search identified no on-going or impending research projects pertaining to Point au Sable Wetland.

WHITNEY SLOUGH

PHYSIOGRAPHIC SETTING

LM 257

Setting

Whitney Slough is located 250 feet from the southern shoreline of Green Bay in Brown County, Wisconsin, east of the mouth of the Fox River and adjacent to the city of Green Bay. The wetland is bounded on the south and east by relatively steep slopes. It is likely that the wetland was at one time contiguous with the waters of Green Bay, but a highway and residential development now separate the wetland from the bay. Whitney Slough has been substantially modified by urban development, and road construction is currently taking place within it. Portions have been used as municipal and industrial landfill sites, and several dikes are present (Wisconsin Bureau of Water and Shoreland Management, 1973). Whitney Slough is a low, partially wooded, Lacustrine System (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Topography

Whitney Slough has slight relief; elevations of the wetland range from roughly 582 to 590 feet above sea level, 2 to 10 feet above the approximate mean elevation of Lake Michigan. The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland, where the topography is rolling, with wetland areas occupying low sites. The natural topography of Whitney Slough has been modified over time; local topographic divides have been created by drainage ditches, roads, and dikes. Dredging of the Green Bay Wildlife Sanctuary lagoons in the west portion of the wetland has created artificial topographic lows (Wisconsin Bureau of Water and Shoreland Management, 1973).

The shoreline in the vicinity of the wetland is an erodible low plain (Great Lakes Basin Commission, 1975). The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels in Green Bay (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Whitney Slough is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Sand spits are discontinuous on the bed of Green Bay north of Whitney Slough, but are essentially continuous from Long Tail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

Of the five soil types present in Whitney Slough, Keowns silt loam is the dominant series. Scattered areas of Markey muck, Wauseon fine sandy loam, and

Manawa silty clay loam occur mostly in the eastern portion and are adjacent to the open water in the western portion of the wetland (Link et al., 1974). The fifth soil type in the wetland is Dumps.

Keowns silt loam consists of black silt loam which includes a moderate amount of organic matter. This series is deep, poorly drained, and located in level or depressional areas on glacial lake plains. Keowns silt loam was formed in stratified silt and fine sand sediment. Markey muck consists of moderately deep, very poorly drained organic soils which formed in organic material derived from decayed wetland sedges, grasses, and reeds. Markey muck is found in shallow glacial lake basins and depressions in stream valleys. Manawa silty clay loam has a high content of organic matter and high natural fertility. This soil is deep and poorly drained, and is found in drainage ways and shallow depressions on lacustrine and glacial till plains. Manawa silty clay loam was formed from calcareous lacustrine deposits of clayey glacial till (Link et al., 1974).

Wauseon fine sandy loam is a deep, poorly drained soil with medium organic content and low natural fertility. This soil formed in sandy deposits and in the underlying calcareous clayey material, and is found in depressions in glacial till or lacustrine plains. Dumps referes to soils that are man-made and consist of trash, garbage, and industrial wastes. The Dumps areas in or near the city of Green Bay are mostly filled with wood refuse and wastes from the paper industries of the city (Link et al., 1974).

Hydrology

The Green Bay Wildlife Sanctuary lagoons are located in the western part of Whitney Slough. These lagoons are a series of ponds and connecting channels which have been excavated to serve as a wildlife refuge. The water source for the lagoons is surface drainage. The Green Bay Wildlife Sanctuary lagoons have a drainage area of 2.0 square miles and are 15 feet deep. The pH value for these lagoons in 1971 was 8.5 and alkalinity ($CaCO_3$) was 154 milligrams per liter. The lagoons are turbid (Nelson and Fassbender, 1972).

Whitney Slough collects drainage from the area bounded by Eastman Avenue to the south and the beach line along Green Bay to the north. Additional surface drainage enters the wetland from Schmitt Park to the southeast. The surface drainage in Whitney Slough is generally from east to west and into the Fox River. Groundwater levls in the wetland are usually at or near the surface. A pumping station, located at the junction of East Tower Drive and Quincy Street, pumps excess water from the Green Bay shore area into Whitney Slough. This pump-supported drainage system has an effect on the water levels of the wetland (Wisconsin Bureau of Water and Shoreland Management, 1973).

The current high water levels of Green Bay have reduced the general quality of the wetlands in this area. These water level fluctuations have become an integral part of the wetland ecology in Green Bay. There is little seiche movement above Whitney Slough in the Bay Beach area because of shoals between Point au Sable and Grassy Island. Lower Green Bay is heavily polluted, with dissolved oxygen levels and nutrient enrichment considered to be significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls

are found throughout the Green Bay ecosystem; however, the extent and effect of these pollutants on Whitney Slough has not been investigated (Bertrand et al., 1976). Water quality data samples for Green Bay were taken just north of Whitney Slough on September 17, 1973. The temperature was 17.5°C, and the dissolved oxygen level was 5.2 milligrams per liter. Phosphorus and nitrogen were 0.356 and 0.700 milligrams per liter, respectively (Patterson et al., 1975).

Climate

The closest weather station providing climatic data for Whitney Slough is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2°F, the average daily low for January was 12.2°F and the average daily high in July was 82.4°F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Whitney Slough (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 257

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Whitney Slough.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Whitney Slough.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Whitney Slough.

Reptiles and Amphibians

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in Whitney Slough.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated the western part of Whitney Slough as Class I wildlife habitat, "most desirable" for waterfowl and songbirds, "desirable" for gulls and terns, and having "supplemental value" for pheasant (Phasianus colchicus). The eastern part of the wetland is designated as Class II wildlife habitat, "desirable" for songbirds, gulls, and terns, with "supplemental value" for pheasant and woodcock (Philohela minor) (Thompson et al., 1976).

The eastern part of Whitney Slough lies in the Green Bay Wildlife Sanctuary. The southern half of this 200-acre refuge is a restricted area and serves as prime nesting habitat for both ducks and geese (Tessen, 1976). Hundreds of Canada geese (Branta canadensis) and thousands of mallards (Anas platyrhynchos) and black ducks (Anas rubripes) winter in the refuge in a series of lagoons which are mechanically kept open. Noteworthy songbirds that are regularly observed in the sanctuary include the willow flycatcher, (Empidonax traillii), veery (Catharus fuscescens), both marsh wrens (Cistothorus platensis, C. palustris), and the swamp sparrow (Melospiza georgiana). The sanctuary also occasionally records unusual birds, including a scissor-tailed flycatcher (Muscivora forficata) in April of 1974 (Tessen, 1976).

Appendices D-23 to D-28 contain general information on wetland birds. General studies on Lake Section 11 related to Whitney Slough are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Whitney Slough.

Mammals

Mammalian species which have been observed in Whitney Slough are listed in Table 11-5. Whitney Slough has been classified as "desirable" habitat for squirrels and as "supplemental" habitat for muskrat (Ondatra zibethicus) and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

Table 11-5. Mammals of Whitney Slough[a]

Common name	Common name
Virginia opossum	muskrat
least shrew	Norway rat
mole[b]	red fox
little brown bat	gray fox
striped ground squirrel	raccoon
fox squirrel	weasel
eastern cottontail	mink
woodchuck	striped skunk
white-footed mouse	white-tailed deer

[a] Wisconsin Bureau of Water and Shoreland Management, 1973
[b] probably star-nosed mole

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Whitney Slough.

Endangered Species

The peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leucocephalus), both on the federal list, and the osprey (Pandion haliaetus), endangered in Wisconsin, are occasionally observed in southern Green Bay, especially during migration. The bald eagle and osprey historically nested along Green Bay but no longer do (Dundas, 1968). Double-crested cormorants (Phalacrocorax auritus), on the state endangered list, nest on islands in Green Bay (e.g., about two miles northwest of Whitney Slough. However, there is no literature documenting their use of this wetland.

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Whitney Slough by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated it as Class I and II wildlife habitat. Industrial wastes and sewage are discharged near the wetland and may have some effect on its health.

Population

Whitney Slough is located in the city of Green Bay in Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Table 11-5 indicates that Brown County experienced a rapid rate of population growth between 1970 and 1975, while the city of Green Bay had a moderate growth rate. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-5. Population Data for the Vicinity of Whitney Slough

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
City of Green Bay	91,189	3.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Whitney Slough is urban open space. The surrounding area is primarily characterized by residential and commercial development. Roads, dikes, and drainage ditches are found in the wetland, and portions of the wetland area have been used as landfill sites. A dumping ground lies several miles offshore of the wetland within Green Bay (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The northwestern portion of the wetland includes Bay Beach Park and Green Bay Wildlife Sanctuary, an area of approximately 240 acres of which 200 acres comprise the sanctuary. Under the management of the city of Green Bay (Artcraft Company, 1978), the Bay Beach area includes an amusement park (U.S. Army Corps of Engineers, 1976). The wetland lies within the corporate limits of the city (Artcraft Company, 1978). Although detailed ownership records of the area are not available, no major areas of public ownership other than the Bay Beach area are known. It is assumed that the remainder of the wetland is privately owned.

Two highways are proposed to intersect in the approximate center of the wetland. The southeastern portion of the wetland is within an area planned for limited industrial development, while the northeastern portion is within an area planned for multi-family residential use. The western portion of the wetland lies almost entirely within an area planned for park and recreational use (Brown County Regional Planning Commission, 1967). Development pressures

on the eastern portion of the wetland are imminent and severe, while pressures on the western portion appear to be minimal, assuming that the regional plans are realized.

Recreation

The 200-acre Green Bay Wildlife Sanctuary lies within the eastern portion of Whitney Slough. The wildlife sanctuary provides refuge for migratory waterfowl. In addition, the sanctuary receives limited outdoor recreational use. The major recreational facility in the sanctuary is a wildlife zoo. Fishing is allowed, and there is a limited amount of hiking in the sanctuary (Green Bay-Brown County Planning Commission, 1977).

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Whitney Slough have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The eastern portion of the wetland is underlain by Richmond or "Cincinnati" shale and the western portion of the wetland is underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, shale, or limestone operations in close proximity to the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

Whitney Slough is partially wooded (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

Transmission lines run through Whitney Slough as well as along the southwestern corner of the wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Pollution Sources

Parts of Whitney Slough have been used for municipal and industrial landfill areas. The fill consists mainly of bark and chips associated with paper mill pulping operations and municipal solid wastes (Wisconsin Bureau of Water and Shoreland Management, 1973). Information on the extent and effect of both point and non-point sources of pollution on the flora and fauna of Whitney Slough can be found in Bertrand et al. (1976).

Numerous industrial waste sources discharge inadequately treated wastes into the Fox River. Studies have indicated that the pollution load carried by the Fox River may affect Green Bay for a distance of five or more miles north of the river mouth. Municipal sewage treatment plants may be bypassing partially treated or untreated sewage during heavy rains, which can cause discharge directly into surface waters. In addition, agricultural byproducts, such as chlorinated hydrocarbons and manure, enter surface and underground water

supplies through runoff and seepage. Highway drainage and storm sewer runoff also contribute nutrients and road salts to the surface waters (Nelson and Fassbender, 1972).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Whitney Slough, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 257

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

FOX RIVER WETLAND

PHYSIOGRAPHIC SETTING LM 258

Setting

Fox River Wetland is located on the east bank of the Fox River, 0.1 mile from the shoreline of Green Bay. The wetland lies within the city of Green Bay, Wisconsin, in Brown County. The area surrounding the wetland is industrialized and the wetland has been substantially altered by dredge and fill activity. This Lacustrine System is low and non-wooded (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin, 1971).

Topography

Fox River Wetland has very slight relief; elevations in the wetland are at or near the approximate mean level of Lake Michigan (580 feet above sea level). The wetland occupies a low site within the valley of the Fox river. The natural topography of the wetland has been modified over time, particularly by dredge and fill activity; local topographic divides have been created by construction of drainage ditches, roads, and dikes. Three boat slips have been dug into the wetland and the river channel has been dredged.

The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland, where topography at high elevations is generally rolling. The shoreline in the vicinity of the wetland is an erodible low plain (Great Lakes Basin Commission, 1975); the littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water in Green Bay-Lake Michigan (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Fox River Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Sand spits are discontinuous on the bed of Green Bay north of Fox River Wetland, but are essentially continuous from Long Tail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

Markey muck is the dominant soil type in Fox River wetland, but the eastern and northern portions contain Fill land (Link et al., 1974). Markey muck consists of moderately deep, very poorly drained soils which were formed in organic material derived from decayed wetland sedges, grasses, and reeds. It is found in shallow glacial lake basins and depressions in stream valleys. Fill land consists of soils of various textures and includes cinders, broken concrete, and industrial wastes. Dredge spoil from Green Bay may also be included in the Fill land.

Hydrology

Fox River Wetland is adjacent to the Fox River. The quality of this river is so poor that fish running upstream in spring cannot make it back to Green Bay before succumbing to oxygen depletion. The Fox River has numerous industrial dischargers. The river passes through both urban and agricultural land on its way to Green Bay. Water from the Fox River is hard and very turbid, and the bottom sediments consist of mostly sand and silt. The river is a very important determinant of the water quality in Green Bay (Nelson annd Fassbender, 1972).

Strong northerly winds and changes in barometric pressure help to cause the water levels of Green Bay to fluctuate. These water level fluctuations and resulting changes in the Fox River cause nutrient- and silt-laden water to inundate the wetlands in lower Green Bay, including Fox River Wetland. The dissolved oxygen content of the Fox River approaches zero milligrams per liter during the summer months (U.S. Army Corps of Engineers, Chicago District 1976). The pH value in 1971 was 7.3 and alkalinity ($CaCO_3$) was 139.0 milligrams per liter (Nelson and Fassbender, 1972).

The surface drainage of Fox River Wetland is from east to west, into the Fox River. Groundwater levels in the wetland are usually at or near the surface (Wisconsin Bureau of Water and Shoreland Management, 1973). Link et al. (1974) have noted that parts of Fox River Wetland contain dredge spoil, which is likely to be adversely affecting the quality of Fox River Wetland. The pollutants in the dredge spoil are from organic, domestic, and industrial sources. These sediments have been classified by the U.S. Environmental Protection Agency as moderately and heavily polluted and are unsuitable for open lake disposal (U.S. Army Corps of Engineers, Chicago District, 1976).

The littoral zone of Green Bay is in poor condition. The current high water levels have altered the vegetation, reducing the general quality of the wetlands in the area. These water level fluctuations have become an integral part of the wetland ecology in Green Bay. There is little seiche movement above Fox River Wetland because of the presence of Point au Sable and Grassy Island. Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem, but the extent and effect of these pollutants has not been investigated (Bertrand et al., 1976). Additional water quality information for Green Bay and the Fox River is available in Patterson et al. (1975).

The literature search yielded no site-specific information pertaining to depth or seasonal changes in Fox River Wetland.

Climate

The closest weather station providing climatic data for Fox River Wetland is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2°F, the average daily low for January was 12.2°F and the average daily high in July was 82.4°F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing

season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Fox River Wetland (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 258

Vegetation

Howlett (1974) provides a general analysis of the vegetation of West Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search provided no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels for the vegetation of Fox River Wetland.

Fish

The lower Fox River and Green Bay in the vicinity of Fox River Wetland were severely polluted by municipal and industrial wastes as recently as 1977, and the abundance and diversity of the fish fauna is lower than elsewhere in Green Bay. The area was once heavily utilized by lake-run northern pike (Esox lucius), muskellunge (Esox masquinongy), and lake sturgeon (Acipenser fulvescens). Species found in the lower Fox River and adjacent to Green Bay at the present time are listed in Table 11-7. Coldwater and lake-run species have been largely eliminated by deteriorating water quality and blockage or destruction of spawning areas upstream, and a fish fauna characterized by warmwater, silt- and pollution-tolerant species predominates. Winter and summer kills of fish due to anoxia also limit the abundance of many species (Nelson and Fassbender, 1972; U.S. Army Corps of Engineers, 1977). It is doubtful that Fox River Wetland, an urban Palustrine unit, supports an extensive or diverse fish fauna. A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Fox River Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Fox River Wetland.

Table 11-7. Major Fish Species Found in the Lower Fox River, Brown County, Wisconsin[a]

Common name	% Total catch lower Fox River	Fox River Mouth
black bullhead	34.0	5.1
carp	22.0	74.6
white bass	15.0	1.3
white sucker	9.0	0.9
black crappie	4.0	1.8
alewife	3.4	5.0
walleye	3.4	0.3
gizzard shad	2.2	1.4
freshwater drum	2.0	0.1
yellow perch	1.4	7.0
northern pike	1.0	0.6
channel catfish	0.4	<0.1
burbot	0.4	1.5
sauger	0.1	0.0
bluegill	<0.1	0.1
goldenshiner	0.0	0.1
pumpkinseed	<0.1	0.1

[a]U.S. Army Corps of Engineers (1977)

Reptiles and Amphibians

Appendix C-11 contains general information on amphibians and reptiles of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Fox River Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife habitat study of the coastal zone, designated Fox River Wetland as Class III wildlife habitat having "supplemental" value to pheasant (Phasianus colchicus) and waterfowl (Thompson et al., 1976). Fox River Wetland is located 0.5 mile east of Atkinson Marsh, which has been well studied by the Wisconsin Department of Natural Resources and local birdwatchers. It also lies 0.5 mile west of the Green Bay Wildlife Sanctuary situated in Whitney Slough. These areas as well as others in southern Green Bay support a diversity of wetland birds, some of which may be forced into the marginal habitat of Fox River Wetland.

Fox River Wetland is included in the census area of the Green Bay Christmas Bird Count (Appendix D-27), but these results are probably more representative of surrounding wetlands which are larger and less urbanized. In late December, Canada geese (Branta canadensis), mallards (Anas platyrhynchos), and black ducks (A. rubripes) are abundant in the vicinity.

Appendices D-23 to D-28 contain general information on wetland birds. General studies on Lake Section 11 related to Fox River Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Fox River Wetland.

Mammals

A limited number of mammalian species utilize Fox River Wetland (U.S. Army Corps of Engineers, 1977). The eastern cottontail (Sylvilagus floridanus), fox squirrel (Sciurus niger), house mouse (Mus musculus), Norway rat (Rattus norvegicus), weasel (Mustela sp.), striped skunk (Mephitis mephitis), and raccoon (Procyon lotor) may be observed on this wetland.

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Fox River Wetland.

Endangered Species

The bald eagle (Haliaeetus leorcocephalus) and the peregrine falcon (Falco peregrinus), both on the federal list, and the osprey (Pandion haliaetus), endangered in Wisconsin, are occasionally observed in the vicinity (e.g., Atkinson Marsh and Whitney Slough), especially during migration. The bald eagle and osprey historically nested along Green Bay but no longer do (Dundas, 1968). Double-crested cormorants (Phalacrocorax auritus), nest on islands in Green Bay two miles northwest of this wetland.

No plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1978; Hine, et al., 1975) were documented in Fox River Wetland by the literature search.

Health

Site-specific information indicates that the environmental quality of Fox River Wetland is poor. The wetland is located within the city of Green Bay and numerous sources of pollution occur in or adjacent to the wetland. The Wisconsin Department of Natural Resources has designated this wetland as Class III wildlife habitat.

CULTURAL SETTING LM 258

Population

Fox River Wetland is located in the city of Green Bay in Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Table 11-6 indicates that Brown County experienced a rapid rate of population growth between 1970 and 1975, while the city of Green Bay had a moderate growth rate. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-8. Population Data for the Vicinity of Fox River Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
City of Green Bay	91,189	3.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Fox River Wetland is urban open space. The surrounding area is primarily characterized by industrial development, including an oil storage area and a sewage disposal facility. The wetland was probably contiguous with Green Bay at one time but roads and industrial development now separate the wetland and the bay. A flood control dike is located along the Green Bay shoreline to the east of the wetland, and a sewage disposal facility is adjacent to the wetland. The northern portion of the wetland has been filled. A power plant lies on the opposite side of the Fox River from the wetland, and dumping grounds lie offshore in Green Bay. It appears likely that the entire wetland may be filled in the near future (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; U.S.G.S. quadrangle map, Green Bay east, Wisconsin, 1971). The wetland lies within the corporate boundaries of the city of Green Bay (Artcraft Company, 1978). The northern portion of the wetland is situated within a parcel of land owned by Wisconsin Public Service Corporation (Wisconsin Industrial Discharge Section, 1978). Detailed ownership records are not available for the remaining portion of the wetland.

The southern portion of the wetland is within an area planned for general industrial use, and the northern portion is within an area planned for institutional and government use. A proposed highway would traverse the approximate center of the wetland (Brown County Regional Planning Commission, 1967). Its location suggests that Fox River Wetland is subject to immediate and severe development pressure.

Recreation

There are no known state or federal recreational facilities in the vicinity of Fox River Wetland.

Mineral, Energy, and Forest Resources

Glaciolacustrine deposits of sand, silt, and clay present in Fox River Wetland have low potential for containing commercial quantities of sand and gravel (Hadley and Pelham, 1976; Buckley, 1901). The wetland area is underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active clay, sand and gravel, or limestone operations in close proximity to the wetland (Ostrom, 1970). No known oil, gas, or coal resources are present.

There are no significant forest resources in Fox River Wetland (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971, and Green Bay West, Wisconsin, 1971; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

Public Utilities and Facilities

A sewage disposal plant is located in Fox River Wetland, and the Pulliam Power Plant is situated west of the wetland. The power plant, owned by the Wisconsin Public Service Corporation, burns mainly coal and some fuel oil and is rated at 393 megawatts. Green Bay is the source of condensing water for the

Pulliam plant (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971, and Green Bay West, Wisconsin, 1971; Federal Power Commission, 1972).

Pollution Sources

Texaco Incorporated, an NPDES permit holder, has oil tank storage facilities which discharge into Fox River Wetland. Runoff from the tank dike area flows through Fox River Wetland before entering the Fox River. A sewage disposal site, maintained by the Green Bay Metropolitan Sewerage District, is also located in Fox River Wetland (Wisconsin Industrial Discharge Section, 1978).

Numerous industrial waste sources discharge inadequately treated wastes into the Fox River. Studies have indicated that the pollution load carried by the Fox River may affect Green Bay for a distance of five or more miles north of the river mouth. Municipal sewage treatment plants may be bypassing partially treated or untreated sewage during heavy rains, which can cause discharge directly into the surface waters. In addition, agricultural byproducts, such as chlorinated hydrocarbons and manure, enter the surface and underground water supplies through runoff and seepage. Highway drainage and storm sewer runoff contribute nutrients and road salts to the surface waters (Nelson and Fassbender, 1972).

Historical and Archaeological Features

There are no known historical sites within 500 feet of Fox River Wetland, but three archaeological sites (BR #135, #9, #15) have been identified in the vicinity. Information regarding the field findings for these sites can be obtained through the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 258

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

ATKINSON MARSH COMPLEX

PHYSIOGRAPHIC SETTING

LM 259-261

Setting

The Atkinson Marsh complex, comprised of Atkinson Marsh and Peats Lake Wetlands #1 and #2, is located near the southern end of Green Bay, west of the mouth of the Fox River and on either side of the mouth of Duck Creek. These wetlands lie to the north of the city of Green Bay, Wisconsin, in Brown County (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971). Peats Lake Wetlands #1 and #2 are submerged within Green Bay and are characterized as emergent vegetation growing in shallow water. These wetlands lie to the north of Atkinson Marsh in an area named Peats Lake. Peats Lake Wetlands #1 and #2 appear to be little altered; however, Atkinson Marsh has been extensively diked and filled. A portion of the wetland has been used by the U.S. Army Corps of Engineers as a disposal site for dredge spoils from Fox River channelization maintenance. Portions of this wetland are also used by the city of Green Bay as a land fill and incineration site.

Atkinson Marsh and Peats Lake Wetlands #1 and #2 occupy low, non-wooded sites. Atkinson Marsh may be described as a Lower Perennial Riverine System as well as a Lacustrine System. Peats Lake Wetlands #1 and #2 are littoral Lacustrine wetlands (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971).

Topography

Wetland elevations in the Atkinson Marsh Complex are less than 585 feet above sea level, only five feet above the approximate mean elevation of Lake Michigan. Peats Lake Wetlands #1 and #2 have little relief, and Atkinson marsh has no more than five feet of relief. The wetlands are located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland. Topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in this area (Harris et al., 1977).

The Great Lakes Basin Commission (1975) describes the Green Bay shoreline in the vicinity of Atkinson Marsh and Peats Lake Wetlands #1 and #2 as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Atkinson Marsh and Peats Lake Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Continuous sand spits are located on the bed of

Green Bay from Long Tail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

No soil mapping has been done for Peats Lake Wetlands #1 and #2, since these wetlands are submerged. There are eight types of soil present in Atkinson Marsh. Marsh soil is the dominant type, followed by Markey muck. Keowns silt loam is found mainly on the north shore of Duck Creek. Areas of Fill land and Dumps form the border of Atkinson Marsh and cover the central portion of what was once a wetland. Wauseon fine sandy loam forms a border on the southern edge of Atkinson Marsh. Manawa silty clay loam and Cathro muck are found in scattered areas in the southern portion of the wetland (Link et al., 1974).

Keowns silt loam includes a moderate amount of organic matter. It formed in stratified silt and fine sand sediment; this soil is deep and poorly drained, and is found in level or depressional areas on glacial lake plains. Markey muck consists of moderately deep, very poorly drained organic soils formed in organic material derived from decayed wetland sedges, grasses, and reeds. It is found in shallow glacial lake basins and depressions in stream valleys. Manawa silty clay loam was formed from calcareous, clayey lacustrine deposits or clayey glacial till (Link et al., 1974).

Wauseon fine sandy loam consists of deep, poorly drained soils that have medium organic content and low natural fertility. This soil formed in sandy deposits and the underlying calcareous clayey material, and is found in depressions on glacial till or lacustrine plains. Dumps refers to man-made soils consisting of trash, garbage, and industrial wastes. Dumps in or near the city of Green Bay are mostly filled with wood refuse and wastes from the paper industries of the city. Fill land consists of soils of various textures and includes cinders, broken concrete, and industrial wastes. Dredge spoil from Green Bay may also be included in the Fill land. Cathro muck has a high content of organic material, low natural fertility, and is poorly drained; it is found in shallow glacial lake basins and other depressions (Link et al., 1974).

Hydrology

Atkinson Marsh is located adjacent to the southern end of Green Bay, and Duck Creek flows through the northern edge of the wetland (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971). Duck creek has a drainage area of 18 square miles and a gradient of 8.7 feet per mile. The creek is a hardwater stream and ranges from turbid in the deeper reaches to relatively clear in the shallow, fast-moving sections. The creek bottom materials consist of bedrock, gravel, and sand, and may have a layer of silt on top (Nelson and Fassbender, 1972).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on the Atkinson Marsh Complex, especially on Peats Lake Wetlands #1 and #2. Atkinson Marsh has a maximum elevation of five feet above lake level; thus, a fluctuation of several inches in the water level can drastically change the amount of wetland that is submerged. The water level fluctuations in Green Bay

have been known to reduce the wetlands along the western shore to one-third normal size during high water periods.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; thus, periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem (Harris et al., 1977). The current high water levels have reduced the general quality of the wetlands (Bertrand et al., 1976).

The water quality of Atkinson Marsh has been seriously degraded by human activity. Dredge spoil from the harbor, sanitary landfill operations, and fly ash disposal have filled in over half of Atkinson Marsh and polluted the waters. Dissolved oxygen levels in Atkinson Marsh have been as low as zero during the winter and very low during the summer. Alkalinity measured in July, 1969, was 708 and in March, 1970, was 1388 parts per million. In addition to the chemical pollutants, the wetland has been littered with bottles, tires, and other trash (Wisconsin Scientific Areas Preservation Council, 1969). Dredge spoil is also present in the wetland. The pollutants in the dredge spoil are from organic, domestic, and industrial sources. These sediments have been classified by the U.S. Environmental Protection Agency as moderately and heavily polluted and are unsuited for open lake disposal (U.S. Army corps of Engineers, Chicago District, 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Since Atkinson Marsh is adjacent to Green Bay, the water quality data presented in Table 11-9 may be representative of the wetland, at least during periods of high water.

Table 11-9. Water Quality Data for Green Bay Sampled above Atkinson Marsh[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/22/74	15.0	8.2	0.127	0.400
9/ 4/74	20.0	4.1	0.328	1.900

[a] Patterson et al. (1975)

Water quality data on Peats Lake, presented in Table 11-10, may reflect conditions in Peats Lake Wetlands #1 and #2. Additional data for other constituents are available from the files of the Wisconsin Scientific Areas Preservation Council.

Table 11-10. Water Quality Data for Peats Lake Sampled in September 1969[a]

Kjeldahl nitrogen (ppm.)	Total phosphate (ppm.)	pH	Alkalinity (ppm.)	Temperature (^{o}F)	Dissolved oxygen (ppm.)
2.53	0.6	8.6	157	74	12.3

[a] Wisconsin Scientific Areas Preservation Council (1969)

The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. The water level fluctuations and resulting changes in the Fox River cause nutrient- and silt-laden water to inundate Atkinson Marsh (U.S. Army Corps of Engineers, Chicago District, 1976).

Groundwater levels in Atkinson Marsh are usually at or near the surface (Wisconsin Bureau of Water and Shoreland Management, 1973). Groundwater quality data were obtained in 1968 near the eastern edge of Atkinson Marsh. The pH value was 7.4; dissolved solids and hardness ($CaCO_3$) were 1000.0 and 404.0 milligrams per liter, respectively.

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes of Atkinson Marsh and Peats Lake Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for Atkinson Marsh Complex is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2^{o}F, the average daily low for January was 12.2^{o}F and the average daily high in July was 82.4^{o}F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Natural special features include a bird's-foot delta formed by Duck Creek southeast of Peats Lake Wetlands #1 and #2 (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

Vegetation

Howlett (1974) provides an analysis of the vegetation of West Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search provided no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels for the vegetation of the three wetlands comprising the Atkinson Marsh Complex.

Fish

In lower Duck Creek, unnamed panfish are most commonly caught by anglers and carp (Cyprinus carpio) are abundant (Nelson and Fassbender, 1972). However, a search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Atkinson Marsh Complex.

Invertebrates

Information on the relative abundance of the invertebrate fauna in Atkinson Marsh is available in the files of the Wisconsin Department of Natural Resources (1971). The tendipedids (Diptera) have been the most common macroinvertebrates collected while Daphnia (Cladocera) dominated the zooplankton samples. The lists of invertebrates and zooplankton appear in Tables 11-11 and 11-12.

Table 11-11. Invertebrates Collected from Atkinson Marsh on April 22 and June 30, 1971[a]

Annelida	Coleoptera
Oligochaeta	Dytiscidae
Hirudinae	Bidessus
Mollusca	Diptera
Gastropoda	Tendipedidae
Ceratopogonidae	
Arthropoda	Culicidae
Crustacea	Chaoborus
Isopoda	Ephydridae
Asellidae	Ephydra
Asellus	Anthemyiidae
Insecta	Limnophora
Hemiptera	
Corixidae	

[a] Wisconsin Department of Natural Resources (files)

Table 11-12. Zooplankton Collected from Atkinson Marsh on April 22 and June 30, 1971[a]

Daphnia	Ceriodaphnia
Cyclops	Leptodora
Nauplius (larvae)	Moina
Ostracods	

[a] Wisconsin Department of Natural Resources, files

Howmiller et al. (1970, 1971) provide information on seasonal distribution and density of the oligochaete fauna and the associated benthos of southern Green Bay. The species of oligochaetes collected in the bay are presented in Appendix B-3. These organisms probably occurred in theAtkinson Marsh Complex at the time of collection owing to its location contiguous to the bay.

General information on the invertebrates of Green Bay may be found in The Wisconsin State Committee on Water Pollution (1939), Surber et al. (1952), Balch et al. (1956), and Howmiller et al. (1970, 1971).

The literature search produced no site-specific data pertaining to productivity, major food sources, or relationship to water levels of the invertebrates present in the three wetlands comprising the Atkinson Marsh Complex.

Reptiles and Amphibians

The Wisconsin Department of Natural Resources (1969 and 1971) made field checks on Atkinson Marsh in 1969 and 1971. The presence of green frog (Rana clamitans), northern leopard frog (R. pipiens), snapping turtle (Chelydra serpentina), and eastern garter snakes (Thamnophis s. sirtalis) was indicated. Local breeding by the frogs may be assumed, inasmuch as the leopard frogs were chorusing on April 22, 1971, and the green frogs were calling on June 27, 1971.

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Atkinson Marsh and Peats Lake Wetlands #1 and #2.

The literature search yielded no site-specific information pertaining to seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in the wetlands of the Atkinson Marsh Complex.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Atkinson Marsh as Class I wildlife habitat, "most desirable" for waterfowl, shore birds, and gulls and terns

(Thompson et al., 1976). Historically, this was one of the finest and largest wetlands in the midwest. Whooping cranes (Grus americana) were reported to breed here in the 19th century (Scharf et al., 1977). Atkinson Marsh is currently highly urbanized, and Tessen (1976) predicts that Avifauna productivity will continue to decrease.

Over 250 bird species have been recorded in Atkinson Marsh, and since 1970 about 174 species have been observed. Cleary's (1972) list of birds seen in Atkinson Marsh from 1940 to 1972 notably includes seven species of herons; 26 species of swans, geese, and ducks; 28 species of shore birds; and nine species of gulls and terns.

Atkinson Marsh and the adjacent waters of southwestern Green Bay receive heavy use by waterfowl and shore birds during migration, as a resting and staging area. This is a particularly important resting area for whistling swans (Olor columbianus), but the changing vegetation of Green Bay in recent years has reduced the size of the flocks using the area (Wallace, 1977). Spring swan populations are the largest; the first swans arrive in late March and peak populations, often close to 3,000 individuals, occur in April (U.S. Army Corps of Engineers, 1976). In the fall, fewer swans use the area and their stay is shorter.

Many waterfowl species use Atkinson Marsh for feeding and nesting. Common waterfowl include the Canada goose (Branta canadensis), mallard (Anas platyrhynchos), black ducks (A. rubripes), blue-winged teal (A. discors), redhead (Aythya americana), ring-necked duck (A. collaris), canvasback (A. valisineria), greater scaup (Aythya marila), lesser scaup (A. affinis), common goldeneye (Bucephala clangula), bufflehead (B. albeola), common merganser (Mergus merganser), and American coot (Fulica americana). Each year many shore birds are observed utilizing the wetland (Tessen, 1976), including the piping plover (Charadrius melodus), solitary sandpiper (Tringa solitaria), willet (Catoptrophorus semipalmatus), red knot (Calidris canutus), short-billed dowitcher (Limnodromus griseus), long-billed dowitcher (L. scolopaceus), stilt sandpiper (Micropalama himantopus), Hudsonian godwit (Limosa haemastica) and marbled godwit (L. fedoa) (U.S. Army Corps of Engineers, Chicago District, 1976). Other regularly observed birds are the least bittern (Ixobrychus exilis), Virginia rail (Rallus limicola), sora (Porzana carolina), greater yellowlegs (Tringa melanoleuca), lesser yellowlegs (T. flavipes), purple martin (Progne subis), and several species of gulls and terns. Occasionally Hungarian partridge (P. perdix) are seen in the wetland (U.S. Army Corps of Engineers, 1976). Atkinson Marsh is also used by some bird species that are becoming locally uncommon, such as the great blue heron (Ardea herodias), black-crowned night heron (N. nycticorax), kingfisher, bluebird (Sialia sialis), and yellow-headed black bird (X. xanthocephalus).

Atkinson Marsh is heavily polluted and is rapidly being filled. Water level changes often affect the wetland during the nesting season, making it difficult to collect a definitive list of breeding birds. Currently, nine species of ducks and the Canada goose breed in Atkinson Marsh (Scharf et al., 1977). The Wisconsin Department of Natural Resources list 15 additional known breeders, including the black-crowned night heron, Forster's tern (Sterna forsteri), long-eared owl (Asio otus), Brewer's blackbird (Euphagus

cyanocephalus), and yellow-headed blackbird. Mallard, blue-winged teal, American coot, tern, red-winged blackbird (Agelaius phoeniceus), and swamp sparrow (Melospiza georgiana) nests have been found within the dredge spoils disposal site. Twenty years ago, harriers (Circus cyaneus) were common in the wetlands of southern Green Bay. Currently, harriers are observed with regularity only at Atkinson Marsh, but no recent nests have been located. In 1976, 75 to 80 pairs of black terns (Chlidonias nigra) nested in this area; the main colony (55 to 60 pairs existed north of the old incinerator (Scharf et al., 1977). During the same year, 80 pairs of Forster's terns attempted nesting, but high spring water levels resulted in a limited amount of suitable nesting habitat. The colony subsequently divided into four small groups, each with poor nesting success; not more than 20 young fledged (Scharf et al., 1977). Tern nesting is in a state of change because high waters of recent years have destroyed most of the cattail areas which had been used as nesting substrate. The diked areas are less affected by high water levels, but are destined to be filled and converted into an industrial park.

The Wisconsin Department of Natural Resources has conducted many bird censuses in Atkinson Marsh. Table 11-13 presents data from August 19 and September 3, 1969. On the former date, 38 species were recorded; on the latter, 60 species were observed. Most of these are wetland-dependent birds. The most abundant waterfowl during this period were the blue-winged teal and green-winged teal (A. crecca); shore birds were also abundant and diverse.

Winter population data are available from the Christmas bird counts of the Green Bay Census Area (Appendix D-27). This census area includes all of Atkinson Marsh, plus several other wetlands. Thus, the data may not be representative of Atkinson Marsh itself. The most abundant waterfowl in late December are the Canada goose, mallard, and black duck. Scharf et al. (1977) report that this wetland is an important wintering area for snowy owls (Nyctea scandiaca). Occasionally as many as eight to ten individuals occur in the area during the winter months (Tessen, 1976).

Transmission lines crossing Atkinson Marsh may be responsible for some avian mortality (Wisconsin Scientific Areas Preservation Council, 1971). Duck hunting is popular in Atkinson Marsh, despite the fact that it lies within the city limits of Green Bay. Illegal shooting of ducks, geese, and other birds in Atkinson Marsh during the summer is fairly common (Wisconsin Scientific Areas Preservation Council, 1971).

A considerable amount of information on the avifauna of Atkinson Marsh exists in the Wisconsin Department of Natural Resources files, including hunting records, bird censuses, nesting records (i.e., number of nests, number of eggs per nest, height of nests above ground or water, and vegetation in which nests are located), and miscellaneous observations.

Appendices D-23, D-24, D-25, D-26, and D-28 contain general information on wetland birds. General studies on Lake Section 11 related to Atkinson Marsh and Peats Lake Wetlands #1 and #2 are included, but care should be exercised in the interpretation of the relevance of the studies to these wetlands. The literature search provided no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity,

Table 11-13. Bird Censuses of Atkinson Marsh in 1969[a]

	Aug. 19	Sept. 3		Aug. 19	Sept. 3
pied-billed grebe	8	43	pectoral sandpiper	3	27
Canada goose		63	Baird's sandpiper		7
mallard	67	45	least sandpiper	22	37
black duck	4	4	dunlin	2	1
pintail		7	short-billed dowitcher	47	6
gadwall	17	28	stilt sandpiper	10	74
American wigeon	3	83	semipalmated sandpiper	23	25
northern shoveler	14	15	marbled godwit	1	
blue-winged teal	55	384	herring gull	--b	132
green-winged teal	434	191	ring-billed gull		48
wood duck	2	2	Forster's tern	2	40
redhead	2		common tern	143	10
ruddy duck		3	Caspian tern		1
hooded merganser	2		black tern	--	84
harrier	1	2	mourning dove		2
great blue heron	12	7	belted kingfisher		1
green heron	3	2	yellow shafted flicker		2
common egret		1	tree swallow		335
black-crowned night heron	35	3	rough-winged swallow		2
king rail		2	barn swallow		27
sora	3	15	cliff swallow		2
common gallinule		3	purple martin		35
American coot	81	126	common crow		4
semipalmated plover	4	10	long-billed marsh wren	--	6
killdeer	9	27	starling		2
black-bellied plover		5	yellow throat		3
ruddy turnstone		1	yellow-headed blackbird	--	6
common snipe	2	4	red-winged blackbird		3
spotted sandpiper		2	American goldfinch		16
greater yellow-legs	26	3	song sparrow	--	11
lesser yellow-legs	56	55			
red knot		2			

[a]Wisconsin Department of Natural Resources (1969 and 1969)
[b]present on August 19 but not counted

recreational and commercial use, life histories, food sources, or relationship to water levels of the birds utilizing Peats Lake Wetlands #1 and #2, or to commercial use and food sources of birds in Atkinson Marsh.

Mammals

Mammalian species which are found in Atkinson Marsh are listed in Table 11-14. Numerous industrial and urban intrusions have lead to the degradation of this wetland (Wisconsin Scientific Areas Preservation Council, 1976), but trapping of various furbearers occurs on Atkinson Marsh (U.S. Army Corps of Engineers, 1976). Atkinson Marsh has been classified as "most desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

Table 11-14. Mammal Species Associated with the "Green Bay Diked Disposal Area" and Adjacent Wetlands[a]

Common name	Common name
eastern cottontail	gray fox
house mouse	raccoon
Norway rat	weasel
muskrat	striped skunk
red fox	white-tailed deer

[a] adapted from U.S. Army Corps of Engineers, 1976, 1977

The literature search provided no other site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the three wetlands of the Atkinson Marsh Complex.

Endangered Species

The endangered peregrine falcon (Falco peregrinus) (U.S. Fish and Wildlife Service, 1977) and the bald eagle (Haliaeetus leucocephalus) and osprey (Pandion haliaetus), both endangered in Wisconsin (Hine at al., 1975), have been observed at Atkinson Marsh and in the vicinity (Scharf et al., 1977). The double-crested cormorant (Phalacrocorax auritus), a species endangered in Wisconsin, nests on the islands directly north of this wetland, but no information is available on its use of Atkinson Marsh except that it does not use the diked dredge disposal site in the eastern part of the wetland (U.S. Army Corps of Engineers 1976). The piping plover (Charadrius melodus), which is on the state list of endangered species (Hine et al., 1975), has disappeared from Lake Michigan as a breeding bird but is occasionally observed in and around Atkinson Marsh. Forster's tern (Sterna forsteri) and common tern (Sterna hirundo) are also listed as endangered in Wisconsin and nest in Atkinson's marsh. The Wisconsin Department of Natural Resources (1969) indicates that harriers (Circus cyaneus)which are incluced on the state watch list (Hine

et al., 1975), have decreased in Atkinson Marsh, and there is no current evidence of breeding. No other endangered or threatened plants and animals were found through the literature search to occur in Atkinson Marsh or in Peats Lake Wetlands #1 and #2.

Health

Site-specific information indicates that the environmental quality of Atkinson Marsh Complex is poor. The Wisconsin Department of Natural Resources has designated this wetland as Class I wildlife habitat and indeed, a great number and diversity of avifauna at one time utilized these wetlands. However, there is now extensive pollution of water in the wetlands due to the highly industrialized surroundings.

CULTURAL SETTING LM 259-261

Population

Atkinson Marsh and Peats Lake Wetlands #1 and #2 are located in Howard Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975, and projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-15. Population Data for the Vicinity of Atkinson Marsh and Peats Lake Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Howard Township	5,921	20.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use in Atkinson Marsh ranges from mixed industrial and urban open space uses in the eastern portion of the wetland within Green Bay to more rural open space uses in the northwestern portion of the wetland. Similarly, the surrounding area is characterized by heavy industrial uses and residential development near the eastern portion of the wetland, with uses becoming less intensive as one moves to the northwest, away from the city of Green Bay. The area surrounding the northwest portion of the wetland is primarily rural open

space. Land use within Peats Lake Wetlands #1-#2 is open space. Land use in the shoreline areas abutting Peats Lake is rural open space. Railroad lines and boat slips are located near Atkinson Marsh. A municipal dumping ground is situated offshore of Atkinson Marsh and Peats Lake Wetlands #1 and #2, within Green Bay. A power plant and a large petroleum depot adjoin the southeast portion of Atkinson Marsh (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

The portion of Atkinson Marsh situated within the corporate limits of Green Bay is largely under municipal ownership, while the portion of the wetland outside of the city is under private ownership (Artcraft Company, 1978). The location of Peats Lake Wetlands #1-#2 within Peats Lake indicates that they are under public ownership.

The eastern portion of Atkinson Marsh is situated within an area planned for industrial use, while the remainder of the wetland is within an area designated as a major conservation objective. The greatest portion of the land surrounding Peats Lake is designated as a conservation objective, while the north shore area is planned for single-family, low-density residential development (Brown County Regional Planning Commission, 1967).

The industrial nature of the surroundings of the eastern portion of Atkinson Marsh and current plans to fill that portion of the wetland for use as an industrial park indicate that the wetland may be subject to imminent and severe development pressure should these plans be realized. The western portion of the wetland appears to be under minimal development pressure. Development pressures on Peats Lake Wetlands #1 and #2 are assumed to be low, since no dredging plans for the area are known.

Recreation

There are no known state or federal recreational facilities in the vicinity of Atkinson Marsh or Peats Lake Wetlands #1 and #2.

Mineral, Energy, and Forest Resources

Trenton-Galena limestone in the vicinity of Atkinson Marsh and Peats Lake Wetlands #1 and #2 is close to the surface. There are numerous outcroppings in the Atkinson Marsh area that have been used for limestone production in the past (Hotchkiss and Steidtmann, 1914). However, there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976).

There are no significant forest resources in Atkinson Marsh or Peats Lake Wetlands #1 and #2 (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

The Pulliam Power Plant is located east of Atkinson Marsh and Peats Lake Wetlands #1 and #2. The power plant, owned by the Wisconsin Public Service Corporation, burns mainly coal and some fuel oil. The plant is rated at 393 megawatts. Green Bay is the source of condensing water for the plant. Several transmission lines and pipelines run through the wetland (Federal Power Commission, 1972; Wisconsin Scientific Areas Preservation Council, 1976; U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971).

Pollution Sources

The Fox River is "lined by a concentrated municipal-industrial complex whose discharge profoundly alters the quality of the river water" (U.S. Army corps of Engineers, Chicago District, 1976). It has been noted that many industrial waste sources discharge inadequately treated wastes into the Fox River. The pollution load carried by the Fox River may affect Green Bay for a distance of five or more miles north of the river mouth. Municipal sewage treatment plants may be bypassing partially treated or untreated sewage during heavy rains, which can cause discharge directly into the surface waters. In addition, agricultural byproducts, such as chlorinated hydrocarbons and manure, enter the surface and the underground water supply through runoff and seepage. Highway drainage and storm sewer runoff also contribute nutrients and road salts to the surface waters which can enter the groundwater of Brown County (Nelson and Fassbender, 1972).

There are no NPDES permit holders adjacent to Peats Lake Wetlands #1 and #2. However, there are at least four NPDES permit holders adjacent to Atkinson Marsh. The F. Hurlbut Company, located adjacent to Atkinson Marsh, discharges noncontact cooling water into the Fox River. The Chicago and North Western Transportation Company's Green Bay Roundhouse is located adjacent to the southern part of Atkinson Marsh. Contaminated storm runoff from the turntable pit area is discharged via a ditch into the Fox River. Cities Service Company discharges wastewater from runoff around the oil terminal into Green Bay. Cities Service is located next to the eastern edge of Atkinson Marsh. Cooling water and wastewater are discharged from a wastewater treatment system into the mouth of the Fox River. Wisconsin Public Service Corporation operates a power plant adjacent to the eastern edge of Atkinson Marsh (Wisconsin Department of Natural Resources, Industrial Discharge Section, 1978). In addition to the above NPDES permit holders, there are other oil storage facilities located at the eastern edge of Atkinson Marsh (U.S. Army Corps of Engineers, 1977).

Historical and Archaeological Features

No known historical sites exist within 500 feet of the Atkinson Marsh Wetland Complex (Wisconsin, Historic Preservation Division), but one archaeological site has been identified in the immediate vicinity of Atkinson Marsh. A campsite discovered on the south side of the marsh has been partially destroyed by interchange construction (U.S. 41). Notes on this site are available at the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

DEAD HORSE BAY WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 262-269

Setting

The Dead Horse Bay Wetland Complex, comprised of Dead Horse Bay Wetlands #1-#7 and Peters Marsh, is located on the western side of Green Bay in Brown County, Wisconsin. The distances of these wetlands relative to the Green Bay shoreline and the city of Green Bay, Wisconsin, are presented in Table 11-16.

Table 11-16. Location of Dead Horse Bay Wetlands #1-#7 and Peter Marsh

	Distance from shoreline	Distance from Green Bay, Wisconsin
Dead Horse Bay Wetland #1	adjacent	2.0 miles north
Dead Horse Bay Wetland #2	adjacent	2.5 miles north
Peters Marsh	adjacent	3.0 miles north
Dead Horse Bay Wetland #3	0.2 mile	4.0 miles north
Dead Horse Bay Wetland #4	adjacent	4.0 miles north
Dead Horse Bay Wetland #5	250 feet	4.8 miles north
Dead Horse Bay Wetland #6	0.2 mile	4.8 miles north
Dead Horse Bay Wetland #7	0.2 mile	5.0 miles north

Dead Horse Bay Wetlands #1 and #2 and Peters marsh extend into Green Bay, and portions of these wetlands consist of emergent vegetation growing in shallow water. The remainder of the wetlands in the complex are located on Dead Horse Bay, south of Long Tail Point. Dead Horse Bay Wetlands #1, #2, and #7 and Peters Marsh are low, non-wooded wetlands; Dead Horse Bay Wetlands #3-#6 are low and wooded. Dead Horse Bay Wetlands #3 and #5-#7 are Palustrine Systems. The rest of the wetlands in this complex are Lacustrine, with Dead Horse Bay Wetlands #1 and #2 being littoral Lacustrine Systems (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin, 1971).

Topography

The wetlands in Dead Horse Bay Wetland Complex have very slight relief; all wetland elevations are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetlands are located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland. Topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands (Harris et al., 1977).

The Great Lakes Basin Commission (1975) describes the Green Bay shoreline in the vicinity of the wetlands as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Dead Horse Bay Wetlands #1-#7 and Peters Marsh is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Continuous sand spits are located in the bed of Green Bay from Long Tail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

There are two soil series present in Dead Horse Bay Wetland Complex, Roscommon loamy fine sand and Tedrow loamy fine sand. The former is a deep, poorly drained soil comprised of black muck on the surface and black loamy fine sand underneath. Roscommon loamy fine sand has low natural fertility and a high amount of organic material. This soil is found in depressions on sandy Lacustrine and outwash plains. Tedrow loamy fine sand is a deep, somewhat poorly drained soil, with a surface layer consisting of dark-brown loamy fine sand underlain with mottled grayish-brown loamy fine sand. Tedrow loamy fine sand formed in deep sands and has low natural fertility and organic matter; it is found on Lacustrine or outwash plains (Link et al., 1974). Table 11-17 lists the soil series for each wetland in Dead Horse Bay Wetland Complex except Dead Horse Bay Wetland #2; since this wetland is submerged, no soil mapping has been done.

Table 11-17. Soils Series for Dead Horse Bay Wetland Complex[a]

Wetland	Soil
Dead Horse Bay Wetland #1	Tedrow loamy fine sand
Dead Horse Bay Wetland #2	soil mapping not available
Peters Marsh	Tedrow loamy fine sand and Roscommon loamy fine sand along the shore
Dead Horse Bay Wetland #3	Tedrow loamy fine sand
Dead Horse Bay Wetland #4	Roscommon loamy fine sand
Dead Horse Bay Wetland #5	Roscommon loamy fine sand
Dead Horse Bay Wetland #6	Roscommon loamy fine sand
Dead Horse Bay Wetland #7	Roscommon loamy fine sand

[a] Link et al. (1974)

Hydrology

There are no streams flowing through Dead Horse Bay Wetlands #1, #3, #6, and #7. Parts of Peters Marsh and Dead Horse Bay Wetland #1 and all of Dead Horse Bay Wetland #2 are submerged in Green Bay. Dead Horse Bay Wetland #3 and Peters Marsh are adjacent to the bay. The center portion of Peters Marsh is drained by two short streams which flow into Green Bay. An unnamed stream originates in Dead Horse Bay Wetland #5 and flows through the north central part of Dead Horse Bay Wetland #5 on its way to Dead Horse Bay. A small area of open water is located in the northern part of Dead Horse Bay Wetland #3 (U.S.G.S. quadrangle maps, Green Bay West, Wisconsin, 1971; Green Bay East, Wisconsin, 1971).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on the wetlands of the Dead Horse Bay Wetland Complex, especially on Dead Horse Bay Wetlands #1-#3 and Peters Marsh. The wetlands in the Dead Horse Bay Wetland Complex have a maximum elevation of five feet above lake level; thus, a fluctuation of several inches in the water level can drastically change the amount of wetland that is submerged. The water level fluctuations in Green Bay have been known to reduce the wetlands along the western shore to one-third normal size during high water periods. The seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short and long term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem (Harris et al., 1977). Current high water levels have reduced the general quality of the wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Water quality data for Green Bay sampled near Dead Horse Wetlands #1 and #2 are presented in Table 11-18 and may reflect conditions in the wetlands adjacent to Green Bay (Dead Horse Bay Wetlands #1-#3 and Peters Marsh), especially during periods of high water.

Table 11-18. Water Quality Data for Green Bay Sampled Near Dead Horse Bay Wetlands #1 and #2[a]

Date	Temperature (^{o}C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/22/74	15.0	9.5	0.095	0.500
9/ 4/74	20.0	9.1	0.168	1.200

[a] Patterson et al. (1975)

The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. The water level fluctuations and resulting changes in the Fox River cause nutrient- and silt-laden water to inundate the wetlands in the Dead Horse Bay Wetland Complex, expecially those adjacent to the shore (U.S. Army Corps of Engineers, Chicago district, 1976).

The poor quality of the water in lower Green Bay is demonstrated by the fact that extensive beds of wild celery oncegrew in Dead Horse Bay but have now been diminished by the water's turbidity. The turbidity is caused, in part, by erosion of the spoil from dredging activity (Dundas, 1968). Seiche activity in Peters Marsh acts as a catalyst for nutrient exchange between the wetland and Green Bay. Water quality studies conducted in Peters Marsh indicate that the wetland receives polluted water containing high levels of suspended solids and turbidity, and releases water which has less of these constituents. During the night, Peters Marsh releases oxygen-depleted water. Although the data are limited, these studies also indicate that Peters Marsh serves as a source of orthophosphate in the early summer months. More intensive study is needed to investigate the extent and the dynamics of nutrient exchange between the coastal wetlands on the west shore and Green Bay (Harris, 1977). Water data for Peters Marsh in 1969 are presented in Table 11-19. Water quality data for other constituents are available from the files of the Wisconsin Scientific Areas Preservation Council. Additional water quality information for Green Bay may be found in Patterson et al. (1975).

Table 11-19. Water Quality Data for Peters Marsh Sampled on September 4, 1969[a]

Kjeldahl nitrogen (ppm.)	Total phosphate (ppm.)	pH	Alkalinity (ppm.)	Temperature (^{o}F)	Dissolved oxygen (ppm.)
1.76	2.50	8.6	157	74	12.3

[a] Wisconsin Scientific Areas Preservation Council (1969)

The groundwater levels in the wetlands of the Dead Horse Bay Wetland Complex are usually at or near the surface (Wisconsin Bureau of Water and Shoreland Management, 1973). Streams and groundwater provide high-quality water compared to the present low quality of Green Bay (Dundas, 1968).

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Dead Horse Bay Wetlands #1-#7 and Peters Marsh.

Climate

The closest weather station providing climatic data for Dead Horse Bay Wetland Complex is located in Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2°F; the average daily low for January was 12.2°F and the average daily high in July was 82.4°F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost 28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

All of the wetlands in the complex lie to the north of the bird's-foot delta of Duck Creek and to the south of Long Tail Point (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971, and Green Bay West, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING

LM 262-269

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of the eight wetlands comprising the Dead Horse Bay Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Dead Horse Bay Wetland Complex.

Invertebrates

Howmiller et al. (1970, 1971) provide information on seasonal distribution and density of the oligochaete fauna and the associated benthos of southern Green Bay. The species of oligochaetes collected in the bay are presented in Appendix B-3. These organisms probably occurred also in the wetland complex at the time of collection owing to its location contiguous to the bay.

General information on the invertebrates of Green Bay may be found in The Wisconsin State Committee on Water Pollution (1939), Surber et al. (1952), Balch et al. (1956), and Howmiller et al. (1970, 1971).

The literature search produced no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in the eight wetlands comprising the Dead Horse Bay Wetland Complex.

Reptiles and Amphibians

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Dead Horse Bay Wetlands #1-#7 and Peters Marsh.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Dead Horse Bay Wetland #1 as Class I wildlife habitat, "most desirable" to songbirds and ruffed grouse (Bonasa umbellus), "desirable" to waterfowl and woodcock (Philohela minor), and with "supplemental value" to pheasant (Phasianus colchicus) (Thompson et al., 1976). Scharf et al. (1977) reports that double-crested cormorants (Phalacrocorax auritus), a species endangered in Wisconsin (Hine et al., 1975), have nested on a small island within Dead Horse Bay Wetland #1 since 1974. In 1976, the birds were first observed on April 26, and the peak numbers (76) occurred on July 6. Nesting records for 1976 appear in Table 11-20. This cormorant population is one of four known nesting colonies in Wisconsin.

Table 11-20. Nesting Records of the Double-crested Cormorant Colony in Dead Horse Bay Wetland #1[a]

Date (1976)	Number of nests	
April 20	7	
June 3	13	
July 6	17	
July 12	19	
July 25	9	(13 young, 53 adults and subadults; 5 of the nests are still active)
August 16	10	

[a] Scharf et al. (1977)

On Willow Island, a small island in the vicinity of Dead Horse Bay Wetland #1, Scharf et al. (1977) observed 46 pairs of black-crowned night herons (N.

nycticorax) nesting. On July 6, 1976, twelve nests with eggs and 30 nests with 51 young (1.7 young per nest) were reported. Most of the nests are in red osier. Two pairs of cattle egrets (Bubulcus ibis) nested in the colony in 1971 and 1972 but did not return in later years, presumably due to competition for nesting sites with the black-crowned night herons. The largest recorded number of herons in the colony at one time, 80 pairs, occurred in 1972.

Lone Tree Island is located near Willow Island. In low-water years a large cattail wetland, which supports numerous waterfowl, extends from this island eastward to Grassy Island (Scharf et al., 1977). Common terns (Sterna hirundo), which are currently being considered for state endangered status (Hine, Wisconsin Endangered Species Committee, personal communication) have nested on the island for at least 15 years. The island's population of ring-billed gulls (Larus delawarensis) is currently increasing and the common tern population is decreasing (Scharf et al., 1977).

The Wisconsin Department of Natural Resources has designated Dead Horse Bay Wetland #2 and Peters Marsh as Class I wildlife habitat, "most desirable" to waterfowl, gulls and terns, and shore birds (Thompson et al., 1976).

In the Peters Marsh area, Harris et al. (1977) have studied the adaptability of wetland birds to habitat changes that result from fluctuating water levels. Nest site selection, nest density, nest success, and territory size of the yellow-headed blackbird (X. xanthocephalus) have been intensively studied. Table 11-21 presents data on nest success in 1975 and 1976 for Peters Marsh, Long Tail Point (located approximately six miles north), and Sensiba Wildlife Area (a diked wetland in the vicinity that is little influenced by short-term water level fluctuations in Green Bay). During 1974, the water level in Peters Marsh increased; the yellow-headed blackbirds invaded the shrub carr when the emergent vegetation, their preferred nesting habitat, was inundated with water. During the subsequent high water years of 1975 and 1976, the difference in number of young fledged per nest in the shrub carr as compared to those fledged in the remaining cattails was not significant. However, the percentage of eggs laid reaching fledgling stage decreased markedly from 1975 to 1976 for both the shrub carr and cattail nesting colonies at Peters Marsh. The rate stayed relatively constant for the Sensiba birds. Harris et al. (1977) conclude that the yellow-headed blackbird was able to partly adapt to fluctuating water levels by invading vegetation not usually available as a nesting substrate.

Data on the least bittern, (Ixobrychus exilis), common gallinule, (Gallinula chloropus), American coot (Fulica americana), Forster's tern (Sterna forsteri), and black tern (Chlidonias nigra) are being collected for the same sites. These data are currently incomplete, but Harris et al. (1977) indicate that their observations are similar to the cyclical changes observed by Weller and Fredrickson (1974) in glacial wetlands of northern Iowa. Harris et al. (1977) further suggest that wetland birds adapt to periodic water level changes and that "short and long term water level fluctuation may be important in the maintenance of the productivity of the system."

The area between Duck Creek and Long Tail Point, which includes Dead Horse Bay Wetland #1 and #2 and Peters Marsh, is heavily used by waterfowl and shore

Table 11-21. Nest Success, Eggs, and Young of Yellow-headed Blackbirds[a]

Study area[b]	1975				1976			
	PM-C	PM-W	SWA	LTP	PM-C	PM-W	SWA	LTP
Eggs:								
Number	94	60	94	35	54	56	139	113
Mean Eggs/Nest	3.25	2.86	3.92	3.50	2.84	3.73	3.23	3.14
Eggs Hatched:								
Number	90	58	75	32	33	44	106	74
Percent	95.7	96.7	79.8	91.4	61.1	78.6	76.3	65.5
Birds Fledged:								
Number	80	57	66	30	28	32	101	62
Percent	85.1	95.0	70.2	85.7	51.9	57.1	72.7	54.9
Ave. All Nests	2.76	2.71	2.75	3.00	1.47	2.13	2.35	1.72
Ave. Successful Nests	2.96	3.56	3.00	3.33	2.55	2.67	3.26	2.82

[a]Harris et al. (1977)
[b]PM-C Peters Marsh - cattail
PM-W Peters Marsh - willow
SWA Sensiba Wildlife Area
LTP Long Tail Point

birds during spring and fall migrations (Tessen, 1976). These wetlands serve as important resting areas for whistling swans (Olor columbianus). Peak numbers usually occur between late March and mid-April, when up to 20,000 have been observed along the southwest shore of Green Bay; numbers are much lower in the fall. Migrant populations in this area have diminished in recent years, as more swans utilize seasonally flooded fields in Brown and adjacent counties (Tessen, 1976). Changing vegetation in Green Bay may be responsible for the reduction in swan flocks (Wallace, 1977).

Seven or eight species of ducks and the Canada goose (Branta canadensis) nest in Peters Marsh (Scharf, et al., 1977) and probably breed in Dead Horse Bay Wetland #1 and #2 as well. The least bittern, common gallinule, American coot, and Forster's and black terns also breed in the area. Information on the wintering birds of these wetlands may be obtained from the Green Bay Christmas Bird Count, which is presented in Appendix D-27. This census area encompasses several other wetlands and may not be representative of individual wetlands. The most abundant waterfowl in late December are the Canada goose, mallard, and black duck.

The Wisconsin Department of Natural Resources has designated Dead Horse Bay Wetlands #3 and #4 as Class I wildlife habitat, "most desirable" to shore birds and gulls and terns (Thompson et al., 1976). Dead Horse Bay Wetlands #5-#7 are also Class I wildlife habitat, "most desirable" to songbirds and "desirable" to woodcock (Philohela minor).

Limited information is available on a deciduous forest wetland located at the mouth of the Suamico River, one to two miles north of the wooded wetlands of the Dead Horse Bay Wetland Complex (Tessen, 1976). During the summer the pied-billed grebe (Podilymbus podiceps), five species of the heron family, two duck species, and four species of gulls and terns including Forster's tern (currently under consideration for endangered status in Wisconsin; Hine, personal communication) are regularly observed. The common tern, which is also being considered for state endangered status (Hine, personal communication), and Caspian tern (S. caspia) are occasional visitors. Tessen (1976) indicates that wetland songbirds typical of the region are present, with a notable abundance of purple martins (Progne subis) and tree sparrows (Spizella arborea). During migratory periods, additional grebes, loons, herons, gulls, and passerines are present.

The literature search provided no site-specific information pertaining to recreational and commercial use, health, life histories, or major food sources of the birds utilizing the Dead Horse Bay Wetland Complex.

Mammals

Dead Horse Bay Wetlands #1 and #2 have been classified as "most desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). Peters Marsh has been classified as "most desirable" habitat for white-tailed deer (Odocoileus virginianus) and as "desirable" habitat for muskrat. Dead Horse Bay Wetlands #5, #6, and #7 have been classified as "most desirable" habitat for squirrels and white-tailed deer.

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting any of the eight wetlands of the Dead Horse Bay Wetland Complex.

Endangered Species

The double-crested cormorant, a species endangered in Wisconsin, nests in Dead Horse Bay Wetland #1 (Scharf et al., 1977). The peregrine falcon (Falco peregrinus) and the bald eagle (Haliaeetus leorcocephalus), both on the federal list, and the osprey (Pandion haliaetus), endangered in Wisconsin, are occasionally observed in the vicinity (e.g., Atkinson Marsh), especially during migration. The bald eagle and osprey historically nested along Green Bay but no longer do (Dundas, 1968).

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Dead Horse Bay Wetlands #1-#7 or Peters Marsh by the literature search.

Health

Site-specific information indicates that the environmental quality of the Dead Horse Bay Wetland Complex is very good. A large number and diversity of avifauna utilize the wetlands as a resting and breeding grounds and many are permanent inhabitants. An abundance of mammals can also be found. The Wisconsin Department of Natural Resources has designated each of the eight wetlands of the Dead Horse Bay Wetland Complex as Class I wildlife habitat.

CULTURAL SETTING LM 262-269

Population

Dead Horse Bay Wetlands #1-#7 and Peters Marsh are in Suamico Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-22. Population Data for the Vicinity of Dead Horse Bay Wetlands #1-#7 and Peters Marsh

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Suamico Township	3,555	25.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Dead Horse Bay Wetlands #1-#7 and Peters Marsh is rural open space. Land use in the surrounding area is predominantly rural open space with scattered areas of residential development, most notably to the immediate west of Peters Marsh and along the shore of Dead Horse Bay Wetlands #5-#7. A dumping ground is located adjacent to Dead Horse Bay Wetlands #1 and #2, and the dredged channel of the Green Bay Harbor federal navigation project lies to the east of these wetlands. Access roads are located in close proximity to Dead Horse Bay Wetlands #1-#7. Barrow pits lie to the west of Dead Horse Bay Wetland #3 (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971, and Green Bay West, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). Dead Horse Bay Wetlands #1 and #2 and part of Peters Marsh are under public ownership, while the remaining wetlands are under private ownership (Artcraft Company, 1978).

Dead Horse Bay Wetland #4 and Peters Marsh are within an area designated as a conservation objective. The remaining wetlands of the complex are within an area planned primarily for agricultural and non-urban residential uses, with a corridor planned for residential use along the shore of Dead Horse Bay (Brown County Regional Planning Commission, 1967).

Since Dead Horse Bay Wetland #4 and Peters Marsh are within an area designated as a conservation objective, developmental pressures appear to be low. The location of the remainder of the wetlands within an area planned for agricultural and residential uses suggests that these wetlands may be subject to moderate to high developmental pressures, assuming these plans are realized.

Recreation

There are no known state or federal recreational facilities in the vicinity of Dead Horse Bay Wetlands #1-#7 or Peters Marsh.

Mineral, Energy, and Forest Resources

Dead Horse Bay Wetlands #1-#7 and Peters Marsh are located in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland complex (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). There are no known oil, gas, or coal resources in the wetlands.

Dead Horse Bay Wetlands #3-#6 are within a large wooded area that extends, with only a few interruptions, approximately three miles inland (U.S.G.S. quadrangle map, Green Bay West, Wisconsin, 1971). It was not determined through the literature search whether this area is used for wood production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Dead Horse Bay Wetlands #1-#7 or Peters Marsh (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin 1971).

Pollution Sources

There are no NPDES permit holders adjacent to the wetlands in the Dead Horse Bay Wetland Complex (Wisconsin Industrial Discharge Section, 1978). Non-point sources of pollution in the area, including agricultural by-products, such as chlorinated hydrocarbons and manure, enter the surface and the underground water supply through runoff and seepage. Highway drainage and storm sewer runoff also contribute nutrients and road salts to the surface waters which can enter the groundwater of Brown County (Nelson and Fassbender, 1972).

Historical and Archaeological Features

No known historical sites exist within 500 feet of the wetlands (Wisconsin Historic Preservation Division, 1977), but the Wisconsin Inventory of Archaeology recognizes two sites in the vicinity of the Dead Horse Bay Wetland Complex. Information about these sites can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 262-269

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural

succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

LONG TAIL POINT WETLAND COMPLEX

PHYSIOGRAPHIC SETTING LM 270-273

Setting

The Long Tail Point Wetland Complex, comprised of Long Tail Point Wetlands #1 and #2 and Dead Horse Bay Wetlands #8 and #9, is located on the west side of Green Bay in Brown County, Wisconsin. The mouth of the Suamico River lies to the north of the wetlands, and the mouth of Duck Creek lies approximately four miles to the south. The Sensiba Wildlife Area, which is managed by the Wisconsin Department of Natural Resources, is located 0.5 mile north of the complex. All of the wetlands are situated adjacent to the Green Bay shoreline. Dead Horse Bay Wetlands #8 and #9 lie 2.0 miles southeast of the town of Suamico, Wisconsin, while Long Tail Point Wetlands #1 and #2 lie 2.5 and 4.0 miles, respectively, to the southeast of Suamico.

Long Tail Point Wetlands #1 and #2 are on a low sand spit extending 3.5 miles southeast into Green Bay. In times of low water levels, this sand spit forms a peninsula; however, the area is presently a series of small islands because of high water levels and severe erosion during recent years (Scharf et al., 1977). This area was once a federal refuge but is now a Wisconsin State Wildlife Area. Dead Horse Bay Wetland #8 lies within Green Bay at the base of Dead Horse Bay. Dead Horse Bay Wetland #9 is a low, non-wooded, Lacustrine System. The remainder of the wetlands in the complex are low, non-wooded, littoral Lacustrine wetlands (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin, 1971).

Topography

The wetlands in the Long Tail Point Wetland Complex have very slight relief. All wetland elevations are less than 585 feet above sea level, which is only 5 feet above the approximate mean elevation of Lake Michigan. The complex is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Dead Horse Bay Wetlands #8 and #9 and Long Tail Point Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976). Continuous sand spits are located

on the bed of Green Bay from Long Tail Point to Point au Sable (Wisconsin Bureau of Water and Shoreland Management, 1973).

Soils

There are two types of soil present in the Long Tail Point Wetland Complex, Markey muck and Roscommon loamy fine sand. Markey muck consists of moderately deep, very poorly drained organic soils, which formed in organic material derived from decayed wetland sedges, grasses, and reeds. Markey muck is found in shallow glacial lake basins and depressions on stream valleys. Roscommon loamy fine sand is a deep, poorly drained soil, comprised of black muck on the surface and black loamy fine sand underneath. Roscommon loamy fine sand has low natural fertility and a high amount of organic material. This soil is found in depressions on sandy lacustrine and outwash plains (Link et al., 1974).

Dead Horse Bay Wetland #8 is submerged and thus no soil mapping has been done. The soil type in Dead Horse Bay Wetland #9 is Markey muck, which is also found on the Dead Horse Bay side of Long Tail Point Wetland #1 and is more extensive than Roscommon loamy fine sand, found on the Green Bay side of the wetland. The soil type in Long Tail Point Wetland #2 is mostly Markey muck, with some Roscommon loamy fine sand found on the Green Bay side of the wetland (Link et al., 1974). Long Tail Point was formed by materials and sediments carried into Green Bay by the two Suamico Rivers (Dundas, 1968).

Hydrology

There are no streams flowing through the wetlands of the Long Tail Point Wetland Complex. Dead Horse Bay Wetland #8 is submerged in Dead Horse Bay. Dead Horse Bay Wetland #9 is adjacent to the bay, as are Long Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin, 1971). High water levels of recent years have transformed Long Tail Point into a series of small islands. Parts of the peninsula have been extensively eroded and are submerged, making accessibility difficult (Green Bay-Brown County Planning Commission, 1976).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on the wetlands in the Long Tail Point Wetland Complex, especially on Dead Horse Bay Wetland #8, which is submerged. The water level changes in Green Bay have been known to alter the size of the wetlands along the western shore, including those in the Long Tail Point Wetland Complex, to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; thus, periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem (Harris et al., 1977). The current high water levels have reduced the general quality of the wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons

and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. These fluctuations and resulting changes in the Fox River cause nutrient-and silt-laden water to inundate the wetlands in the Long Tail Point Wetland Complex (U.S. Army Corps of Engineers, Chicago District, 1976).

The poor quality of the water in lower Green Bay is demonstrated by the fact that extensive beds of wild celery once grew in Dead Horse Bay but have now been diminished by erosion of the soil from dredging activity (Dundas, 1968). Streams and groundwater provide high quality water compared to the present bad quality of Green Bay. Water quality data from Dead Horse Bay are presented in Table 22-23. These data may reflect conditions in Long Tail Point Wetlands #1 and #2 and Dead Horse Bay Wetlands #8 and #9. Additional water quality data for Green Bay are available in Patterson et al. (1975).

Table 11-23. Water Quality Data for Dead Horse Bay[a]

Date	Temperature (^{o}C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/22/74	16.0	11.3	0.080	0.300
9/ 4/74	19.0	10.2	0.076	0.600

[a] Patterson et al. (1975)

Groundwater levels in the wetlands are either at or near the surface (Green Bay-Brown County Planning Commission, 1976). The literature search provided no site-specific data pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Dead Horse Bay Wetlands #8 and #9 and Long Tail Point Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for the Long Tail Point Wetland Complex is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2^{o}F, the average daily low for January was 12.2^{o}F and the average daily high in July was 82.4^{o}F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28^{o}F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Long Tail Point Wetland Complex (U.S.G.S. quadrangle maps, Green Bay West, Wisconsin, 1971, and Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 270-273

Vegetation

Howlett (1974) provides an analysis of the vegetation of West Green Bay from the mouth of the Fox River to Peshtigo Point.

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation in the four wetlands comprising the Long Tail Point Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Long Tail Point Wetland Complex.

Invertebrates

Howmiller et al. (1970, 1971) provide information on seasonal distribution and density of the oligochaete fauna and the associated benthos of southern Green Bay. The species of oligochaetes collected in the bay are presented in Appendix B-3. These organisms probably occurred in the Long Tail Point Wetland Complex owing to its location contiguous to the bay.

General information on the invertebrates of Green Bay may be found in The Wisconsin State Committee on Water Pollution (1939), Surber et al. (1952), Balch et al. (1956), and Howmiller et al. (1970, 1971). However, the literature search produced no site-specific data pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in the four wetlands comprising the Long Tail Point Wetland Complex.

Reptiles and Amphibians

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to the Long Tail Point Wetland Complex. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and

commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated all of the Long Tail Point Wetland Complex as Class I wildlife habitat, "most desirable" for shore birds and gulls and terns (Thompson et al., 1976). High water in the early 1970's transformed the area from a peninsula to a series of small islands; related changes have taken place in the vegetation. In view of this situation, much information gathered prior to the high water may have only historical relevance. For example, a large cattail marsh existed in Dead Horse Bay Wetland #1 (LM 262) until 1973, when it was destroyed by high water. This wetland supported a large colony (175-200 pairs) of Forster's terns (Sterna forsteri), which are currently under consideration for state endangered status (Hine, Wisconsin Department of Natural Resources, Endangered Species Commmittee, personal communication), black terns (Chlidonias nigra), and numerous nesting green herons (Butorides striatus); two pairs of little gulls (Larus minutus) nested in the tern colony in 1972 (Scharf et al. 1977). The Forster's terns subsequently moved three miles south to the diked dredge-spoils disposal site in Atkinson Marsh (Arbib, 1975), which is rapidly being filled.

Scharf et al. (1977) have recently studied the avifauna of Long Tail Point Wetland #1 and state that although six species of ducks formerly nested there, only the mallard (Anas platyrhynchos) and gadwall ducks (A. strepera) currently do so. A gull colony exists on a 1.9 acre island within this wetland, and in 1976 seven pairs of herring gulls (L. argentatus) and three pairs of ring-billed gulls (Larus delawarensis) were observed nesting. A few herring gulls have always nested here, but the ring-billed gull is a recent addition. Scharf et al. predict that this gull colony will grow until water levels decline and the island becomes re-attached to the rest of the peninsula. Numerous nonbreeding gulls and terns also use this area for resting and feeding. On June 6, 1976, 185 herring gulls, 410 ring-billed gulls, 15 Bonaparte's gulls (Larus philadelphia), 5 Caspian terns (Sterna caspia), and 9 Forster's terns were observed. The black-crowned night heron (N. nycticorax) has nested in Long Tail Point Wetland #1 since at least 1940. This population is presently decreasing, probably because of a great increase in human disturbance. In 1976, a colony of 30 to 40 pairs existed in about 1.9 acres of flooded willows.

The Long Tail Point Wetland Complex is an important migratory focal point that is heavily used by waterfowl and shorebirds, particularly during fall migration (Tessen, 1976). The habitat between the mouth of Duck Creek and the Long Tail Point Wetland Complex is an important resting area for whistling swans (Olor columbianus) during migration. Peak numbers usually occur between late March and mid-April, when up to 20,000 have been observed; numbers are much lower in the fall. Migrant numbers have diminished in recent years as more swans utilize seasonally flooded fields in Brown and adjacent counties (Tessen, 1976). This reduction in swan flocks may result from vegetational changes occurring in Green Bay (Wallace, 1977).

Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to the Long Tail Point Wetland Complex are included, but care should be exercised in the interpretation of the relevance of these studies to these wetlands.

The literature search provided no site-specific information pertaining to productivity, recreational and commercial use, health, life histories, or major food sources of the birds utilizing the wetlands of the Long Tail Point Wetland Complex.

Mammals

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational use, life histories, food sources, or relationship to water levels of the mammals inhabiting the four wetlands comprising the Long Tail Point Wetland Complex.

Endangered Species

The double-crested cormorant (Phalacrocorax auritus), endangered in Wisconsin, has nested on a small island two miles to the south of the wetland complex since 1974 (Scharf et al., 1977). The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leorcocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed in the vicinity. The bald eagle and osprey historically nested along Green Bay but no longer do (Dundas, 1968).

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in the Long Tail Point Wetland Complex by the literature search.

Health

Site-specific information indicates that the environmental quality of the Long Tail Point Wetland Complex is good. Previous studies show that the wetlands were well used by avifauna, but recent high water may have had some effect on the health of the wetlands. The Wisconsin Department of Natural Resources has designated all four of the wetlands in the complex as Class I wildlife habitat.

Population

The Long Tail Point Wetland Complex is located in Suamico Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-24. Population Data for the Vicinity of the Long Tail Point Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Suamico Township	3,555	25.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetlands of this complex is rural open space, as is the land use in the surrounding area on Long Tail Point. The dredged channel of the Green Bay Harbor federal navigation project lies to the east of the wetlands. An abandoned lighthouse is located to the north of Long Tail Point Wetland #2. Barrow pits lie to the southwest of these wetlands and dumping grounds are located within Green Bay south of the wetlands (U.S.G.S. quadrangle maps, Green Bay West, Wisconsin, 1971, and Green Bay East, Wisconsin, 1971; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

Long Tail Point was proposed in 1968 by the Department of the Interior as a National Wildlife Refuge, but the proposal was never adopted. The area is presently utilized as a state-owned wildlife area (U.S. Army Corps of Engineers, 1976). Long Tail Point Wetlands #1 and #2 fall within this wildlife area. Dead Horse Bay Wetland #8 is under public ownership due to its location within the bay. Dead Horse Bay Wetland #9 is privately owned.

The location of Long Tail Point Wetlands #1 and #2 within a state controlled wildlife area suggests that the wetlands will be subject to minimal development pressures in the future. Dead Horse Bay Wetland #8 is located offshore, within the public domain. Assuming no plans for dredging of the wetland are forthcoming, the development pressures for Dead Horse Bay Wetland #8 can be viewed as low. Dead Horse Bay Wetland #9 is located within an area

designated for an environmental objective (Brown County Regional Planing Commission 1967). Assuming the present arrangements remain unchanged, Dead Horse Bay Wetland #9 can be viewed as having low development pressures.

Recreation

Long Tail Point Wetlands #1 and #2 lie within the 103-acre Long Tail Point Wildlife Area, and the 551-acre Sensiba Wildlife Area is located just north of the Suamico River, across the river from Dead Horse Bay Wetland #9. The wildlife areas on the western shore of Green Bay are used for a multiplicity of recreational uses of which the most significant is hunting, but the areas also receive use from sport and commercial fishing and trapping. In the summer the areas receive boating use with some large craft, while in the winter snowmobiling and cross-country skiing are popular (Green Bay-Brown County Planning Commission, 1977; Dan Olson, Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

The area in which the wetlands are situated is underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetlands (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976).

There are no significant forest resources present in Dead Horse Bay Wetlands #8 and #9 and Long Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle maps, Green Bay East, Wisconsin, 1971; Green Bay West, Wisconsin, 1971), nor are there any known oil, gas, or coal resources present in these wetlands.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Dead Horse Bay Wetland #8 (U.S.G.S. quadrangle map, Green Bay West, Wisconsin 1971); Dead Horse Bay Wetland #9 (U.S.G.S. quadrangle maps, Green Bay West, Wisconsin, 1971; Green Bay East, Wisconsin, 1971); or Long Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle map, Green Bay East, Wisconsin, 1971).

Pollution Sources

There are no NPDES permit holders adjacent to the wetlands in the Long Tail Point Wetland Complex (Wisconsin Industrial Discharge Section, 1978). Non-point sources of pollution in the area, including agricultural by-products (e.g., chlorinated hydrocarbons and manure), enter the surface and the underground water supply through runoff and seepage. Highway drainage and storm sewer runoff also contribute nutrients and road salts to the surface waters which can enter the groundwater of Brown County (Nelson and Fassbender, 1972).

Historical and Archaeological Features

A stone lighthouse, built in 1848, sits on the southern tip of Long Tail Point Peninsula near Long Tail Point Wetland #2 (Wisconsin Historic Preservation Division, 1978). A campsite workshop is located on a low, sandy strip of land extending into Green Bay from the west shore of the peninsula. Information regarding research and discoveries of this area can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 270-273

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

LITTLE TAIL POINT WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 274-275

Setting

The Little Tail Point Wetland Complex, comprised of Little Tail Point Wetlands #1 and #2, is located on the west side of Green Bay in Brown County, Wisconsin. Both of the wetlands are adjacent to the Green Bay shoreline, approximately 3.5 miles northeast of the town of Suamico, Wisconsin. Little Tail Point Wetland #1 occupies a low, non-wooded site on the mainland, south of the point at which Little Tail Point joins the mainland. Little Tail Point Wetland #2 lies on Little Tail Point, a low, wooded, sand and gravel bar extending into Green Bay (Scharf et al., 1977). Both wetlands are Lacustrine Systems (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954).

Topography

Little Tail Point Wetlands #1 and #2 have very slight relief; all wetland elevations are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetlands are situated in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; the topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Little Tail Point Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

There are three types of soil present in the Little Tail Point Wetland Complex: Markey muck, Roscommon loamy fine sand, and Tedrow loamy fine sand. Markey muck consists of moderately deep, very poorly drained organic soils, which formed in organic material derived from decayed wetland sedges, grasses, and reeds. Markey muck is found in shallow glacial lake basins and depressions on stream valleys. Roscommon loamy fine sand has low natural fertility and a high amount of organic material. This soil is found in depressions on sandy lacustrine and outwash plains. Tedrow loamy fine sand is a deep, somewhat poorly drained soil with a surface layer of dark-brown loamy fine sand underlain with mottled grayish-brown loamy fine sand. Tedrow loamy fine sand formed in

deep sands; it has low natural fertility and little organic matter. It is found on lacustrine or outwash plains (Link et al., 1974).

The northern part of Little Tail Point Wetland #1 has Roscommon loamy fine sand and the southern part has Markey muck soil. Markey muck is found on the western part of Little Tail Point Wetland #2; Roscommon loamy fine sand is found on the Green Bay side of the wetland, along with small pockets of Tedrow loamy fine sand (Link et al., 1974). Little Tail Point was formed by materials and sediments carried into Green Bay by the two Suamico Rivers (Dundas, 1968).

Hydrology

There are no streams or rivers flowing through Little Tail Point Wetlands #1 and #2. Little Tail Point Wetland #1 is adjacent to Green Bay, and Little Tail Point Wetland #2 is on a sand and gravel spit in Green Bay (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Little Tail Point Wetlands #1 and #2. The wetlands have a maximum elevation of five feet above lake level so a fluctuation of several inches in the water level can drastically change the amount of wetland that is submerged. The water level fluctuations in Green Bay have been known to reduce wetlands along the western shore, including Little Tail Point Wetlands #1 and #2, to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; thus, periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. Seiche activity in Little Tail Point Wetlands #1 and #2 acts as a catalyst for nutrient exchange between the wetlands and Green Bay (Harris et al., 1977). The current high water levels have reduced the general quality of the wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate; these fluctuations and resultant changes in the Fox River cause nutrient-and silt-laden water to inundate Little Tail Point Wetlands #1 and #2 (U.S. Army Corps of Engineers, Chicago District, 1976). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968). Water quality data from samples collected near Little Tail Point are presented in Table 11-25. These data may reflect conditions in the wetlands, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al. (1975).

Table 11-25. Water Quality Data for Green Bay Sampled Near Little Tail Point[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
9/18/73	--	--	0.040	0.400
6/ 3/74	13.0	10.8	--	--
9/ 4/74	18.0	9.1	--	--

[a] Patterson et al. (1975)

The groundwater levels in the wetlands are at or near the surface (Green Bay-Brown County Planning Commission, 1976). The literature search provided no site-specific data pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Little Tail Point Wetlands #1 and #2.

Climate

The closest weather station providing climatic data for the Little Tail Point Wetland Complex is located at Green Bay Airport, Wisconsin. In 1975, the average monthly temperature was 44.2°F, the average daily low for January was 12.2°F and the average daily high in July was 82.4°F. The average annual precipitation is 27.01 inches, with a mean monthly precipitation of 1.09 inches in January and 3.09 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Little Tail Point Wetland Complex (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 274-275

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Little Tail Point Wetlands #1 and #2.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Little Tail Point Wetlands #1 and #2.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Little Tail Point Wetlands #1 and #2.

Reptiles and Amphibians

Judging from the presence of small, quiet, open and duckweed-covered water areas, as well as wet meadows, in Little Tail Point Wetland #2 (Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), one can predict the presence of the American toad (Bufo americanus), northern leopard frog (Rana pipiens), snapping turtle (Chelydra serpentina), painted turtle (Chrysemys picta), Blanding's turtle (Emydoidea blandingi), and eastern garter snake (Thamnophis sirtalis) in this wetland.

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Little Tail Point Wetlands #1 and #2.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Little Tail Point Wetlands #1 and #2 as Class I wildlife habitat, "most desirable" for songbirds, waterfowl, and gulls and terns (Thompson et al., 1976).

The mallard (Anas platyrhynchos), black duck (A. rubripes), blue-winged teal (A. discors), green-winged teal (A. crecca), wood duck (Aix sponsa), and gadwall (Anas strepera) probably nest in Little Tail Point Wetland #2. The American coot (Fulica americana), common gallinule (Gallinula chloropus), black tern (Chlidonias nigra), yellow-headed blackbird (X. xanthocephalus), and red-winged blackbird (Agelaius phoeniceus) nest in the cattail stands of this wetland. Scharf et al. (1977) report 7 to 10 pairs of nesting green herons (Butorides striatus) and a Forster's tern (Sterna fosteri) colony (103 nests; 210 to 250 birds) in the wetland. A small colony of Forster's terns, a species that is being considered for endangered status in Wisconsin (Hine, Wisconsin Endangered Species Committee, personal communication), has existed on the west

side of this point since 1968. In 1976, the population greatly increased due to the influx of displaced birds from Sensiba Wildlife Area and Long Tail Point where high water had destroyed suitable nesting substrate (Scharf et al., 1977). The herring gull (Larus argentatus), ring-billed gull (L. delawarensis), and Bonaparte's gull (L. philadelphia) use Long Tail Point Wetland for feeding and resting.

Little Tail Point is an important focal point for migrating waterfowl, shore birds, and gulls and terns on Green Bay, particularly during the fall (Scharf et al., 1977). The Canada goose (Branta canadensis), northern shoveler (Anas clypeata), pintail (A. acuta), and common goldeneye (Bucephala clangula) have been reported in Little Tail Point Wetland #2 during migration.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing the Little Tail Point Wetland Complex.

Mammals

The two wetlands of the Little Tail Point Wetland Complex have been classified as "most desirable" habitat for furbearers (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to major species, seasonal distribution and abundance, density and productivity, recreational use, life histories, food sources, or relationship to water levels of the mammals inhabiting the two wetlands comprising the Little Tail Point Wetland Complex.

Endangered Species

The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leucocephalus), both on the federal list, and the osprey (Pandion haliaetus), endangered in Wisconsin, are occasionally observed in southern Green Bay, especially during migration. The bald eagle and osprey historically nested along the western shore of Green Bay but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), endangered in Wisconsin, nests on islands in the bay. However, no other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in the Long Tail Point Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat.

CULTURAL SETTING LM 274-275

Population

Little Tail Point Wetlands #1 and #2 are located in Suamico Township of Brown County, Wisconsin. The county has a moderate population density of 302 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975. Projections for 1990 indicate that rapid population growth is expected to continue in Brown County.

Table 11-26. Population Data for the Vicinity of Little Tail Point Wetlands #1 and #2

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Brown County	169,467	7.1	212,150
Suamico Township	3,555	25.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Little Tail Point Wetlands #1 and #2 is rural open space, while the surrounding area is characterized primarily by agricultural open space uses with occasional rural residences. An area south of Little Tail Point Wetland #1 has been filled and a boat dock has been built there. The dredged channel of the Green Bay Harbor federal navigation project lies to the east of Little Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetlands are under private ownership (Artcraft Company, 1978).

Little Tail Point Wetland #1 is planned for use as a conservation area, while Little Tail Point Wetland #2 is situated within an area planned for agricultural and non-urban residential use (Regional Planning Commission of Brown County, 1967). Little Tail Point Wetland #1 may be subject to moderate development pressures, if these plans are realized.

Recreation

There are no known state or federal recreational facilities in the vicinity of Little Tail Point Wetlands #1 and #2.

Mineral, Energy, and Forest Resources

The area in which Little Tail Point Wetlands #1 and #2 are located is underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to these wetlands (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976).

There are no significant forest resources present in Little Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Little Tail Point Wetlands #1 and #2 (U.S.G.S. quadrangle map, New Franken, Wisconsin 1954). The area north of the wetlands, however, is owned by the Wisconsin Public Service Corporation. A nuclear power plant is proposed to be built at the site (Scharf et al., 1977).

Pollution Sources

There are no NPDES permit holders adjacent to Little Tail Point Wetlands #1 and #2 (Wisconsin Industrial Discharge Section, 1978). Non-point sources of pollution in the area, including agricultural by-products (e.g., chlorinated hydrocarbons and manure), enter the surface and the underground water supply through runoff and seepage. Highway drainage and storm sewer runoff also contribute nutrients and road salts to the surface waters which can enter the groundwater of Brown County (Nelson and Fassbender, 1972).

Historical and Archaeological Features

No known historical sites exist within 500 feet of Little Tail Point Wetlands #1 and #2 (Wisconsin Historic Preservation Division, 1978), but the Wisconsin Inventory of Archaeology lists one archaeological site (BR #175) in the Little Tail Peninsula. Information regarding the field findings for this site can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

LITTLE SUAMICO TOWNSHIP WETLAND

PHYSIOGRAPHIC SETTING LM 276

Setting

Little Suamico Township Wetland is located on the western side of Green Bay in Oconto County, Wisconsin, 0.1 mile from the Green Bay shoreline and four miles east of the community of Sobieski. This Palustrine wetland occupies a low, partially wooded site between the mouths of Tibbet Creek and Little Suamico River (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954).

Topography

Little Suamico Township Wetland has very slight relief; elevations in the wetland are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; the topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland management, 1973).

Surficial Geology

The surficial geology for Little Suamico Township Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Little Suamico Township Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, woods, and mosses (Hole et al., 1968).

Hydrology

There are no streams flowing through Little Suamico Township Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches; these fluctuations are large enough to have an impact on Little Suamico Township Wetland. Since the wetland has a maximum elevation of five feet above lake level, a fluctuation of several inches in the water level can drastically change the amount of wetland that is submerged. The

water level fluctuations in Green Bay have been known to reduce wetlands along the western shore, including Little Suamico Township Wetland, to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem (Harris et al., 1977). The current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. These fluctuations and resultant changes in the Fox River may cause nutrient-and silt-laden water to inundate Little Suamico Township Wetland (U.S. Army Corps of Engineers, Chicago District, 1976). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968). Water quality data from samples collected near Little Tail Point are presented in Table 11-27, and may reflect conditions in Little Suamico Township Wetland, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al., (1975).

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Little Suamico Township Wetland.

Table 11-27. Water Quality Data for Green Bay Sampled Near Little Tail Point[a]

Date	Temperature (^{o}C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
9/18/73	13.7	9.6	0.034	0.600
5/20/74	10.0	12.2	--	--

[a] Patterson et al. (1975)

Climate

The closest weather station providing climatic data for Little Suamico Township Wetland is located in Oconto, Wisconsin. In 1975, the average monthly temperature was 43.4^{o}F, the average daily low for January was 8.7^{o}F and the average daily high in July was 82.9^{o}F. The average annual precipitation is

28.78 inches, with a mean monthly precipitation of 1.18 inches in January and 3.20 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Little Suamico Township Wetland lies between the mouths of Tibbet Creek and Little Suamico River. Abandoned meanders of the Suamico River are located nearby (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978).

BIOTIC SETTING LM 276

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Little Suamico Township Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Little Suamico Township Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Little Suamico Township Wetland.

Reptiles and Amphibians

The American toad (Bufo americanus) has been collected from the general vicinity of Suamico (Suzuki, 1950).

Judging from the presence of a variety of suitable habitats (e.g., small, quiet, open and duckweed-covered water areas, wet meadows, and interspersed sand ridges) associated with Little Suamico Township Wetland (Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), one can predict the presence of the American toad, northern leopard frog (Rana pipiens), snapping turtle (Chelydra serpentina), painted turtle (Chrysemys picta), Blanding's turtle (Emydoidea blandingi), eastern garter

snake (Thamnophis s. sirtalis), northern red-bellied snake (Storeria o. occipitomaculata) and eastern hognose snake (Heterodon platyrhinos) in this wetland.

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Little Suamico Township Wetland. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Little Suamico Township Wetland as Class I wildlife habitat "most desirable" for songbirds, ruffed grouse (Bonasa umbellus), waterfowl, and gulls and terns, and "desirable" for shore birds (Thompson et al., 1976).

Tessen (1976) characterizes the area surrounding Little Suamico Township Wetland as having moderate numbers of passerine birds during spring migration, including warblers, sparrows, vireos, thrushes, flycatchers, and finches. The autumn passerine migration is more diffuse and is frequently augmented by great numbers and varieties of hawks. Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to Little Suamico Township Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland. The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Little Suamico Township Wetland.

Mammals

Little Suamico Township Wetland has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational use, life histories, food sources, or relationship to water levels of the mammals inhabiting Little Suamico Township Wetland.

Endangered Species

The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leurcocephalus), and the osprey (Pandion haliaetus), are all endangered in Wisconsin, and are occasionally observed along the western shore of lower Green Bay, especially during migration. The bald eagle and osprey historically nested here but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also endangered in Wisconsin, nests on islands in Green Bay. However, no other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Little Suamico Township Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat.

CULTURAL SETTING LM 276

Population

Little Suamico Township Wetland is located in Little Suamico Township of Oconto County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975, and projections for 1990 indicate that rapid population growth is expected to continue in Oconto County.

Table 11-28. Population Data for the Vicinity of Little Suamico Township Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Oconto County	27,356	7.1	34,240
Little Suamico Township	1,386	21.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Little Suamico Township Wetland is rural open space. The surrounding area is characterized primarily by agricultural open space uses with small residential areas. An access road lies to the north of the wetland

(U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication). The agricultural use of the area surrounding the wetland suggests that the wetland may be subject to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Little Suamico Township Wetland.

Mineral, Energy, and Forest Resources

Little Suamico Township Wetland is situated in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). There are no known oil, gas, or coal resources in the wetland.

Little Suamico Township Wetland is partially wooded (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). It was not determined through the literature search whether the wooded area is used for commercial production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Little Suamico Township Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Little Suamico Township Wetland (Wisconsin Industrial Discharge Section, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Little Suamico Township Wetland (Wisconsin Historic Preservation Division, 1978), but the Wisconsin Inventory of Archaeology lists one archaeological site (OC #97) in the vicinity of Little Suamico Township Wetland. Information on the period identification and field findings for the site can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

MUD CREEK WETLAND

PHYSIOGRAPHIC SETTING

LM 277

Setting

Mud Creek Wetland is located approximately 200 feet from the western shore of Green Bay in Oconto County, Wisconsin, 3.5 miles east of the community of Sobieski Corners. Mud Creek Wetland is a Palustrine System and occupies a low, non-wooded site approximately 0.5 mile north of the mouth of Tibbet Creek (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954).

Topography

Mud Creek Wetland has very slight relief; elevations in the wetland are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management 1973).

Surficial Geology

The surficial geology for Mud Creek Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Mud Creek Wetland is Peat, which consists of organic material derived from sedges, reeds, woods, and mosses. This soil is poorly drained and is generally found in level areas (Hole et al., 1968).

Hydrology

It is not evident from the U.S.G.S. quadrangle map whether Mud Creek is adjacent to Mud Creek Wetland or flows through it. There is no apparent elevational change in Mud Creek as it flows towards Green Bay (U.S.G.S quadrangle map, New Franken, Wisconsin, 1954).

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Mud Creek Wetland. Since the wetland has a maximum elevation of five feet above lake level, a fluctuation of several inches in the water level can

drastically change the amount of wetland that is either submerged or exposed. The water level fluctuations in Green Bay have been known to reduce wetlands along the western shore to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. The current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. These fluctuations and resultant changes in the Fox River may cause nutrient-and silt-laden water to inundate Mud Creek Wetland (U.S. Army Corps of Engineers, Chicago District, 1976). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968).

Water quality data sampled above Little Tail Point, presented in Table 11-29, may reflect conditions in Mud Creek Wetland, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al. (1975).

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Mud Creek Wetland.

Table 11-29. Water Quality Data for Green Bay Sampled Above Little Tail Point[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorous (mg/l)	Nitrogen (mg/l)
9/18/73	13.7	9.6	0.034	0.600
5/20/74	10.0	12.2	--	--

[a] Patterson et al. (1975)

Climate

The closest weather station providing climatic data for Mud Creek Wetland is located in Oconto, Wisconsin. In 1975, the average monthly temperature was 43.4°F, the average daily low for January was 8.7°F and the average daily high in July was 82.9°F. The average annual precipitation is 28.78 inches, with a mean monthly precipitation of 1.18 inches in January and 3.20 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Mud Creek Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 277

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation in Mud Creek Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Mud Creek Wetland.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in Mud Creek Wetland.

Reptiles and Amphibians

Appendix C-11 contains general information on amphibians and reptiles of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Mud Creek Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Mud Creek Wetland as Class I wildlife habitat, "most desirable" to songbirds, ruffed grouse (Bonasa umbellus), waterfowl, and gulls and terns, and "desirable" to shore birds (Thompson et al., 1976).

Tessen (1976) characterizes the area surrounding Mud Creek Wetland as having moderate numbers of passerine birds during spring migration, including warblers, sparrows, viroes, thrushes, flycatchers, and finches. The autumn passerine migration is more diffuse and is frequently augmented by great numbers and varieties of hawks.

Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to Mud Creek Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing Mud Creek Wetland.

Mammals

Mud Creek Wetland has been classified as "most desirable" habitat for squirrels and white-tailed deer (Odocoileus virginianus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report). A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Mud Creek Wetland.

Endangered Species

The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leucocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed along the western shore of lower Green Bay,

especially during migration. The bald eagle and osprey historically nested here but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also on the state endangered list, nests on islands in Green Bay.

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Mud Creek Wetland by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of this wetland. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitats.

CULTURAL SETTING LM 277

Population

Mud Creek Wetland is located in Little Suamico Township of Oconto County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975, and projections for 1990 indicate that rapid population growth is expected to continue in Oconto County.

Table 11-30. Population Data for the Vicinity of Mud Creek Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Oconto County	27,356	7.1	34,240
Little Suamico Township	1,386	21.8	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Mud Creek Wetland and the surrounding area is rural open space. A system of drainage ditches lies immediately to the south of Mud Creek Wetland. Access roads lie to the west and north (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication), but the rural nature of the area suggests that Mud Creek Wetland is subject to low development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Mud Creek Wetland.

Mineral, Energy, and Forest Resources

Trenton-Galena limestone is present in the vicinity of Mud Creek Wetland (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976).

There are no significant forest resources present in Mud Creek Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin, 1954; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Mud Creek Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin 1954).

Pollution Sources

There are no NPDES permit holders adjacent to Mud Creek Wetland (Wisconsin Industrial Discharge Section, 1978). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Mud Creek Wetland (Wisconsin Historic Preservation Division, 1978), but the Wisconsin Inventory of Archaeology indicates the presence of one archaeological site (OC #18) near Mud Creek Wetland. Information on the period identification and field findings for this site can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 277

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research

Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

CHARLES POND AREA WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 278-279

Setting

The Charles Pond Area Wetland Complex, comprised of Kirchner Creek Area Wetland and Charles Pond Wetland, is located on the west side of Green Bay in Oconto County, Wisconsin. Both of these wetlands are situated adjacent to the shoreline of Green Bay, approximately four miles south of the town of Pensaukee (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956; New Franken, Wisconsin, 1954).

Charles Pond Wetland is owned by the State of Wisconsin and managed by the State Department of Natural Resources as Charles Pond Wildlife Area. Charles Pond is formed by a bay-mouth bar with only a narrow outlet to Green Bay. The pond is actually a bay within a bay. The shallow wetland extends southward from the pond more than 0.3 mile, and a 40-acre stand of hardwood forest lies to the west. Part of this acreage (approximately 12 acres) has never been cut or subjected to disturbance of any kind (Wisconsin Scientific Areas Preservation Council, 1968). The wetland area is periodically swept by wildfire, with generally beneficial results (Wisconsin Scientific Areas Preservation Council, 1968). Much of the wetland area visible in past years is now inundated by high water, and only the tips of hardy shrubs remain to indicate the outline of the bay.

The shoreline in the vicinity of the wetlands has been described as a soupy mush of silt, organic debris, and dead trees. It is vegetated in stabilized parts by weeds (Wisconsin Scientific Areas Preservation Council, 1968). Charles Pond Wetland is a low, partially wooded, Lacustrine System, while Kirchner Creek Area Wetland is a low, non-wooded, Palustrine System (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956; New Franken, Wisconsin, 1954).

Topography

Charles Pond Wetland and Kirchner Creek Area Wetland have very slight relief; elevations in the wetlands are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetlands are located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland management, 1973).

Surficial Geology

The surficial geology of Charles Pond Wetland and Kirchner Creek Area Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Charles Pond Wetland and Kirchner Creek Area Wetland is Peat, which consists of organic material derived from sedges, reeds, woods, and mosses. This soil is poorly drained and is generally found in level areas (Hole et al., 1968). The shore of Charles Pond consists of silt and organic debris (Wisconsin Scientific Areas Preservation Council, 1973)

Hydrology

An intermittent stream flows through Charles Pond Wetland and another intermittent stream flows between Charles Pond Wetland and Kirchner Creek Area Wetland. A small, unnamed stream originates in Kirchner Creek Area Wetland and flows into Green Bay. Both Charles Pond Wetland and Kirchner Creek Area Wetland are adjacent to Green Bay, and Charles Pond Wetland is adjacent to Charles Pond (U.S.G.S. quadrangle maps, New Franken, Wisconsin, 1954, Oconto, Wisconsin, 1956). Water quality data for Charles Pond presented in table 11-31 may reflect conditions in Charles Pond Wetland. Additional information is available from the files of the Wisconsin Scientific Areas Preservation Council.

Table 11-31. Water Quality Data for Charles Pond[a]

Date	Kjeldahl nitrogen (ppm.)	Total phosphorus (ppm.)	pH	Alkalinity (ppm.)	Temp. (^{o}F)	Dissolved oxygen (ppm.)
4/16/69	1.00	0.60	7.8	88	49	8.7
7/23/69	0.85	0.30	7.0	--	75	6.8

[a] Wisconsin Scientific Areas Preservation Council (1969)

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Kirchner Creek Wetland and Charles Pond Wetland. Since both of the wetlands have a maximum elevation of five feet above lake level, fluctuations of several inches in the water level can drastically change the amount of wetland that is submerged. The water level fluctuations in Green Bay have been known to reduce wetlands along the western shore, including Kirchner Creek Area Wetland

and Charles Pond Wetland, to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. The current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Water quality data from Green Bay off shore from Charles Pond, presented in Table 11-32, may reflect conditions in the wetlands, expecially during high water periods.

The Fox River is an important determinant of water quality in Green Bay. Strong northerly winds and changes in barometric pressure help cause the water levels in Green Bay to fluctuate. These fluctuations and resultant changes in the Fox River may cause nutrient-and silt-laden water to inundate Kirchner Creek Area Wetland and Charles Pond Wetland (U.S. Army Corps of Engineers, Chicago District, 1976). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968). Additional water quality data for Green Bay are available in Patterson et al. (1975).

Table 11-32. Water Quality Data for Green Bay Sampled Near Charles Pond[a]

Date	Temperature (^{o}C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
9/18/73	13.0	10.0	0.040	0.600
5/20/74	10.0	11.7	--	--

[a] Patterson et al. (1975)

The groundwater level in the wetlands is either at or near the surface (Green Bay-Brown County Planning Commission, 1976). The literature search provided no published, site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Kirchner Creek Area Wetland and Charles Pond Wetland.

Climate

The closest weather station providing climatic data for the Charles Pond Area Wetland Complex is located in Oconto, Wisconsin. In 1975, the average monthly temperature was 43.4°F, the average daily low for January was 8.7°F and the average daily high in July was 82.9°F. The average annual precipitation is 28.78 inches, with a mean monthly precipitation of 1.18 inches in January and 3.20 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special fetures are found in the vicinity of the Charles Pond Area Wetland Complex (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956, and New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial reconnaissance, 1978).

BIOTIC SETTING LM 278-279

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation in the two wetlands comprising the Charles Pond Area Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Charles Pond Area Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Charles Pond Area Wetland Complex.

Reptiles and Amphibians

Judging from the presence of shallow, semi-quiet open water areas and wet meadows in these wetlands, and of associated sand, brush, and forest margins (Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), one can predict the presence of the American toad (Bufo

americanus), northern leopard frog (Rana pipiens), snapping turtle (Chelydra serpentina), and eastern garter snake (Thamnophis s. sirtalis) in the Charles Pond Area Wetland Complex.

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Kirchner Creek Area Wetland and Charles Pond Wetland. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food source, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Kirchner Creek Area Wetland and Charles Pond Wetland as Class I wildlife habitat, "most desirable" to waterfowl, gulls and terns, and shore birds. Kirchner Creek Area Wetland is also of "supplemental value" to pheasant (Phasianus colchicus) (Thompson et al., 1976).

Charles Pond Wetland is one of the state Wildlife Areas along Green Bay administered by the Marinette Game Office. Several small potholes have been constructed in the wetland around the pond to improve the habitat for waterfowl (Wisconsin Scientific Areas Preservation Council, 1967). Table 11-33 summarizes some casual bird sightings made in 1969 by the Wisconsin Department of Natural Resources. The eastern wood pewee (Contopus virens), red-eyed vireo (Vireo olivaceus), and rose-breasted grosbeak (Pheucticus ludovicianus) were seen on the edge of the maple-basswood-elm forest that is adjacent to the wetland.

The literature search provided no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, health, life histories, relationship to water levels, or major food sources of the birds utilizing the Charles Pond Area Wetland Complex.

Mammals

Kirchner Creek Wetland has been classified as "supplemental" habitat, and Charles Pond Wetland as "desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of

Table 11-33. Bird Observations of Charles Pond Wetland in 1969[a]

	May 1	May 15	July 22	Sept. 25
great blue heron			3	
green heron			2	
mallard	11		3	4
gadwall	2			
northern shoveler	7			
wood duck				6
scaup spp.	102			
surf scoter				7
common merganser	6			
American coot	1			40
killdeer			3	
herring gull	30			
common tern				4
black tern			20	
eastern wood pewee		--[b]		
tree swallow			--	--
red-eyed vireo		--		
rose-breasted grosbeak				
long-billed marsh wren		--	--	
swamp sparrow	--			

[a]Wisconsin Department of Natural Resources (1969d)
[b]Species observed but not counted

the mammals inhabiting the two wetlands comprising the Charles Pond Area Wetland Complex.

Endangered Species

The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leucocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed along the western shore of lower Green Bay, especially during migration. The bald eagle and osprey historically nested here but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also endangered in Wisconsin, nests on islands in Green Bay. However, no other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in the Charles Pond Area Wetland Complex by the literature search.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated these wetlands as Class I wildlife habitat.

CULTURAL SETTING

LM 278-279

Population

Charles Pond Wetland and Kirchner Creek Area Wetland are located in Pensaukee Township of Oconto County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975, and projections for 1990 indicate that rapid population growth is expected to continue in Oconto County.

Table 11-34. Population Data for the Vicinity of Charles Pond Wetland and Kirchner Creek Area Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Oconto County	27,356	7.1	34,240
Pensaukee Township	990	14.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within the wetlands of this complex is rural open space. The surrounding area is characterized primarily by agricultural and other rural open space uses. Small areas of residential development are located along the lakeshore just to the east of Kirchner Creek Area Wetland and to the north of Charles Pond Wetland. Residential development is also present along the northwest inland boundary of Charles Pond Wetland. An access road lies between Kirchner Creek Area Wetland and the Green Bay shoreline. A secondary highway lies landward of Charles Pond Wetland and a boat canal is located to the north of this wetland (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956, and New Franken, Wisconsin, 1954; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

Charles Pond Wetland was designated in 1965 as the Charles Pond Scientific Area, covering 110 acres (Wisconsin Scientific Areas Preservation Council, 1977). The wetland is under state ownership except for the northern tip, which is privately owned. Kirchner Creek Area Wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication).

The portion of Charles Pond Wetland within the Charles Pond Scientific Area is under minimal development pressures. The agricultural nature of the surrounding area suggests that the remainder of Charles Pond Wetland, as well as Kirchner Creek Area Wetland, may be subject to low to moderate development pressures.

Recreation

There are no known state or federal recreational facilities in the vicinity of Charles Pond Wetland or Kirchner Creek Area Wetland.

Mineral, Energy, and Forest Resources

The two wetlands are situated in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetlands (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). No known oil, gas, or coal resources are present in Charles Pond Wetland or Kirchner Creek Area Wetland.

There are no significant forest resources present in Kirchner Creek Area Wetland. Charles Pond Wetland is partially wooded (U.S.G.S. quadrangle map, Oconto Wisconsin, 1956; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). It was not determined through the literature search whether this wooded area is used for commercial production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Kirchner Creek Area Wetland (U.S.G.S. quadrangle map, New Franken, Wisconsin 1954) or Charles Pond Wetland (U.S.G.S. quadrangle map, Oconto, Wisconsin, 1956).

Pollution Sources

There are no NPDES permit holders adjacent to Kirchner Creek Area Wetland and Charles Pond Wetland (Wisconsin Industrial Division of Environmental Standards, 1976). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

There are no known historical sites within 500 feet of the Charles Pond Area Wetland Complex, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 278-279

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

PENSAUKEE RIVER WETLAND COMPLEX

PHYSIOGRAPHIC SETTING

LM 280-282

Setting

The Pensaukee River Wetland Complex, comprised of Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2, is located near the mouth of the Pensaukee River on the western shore of Green Bay, in Oconto County, Wisconsin. All of the wetlands in the complex are adjacent to the shoreline. Pensaukee River Wetland is four miles south of the town of Oconto, Wisconsin. Pensaukee River Area Wetlands #1 and #2 are 3.3 miles and 2.2 miles, respectively, south of Oconto. All of the wetlands in this complex are low, Lacustrine Systems. Pensaukee River Wetland and Pensaukee River Area Wetland #1 are partially wooded, and Pensaukee River Area Wetland #2 is non-wooded (U.S.G.S. quadrangle map, Oconto, Wisconsin, 1956).

Topography

Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 have very slight relief. Elevations in these wetlands are less than 585 feet above sea level (5 feet above the approximate mean elevation of Lake Michigan). The wetlands are located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type for Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, woods, and mosses (Hole et al., 1968).

Hydrology

The Pensaukee River flows through the middle of Pensaukee River Wetland with little change in elevation. An intermittent stream having a change in

elevation of approximately five feet flows through the southern portion of Pensaukee River Wetland. There are no streams flowing through Pensaukee River Area Wetlands #1 and #2. Limited hydrologic information, such as stream flow, temperature, and suspended sediment analysis, is available for the Pensaukee River, sampled two miles upstream from Pensaukee River Wetland (U.S. Geological Survey 1977). Runoff in the Pensaukee River drainage basin is heavy and may cause significant amounts of suspended solids to enter the Pensaukee River (Wisconsin Division of Environmental Protection, 1971). The effect of the river on Pensaukee River Wetland is unknown. Water quality data for Pensaukee River Wetland are available from samples taken on September 25, 1969. The pH value was 8.2, while Kjeldahl nitrogen and total phosphorus were 1.56 and 0.20 parts per million, respectively (Wisconsin Scientific Areas Preservation Council, 1969). Additonal water quality data for this wetland are available from the files of the Wisconsin Scientific Areas Preservation Council.

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2. The water level fluctuations in Green Bay have been known to reduce wetlands along the western shore, including those in the Pensaukee River Wetland Complex to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. The current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968). Additional water quality information for Green Bay is available in Patterson et al. (1975).

Water quality data collected offshore of Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 are presented in Table 11-35. These data may reflect conditions in the wetlands, especially during high water periods.

Table 11-35. Water Quality Data for Green Bay Sampled Near the Pensaukee River Wetland Complex[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
9/18/73	13.0	10.0	0.040	0.600
5/20/74	10.0	11.7	--	--

[a] Patterson et al. (1975)

The groundwater level in the wetlands are often at or near the surface (Wisconsin Division of Environmental Protection, 1971). The literature search provided no published, site-specific information pertaining to groundwater drainage patterns and runoff, water quality, depth, or seasonal changes in Pensaukee River Area Wetlands #1 and #2, or to groundwater drainage patterns and runoff, depth, or seasonal changes in Pensaukee River Wetland.

Climate

The closest weather station providing climatic data for Pensaukee River Wetland Complex is located in Oconto, Wisconsin. In 1975, the average monthly temperature was 43.4°F, the average daily low for January was 8.7°F and the average daily high in July was 82.9°F. The average annual precipitation is 28.78 inches, with a mean monthly precipitation of 1.18 inches in January and 3.20 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of the Pensaukee River Wetland Complex (U.S.G.S. quadrangle map, Oconto, Wisconsin, 1956; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 280-282

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation in the three wetlands comprising the Pensaukee River Wetland Complex.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in the Pensaukee River Wetland Complex.

Invertebrates

The literature search produced no site-specific data pertaining to species composition, seasonal distribution and abundance, density and productivity, food sources, or relationship to water levels of the invertebrates present in the Pensaukee River Wetland Complex.

Reptiles and Amphibians

Leroy Lintereur (Wisconsin Department of Natural Resources, personal communication) has indicated that the American toad (Bufo americanus), green frog (Rana clamitans), northern leopard frog (R. pipiens), wood frog (R. sylvatica), snapping turtle (Chelydra serpentina), painted turtle (Chrysemys picta), Blanding's turtle (Emydoidea blandingi), and eastern garter snake (Thamnophis s. sirtalis) occur in the Pensaukee River Wetland Complex. Another record of the leopard frog in Pensaukee Township is given by Vogt (1978, in preparation).

Appendix C-11 contains general information on reptiles and amphibians of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to the Pensaukee River Wetland Complex. The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food source, or relationship to water levels of the reptiles and amphibians in these wetlands.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated the area south of the Pensaukee River in Pensaukee River Wetland as Class II wildlife habitat, "most desirable" to waterfowl, "desirable" to songbirds, gulls and terns, and shore birds, and of "supplemental value" to pheasant (Phasianus colchicus). The area north of the Pensaukee River in Pensaukee River Wetland is Class I wildlife habitat, "most desirable" to songbirds, waterfowl, and gulls and terns, and "desirable" to shore birds (Thompson et al., 1976). Part of Pensaukee River Wetland lies in the Pensaukee Wildlife Area, administered by the Wisconsin Department of Natural Resources-Marinette Game office. This wetland habitat is excellent for ducks and gulls through much of the year, terns from May to October, and passerine birds from April until November (Tessen, 1976).

The Wisconsin Department of Natural Resources designated Pensaukee River Area Wetlands #1 and #2 as Class I wildlife habitat (Thompson et al., 1976). The former is "most desirable" to songbirds, waterfowl, and gulls and terns, and

"desirable" to shore birds; the latter is "most desirable" to waterfowl and gulls and terns, and "desirable" to shore birds.

Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to the Pensaukee River Wetland Complex are included, but care should be exercised in the interpretation of the relevance of these studies to these wetlands. The literature search yielded no site-specific information pertaining to seasonal abundance, density and productivity, recreational and commercial use, life histories, food sources, and relationship to water levels of the birds utilizing the Pensaukee River Wetland Complex.

Mammals

Pensaukee River Wetlands #1 and #2 have been classified as "desirable" habitat for white-tailed deer (Odocoileus virginianus), and Pensaukee River Wetland #3 has been classified as "desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink, and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting the three wetlands comprising the Pensaukee River Wetland Complex.

Endangered Species

The peregrine falcon (Falco peregrinus), the bald eagle (Haliaeetus leucocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed along the western shore of lower Green Bay, especially during migration. The bald eagle and the osprey historically nested here but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also endangered in Wisconsin, nests on islands in Green Bay. However, no plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in the Pensaukee River Wetland Complex.

Health

The available information is not sufficient to allow an evaluation of the environmental quality of these wetlands. However, the Wisconsin Department of Natural Resources has designated them as Class I and II wildlife habitat. A fish reduction plant is located nearby, and may have some effect on the health of the wetlands.

BIOTIC SETTING

LM 280-282

Population

Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 are located in Pensaukee Township of Oconto County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Both the county and the township experienced a rapid rate of population growth between 1970 and 1975, and projections for 1990 indicate that rapid population growth is expected to continue in Oconto County.

Table 11-36. Population Data for the Vicinity of the Pensaukee River Wetland Complex

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Oconto County	27,356	7.1	34,240
Pensaukee Township	990	14.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Pensaukee River Wetland and Pensaukee River Area Wetlands #1 and #2 is primarily rural open space. The surrounding area is under mixed agricultural and other rural open space uses. There are residential areas along the lakeshore to the north and the south of the wetlands and a small area of residential and commercial development (the town of Pensaukee) on the Pensaukee River just west of Pensaukee River Wetland. Two access roads and a secondary highway lie within Pensaukee Wetland. Four small, man-made ponds have been constructed within the wetland. A dredged canal extends lakeward from the mouth of the Pensaukee River through this wetland, and a harbor light marks the channel (U.S.G.S. quadrangle map, Oconto, Wisconsin, 1956; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

The southern portion of Pensaukee River Wetland is under state ownership. The remainder of the wetland is under private ownership. Pensaukee River Area Wetlands #1 and #2 are privately owned (Bay-Lake Regional Planning Commission, personal communication).

The portion of Pensaukee River Wetland #1 under state ownership is assumed to be under minimal development pressures. The primarily agricultural and residential nature of the area suggests that the remainder of Pensaukee River Wetland as well as Pensaukee River Area Wetlands #1 and #2 may be subject to low to moderate development pressures.

Recreation

The southern portion of Pensaukee River Wetland lies within the Pensaukee Wildlife Area. The wildlife areas on the west shore of Green Bay are used for a multiplicity of recreational uses. The most significant use is hunting, but the areas also are used for sport and commercial fishing and trapping. In the summer the areas receive boating use with some large craft, while in the winter snowmobiling and cross-country skiing are popular (Dan Olson, Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

The wetlands are located in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetlands (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). No known oil, gas, or coal resources are present in the wetlands.

There are no significant forest resources present in Pensaukee River Area Wetland #2. Pensaukee River Wetland and Pensaukee River Area Wetland #1 are partially wooded (U.S.G.S. quadrangle map, Oconto Wisconsin, 1956). It was not determined through the literature search whether these wooded areas are used for commercial production.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Pensaukee River Wetland or Pensaukee River Area Wetlands #1 and #2 (U.S.G.S. quadrangle map, Oconto, Wisconsin 1956).

Pollution Sources

As of 1971, the Shilling Fish Company, Incorporated, operated a fish reduction plant near the mouth of the Pensaukee River. Excess process liquid wastes and sanitary sewage were dumped into a shallow holding pond probably located in Pensaukee River Wetland. These wastes, when not treated, have a strong odor and constitute one of the major pollution problems in the Pensaukee

River Basin. It is not known if this plant is still in operation or if it is a current NPDES permit holder. The past and present effects of this fish plant on Pensaukee River Wetland are unknown (Wisconsin Deivision of Environmental Protection, 1971). No other NPDES permit holders are adjacent to the wetlands in the Pensaukee River Wetland Complex (Wisconsin Industrial Discharge Section, 1978).

No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

There are no known historical sites within 500 feet of Pensaukee River Wetland or Pensaukee River Area Wetlands #1 and #2, but the Wisconsin Inventory of Archaeology lists twelve archaeological sites in the Pensaukee River vicinity. Information concerning the exact location and field findings for these sites can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 280-282

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

OCONTO MARSH

PHYSIOGRAPHIC SETTING

LM 283

Setting

Oconto Marsh is a large wetland located on the western shoreline of Green Bay. The major portion of the wetland lies within Oconto County, Wisconsin, although the northern and eastern portions of the wetland extend into Marinette County, Wisconsin. The southern extent of the wetland abuts the town of Oconto, and the northern edge of the wetland lies two miles southwest of the town of Peshtigo (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956; Porterfield, Wisconsin, 1963). Part of the southern portion of the wetland is diked, and this area is managed by the Wisconsin Department of Natural Resources as the Green Bay Shores Wildlife Area.

The Oconto River flows through Oconto Marsh, and the southern portion of the wetland surrounds the river mouth. Abandoned meanders of the Oconto River lie within the southern portion of the wetland. Oconto Marsh lies adjacent to Green Bay at several points along the shoreline, and much of the wetland is influenced by Lake Michigan water levels (Wisconsin Scientific Areas Preservation Council, 1976).

Most of Oconto Marsh is wooded, although parts of the wetland, particularly around the Oconto River delta, are non-wooded. The wetland features low beach ridges and swales. Much of the area is second growth Lacustrine wetland; however, the area near the Oconto River mouth can be classified as a Lower Perennial Riverine System (Wisconsin Scientific Areas Preservation Council, 1976).

Topography

The total relief of Oconto Marsh is approximately 40 feet. The highest inland wetland elevation is 620 feet above sea level, 40 feet above the approximate mean elevation of Lake Michigan. The wetland gradually slopes lakeward to 580 feet above sea level (lake level). Oconto Marsh is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths; substantial portions of sandy beach are exposed during periods of low water levels (Wisconsin Bureau of Water and Shoreland Management, 1973).

Surficial Geology

The surficial geology of Oconto Marsh is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Oconto Marsh is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Hole et al., 1978).

Hydrology

The Oconto River flows through the southern tip of Oconto Marsh with no change in elevation. The bottom of the Oconto River is comprised of sand, silt, wood chips, and detritus (Wisconsin Division of Environmental Standards, 1976). Thomas Slough, which has been channelized, flows south through the western part of the wetland and has an elevational change of approximately 20 feet. There are five unnamed perennial streams flowing through Oconto marsh. The first stream originates at the edge of the wetland approximately 1.3 miles north of the town of Oconto. This stream is in the southern portion of the wetland and has an elevational change of four feet as it travels through the wetland. The second stream is located approximately 0.3 mile above the first and also originates at the border of the wetland. This stream has been channelized and has an elevational change of about thirteen feet as it flows through the wetland into Green Bay. The third stream is short and has little elevational change. This stream is located south of the WMBV television tower. The fourth stream originates in the surrounding upland and flows through Oconto Marsh to Green Bay to the north of the WMBV television tower. This stream has an elevational change of eighteen feet and has been channelized. Oconto Marsh has numerous inlets from Green Bay and the Oconto River (U.S.G.S. quadrangle maps, Oconto, Wisconsin, 1956; Porterfield, Wisconsin, 1963).

Oconto Marsh is heavily influenced by Lake Michigan water levels (Wisconsin Scientific Areas Preservation Council, 1976). The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches, and these fluctuations are large enough to have an impact on Oconto Marsh. The water level fluctuations in Green Bay have been known to reduce the wetlands along the western shore to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. Current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

The Scientific Areas Preservation Council has sampled water quality in Oconto Marsh. These data are presented in Table 11-37. Additional data are available from the files of the Wisconsin Department of Natural Resources,

Scientific Areas Preservation Council. The Oconto River mouth, including the last 1.3 miles, is polluted. An unbalanced benthic community exists which contains no pollution-intolerant organisms. Water quality information is available for the Oconto River, sampled from the part of the river that flows through the extreme southern portion of the wetland. These data (Table 11-38) may reflect conditions in this part of Oconto Marsh. Additional data are available from the Wisconsin Division of Environmental Standards (1976).

Table 11-37. Water Quality Data for Oconto Marsh Sampled July 17, 1969[a]

Kjeldahl nitrogen (ppm.)	Total phosphorus (ppm.)	pH	Alkalinity (ppm.)
1.15	0.4	7.4	128

[a] Wisconsin Scientific Areas Preservation Council (1969)

Table 11-38. Water Quality Data for the Oconto River Sampled at River Mile 1.3[a]

Date	Temperature (^{o}C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	pH
3/15/73	4.0	10.1	0.30	7.4
10/ 3/73	17.0	6.6	0.03	7.6

[a] Wisconsin Division of Environmental Standards (1976)

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Water quality data sampled near Oconto Marsh in Green Bay, (Table 11-39), may reflect conditions in the wetland, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al. (1975). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968).

Table 11-39. Water Quality Data for Green Bay Sampled Offshore of Oconto Marsh[a]

Date	Temperature (°C)	Dissolved Oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/21/74	9.0	12.2	0.047	0.200
9/ 5/74	16.0	10.6	0.025	0.100

[a] Patterson et al. (1975)

The groundwater levels in the wetland are either at or near the surface (Wisconsin Division of Environmental Protection, 1971). The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Oconto Marsh.

Climate

The closest weather station providing climatic data for Oconto Marsh is located in Oconto, Wisconsin. In 1975, the average monthly temperature was 43.4°F, the average daily low for January was 8.7°F and the average daily high in July was 82.9°F. The average annual precipitation is 28.78 inches, with a mean monthly precipitation of 1.18 inches in January and 3.20 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

Abandoned oxbows and meanders of the Oconto River lie within the wetland near the river delta (U.S.G.S. quadrangle maps, Oconto, Wisconsin, and Porterfield, Wisconsin, 1963; Wisconsin Coastal Zone Management Program aerial photograph, 1975).

BIOTIC SETTING LM 283

Vegetation

Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation in Oconto Marsh.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Oconto Marsh.

Invertebrates

Information on the composition and relative abundance of the invertebrate fauna of this wetland is available in files of the Wisconsin Department of Natural Resources (1970). The oligochaetes, tendipedids (Diptera), and amphipods have been the major species collected at the sample sites. These organisms are probably still present in Oconto Marsh.

The literature search produced no site-specific information pertaining to seasonal distribution, density and productivity, major food sources, or relationship to water levels of the invertebrates present in this wetland.

Reptiles and Amphibians

Wendel J. Johnson (University of Wisconsin Center-Marinette, personal communication) and Leroy Lintereur (Wisconsin Department of Natural Resources, personal communication) concur that the bullfrog (Rana catesbeiana) is common in Oconto Marsh. Lintereur has also indicated that the red-backed salamander (Plethedon c. cinereus), American toad (Bufo americanus), green frog (Rana clamitans), leopard frog (R. pipiens), wood frog (R. sylvatica), snapping turtle (Chelydra serpentina), painted turtle (Chrysemys picta), Blanding's turtle (Emydoidea blandingi), and eastern garter snake (Thamnophis s. sirtalis) occur in Oconto Marsh. Vogt (1978, in preparation) confirms the presence of the American toad and leopard frog in Oconto Township and adds the northern red-bellied snake (Storeria o. occipitomaculata) to the list of locally occurring reptiles. Suzuki (1950) reported that the gray tree frog (Hyla versicolor) has been collected in the vicinity of the town of Oconto.

Appendix C-11 contains general information on amphibians and reptiles of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Oconto Marsh.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Oconto Marsh as Class I wildlife habitat, "most desirable" to waterfowl, gulls and terns, shore birds, and songbirds (Thompson et al., 1976). This wetland is one of the outstanding bird habitats in Wisconsin. The mallard (Anas platyrhynchos), black duck (Anas rubripes),

blue-winged teal (Anas discors), green-winged teal (A. crecca), ruddy duck (Oxyura jamaicensis), northern shoveler (Anas clypeata), wood duck (Aix sponsa), gadwall (Anas strepera), redhead (Aythya americana), Canada goose (Branta canadensis), American coot (Fulica americana), and common gallinule (Gallinula chloropus) nest in Oconto Marsh (Scharf et al., 1977). Other ducks that are commonly present include the canvasback (Aythya valisineria), lesser scaup (A. affinis), American wigeon (Anas americana), ring-necked duck (Aythya collaris), pintail (Anas acuta), and hooded merganser (Lophodytes cucullatus). The Virginia rail (Rallus limicola), sora (Porzana carolina), and king rail (Rallus elegans) probably breed here. Although yellow rails (Coturnicops noveboracensis) were formerly common in this wetland (Tessen, 1976), recent sightings are extremely rare, probably because of high water conditions. Black terns (Chlidonias nigra) and Forster's terns (Sterna forsteri) breed in Oconto Marsh, while Caspian terns (S. caspia) and common terns (S. hirundo) utilize the wetland for resting and feeding. A variety of wetland passerine birds are known to nest here.

Large numbers of black-crowned night herons (N. nycticorax), green herons (Butorides striatus), and least bitterns (Ixobrychus exilis) also nest in Oconto Marsh (Tessen, 1976). In addition, unusual heron species are currently being reported as visitors and breeders (Arbib, 1975, 1976, 1977). In 1975, for example, the first Wisconsin nesting record of snowy egrets (Egretta thula) occurred here, and 12 pairs of cattle egrets (Bubulcus ibis) produced many young (14 young birds were banded and an additional 10 were thought to be present). In 1976, two pairs of snowy egrets nested for the second consecutive summer, and at least 12 pairs of cattle egrets nested. Ten snowy egrets were observed in early July. Four Louisiana herons (Egretta tricolor) were present from mid-June into August. Two adult and one immature yellow-crowned night heron (Nycticorax violacea) were observed from early June until late July. A single glossy ibis (Plegadis falcinellus) remained at the heronry from late June until mid-July, and a little blue heron (Egretta caerulea) in breeding plumage was sighted during late July. In 1977, Oconto Marsh dried up by late May, owing to a prolonged regional drought, and no cattle or snowy egrets nested. Many other herons abandoned the area, including most of the black-crowned night herons.

Scharf et al. (1977) studied colonial nesting birds in and around the Wisconsin Department of Natural Resources diked area (between the town of Oconto and county highway "Y"). Thirty-five to 45 pairs of black terns were nesting in scattered areas along both sides of county highway "Y". About 75 pairs of Forster's terns, which are currently being considered for endangered status in Wisconsin (Hine, Wisconsin Endangered Species Committee, personal communication), nested in three groups of 20, 35, and 18 to 22 pairs. All of these colonies were in the diked area; a total of 34 young were counted on July 22, 1976. About 100 pairs of green herons nested in the area, 60 pairs within the diked area and 40 pairs outside of it, with a combined average of 2.3 young per nest. Scharf et al. estimate that 275 to 350 pairs of black-crowned night herons nested in this area and averaged 2.7 young per nest. Two snowy egret nests located within the black-crowned night heron colony contained three eggs and three eggs and one young, respectively. Thirteen pairs of cattle egrets were also present in this heronry, and 12 nests produced 37 young (3.08 young per nest), 24 of which were banded.

Scharf et al. (1977) also describe the spatial use of Oconto Marsh by herons and terns. The outlet to the Oconto River (south of the diked area) is heavily used for feeding by the herons and snowy egrets. All heron and egret nests were in flooded willows; green heron nests were found only in live trees and many of the black-crowned night heron nests were in dead trees. Green heron nests were present at the periphery of the black-crowned night heron colony. Scharf et al. note that this is the only site on the Great Lakes where colonial nesting of green herons has been observed. The green heron was also the only heron species to nest outside of the diked area. The black tern nested in cattails and sedges, while the Forster's tern only nested in cattail areas.

Oconto Marsh, particularly near the Oconto River mouth, is an important focal point for migrating waterfowl and shore birds (Scharf et al., 1977). Winter population data are available for Peshtigo Christmas bird counts. The Peshtigo Census Area includes the northern portion of Oconto Marsh but also includes several small, non-coastal wetlands and thus may not be representative of Oconto Marsh. Table 11-40 presents the 1972-1976 bird counts, which include five species of waterfowl as well as the Cooper's hawk (Accipiter cooperii), a threatened species in Wisconsin (Hine, et al., 1975) and the endangered bald eagle (Haliaeetus leucocephalus).

Scharf et al. (1977) report that the diked area of Oconto Marsh receives intensive use from birdwatchers. This indiscriminate use threatens an important breeding area. The authors believe that a management plan is critically needed to protect the nesting birds from human disturbance. Much of the wetland is inaccessible to human traffic, and there the avifauna remain unstudied and undisturbed. Oconto Marsh is the only large wetland remaining on lower Green Bay and is probably important to many species that have been forced to abandon traditional habitat in the southern part of the bay because of high water levels and filling. Scharf et al. predict that the number and diversity of birds in Oconto Marsh will increase for several years.

Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to Oconto Marsh are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search yielded no site-specific information pertaining to commercial use, food sources, and relationship to water levels of the birds utilizing Oconto Marsh.

Mammals

Oconto Marsh has been classified as "most desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat (Ondatra zibethicus) and mink (Mustela vison) are common in most wetlands. Trapping of beaver (Castor canadensis), muskrat, mink,

Table 11-40. Wetland Bird Species of the Peshtigo Census Area in the 1972-1976 Christmas Bird Counts[a]

	1976	1975	1974	1973	1972
pied-billed grebe	1				
mallard	23	10	1		2
black duck	19	2	2		27
common goldeneye	56	59	51	90	133
common merganser	14				1
Cooper's hawk	1				
bald eagle	--b				
herring gull		1	95	4	550
barred owl	2	1			
pileated woodpecker	--		1	--	--
starling	84	183	71	23	15
Brewer's blackbird			--		
cardinal	4	4	2	--	2
purple finch		6	3		2

[a]The Peshtigo Census Area encompasses the northern portion of Oconto Marsh and several smaller wetlands not included in this study (Arbib, 1973; 1974; 1975; 1976; 1977)

[b]Observed in the area during the count week, but not seen on the count day

and river otter (Lutra canadensis) is an important activity in the wetlands inhabited by these species.

The literature search provided no other site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Oconto Marsh.

Endangered Species

Forster's tern, which is being considered for state endangered status (Hine, Wisconsin Department of Natural Resource, Endangered Species Committee personal communication) nests in Oconto Marsh. The yellow rail, a bird threatened in Wisconsin, has been frequently observed in this wetland in the past but recent sightings are extremely rare.

The peregrine falcon (Falco peregrinus), the bald eagle, and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed along the western shore of Green Bay, especially during migration. The bald eagle and the osprey historically nested here but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also endangered in Wisconsin, nests on islands in the bay. However, no other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Oconto Marsh.

Health

Site-specific information indicates that the environmental quality of Oconto Marsh is very good. An abundance of waterfowl, shore birds and heron is found in this wetland which has been designated as Class I wildlife habitat by the Wisconsin Department of Natural Resources. Several NPDES permit holders discharge into the Oconto River, which flows through part of Oconto Marsh and may have some effect on its health.

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Population

Oconto Marsh is located in Little River and Oconto Townships of Oconto County, Wisconsin, and Grover Township of Marinette County, Wisconsin. Oconto County experienced a rapid rate of population growth between 1970 annd 1975. Oconto Township experienced slow growth, and Little River Township underwent rapid decline during the same time period. Marinette County experienced moderate decline in population between 1970 and 1975. Grover Township had a moderate growth rate during the same time period. Projections for 1990 indicate that Oconto County is expected to undergo continued rapid population growth, while Marinette County will have a moderate increase in population.

Table 11-41. Population Data for the Vicinity of Oconto Marsh

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Oconto County	27,356	7.1	34,240
Oconto Township	4,746	1.7	--
Little River Township	792	-7.8	--
Marinette County	37,555	-4.7	40,130
Grover Township	1,620	3.6	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Oconto Marsh is rural open space. The areas surrounding the wetland are primarily in rural open space uses, with an area of industrial, commercial, and residential development (the town of Oconto) just west of the extreme southern portion of the wetland. Areas of residential development occur along the lakeshore near the eastern border of the wetland. A navigation aid and piles lie offshore from Oconto Marsh at the mouth of the Oconto River and a dumping ground lies within Green Bay near the wetland. A cemetery and a television transmission tower are located within the wetland. Several roads cross the wetland, and a rail line lies to the west. A portion of Oconto Marsh is diked and water levels within this area are controlled by the Wisconsin Department of Natural Resources (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The ownership of this wetland is primarily private, with areas of state and local ownership interspersed throughout the wetland. Predominant among these is a large area of local ownership in the northeastern portion of the wetland near the Oconto-Marinette county line. A significant part of the wetland south of the Oconto River is privately owned by the Oconto Sportsman Club (Bay-Lake Regional Planning Commission, personal communication).

Developmental pressures on Oconto Marsh vary greatly within the wetland. The portion of the marsh south of the Oconto River appears to be subject to low developmental pressure since it is under the protective ownership of the Oconto Sportsman Club. The areas north of the river under the ownership of the Wisconsin Department of Natural Resources and local governmental units are also assumed to be under minimal pressures. The privately-owned area northeast of the town of Oconto between the diked area and Lake Michigan appears to be under high developmental pressure, while pressures become moderate as one moves further north in the wetland.

Recreation

Much of Oconto Marsh north of the Oconto River is within the Green Bay Shores Wildlife Area. The wildlife areas on the west shore of Green Bay receive a multiplicity of recreational uses. The most significant use is hunting, but the areas also are used for sport and commercial fishing and trapping. In the summer the areas receive boating use with some large craft, while in the winter snowmobiling and cross-country skiing are popular (Dan Olson, Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

Oconto Marsh is situated in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). No known oil, gas, or coal resources are present in Oconto Marsh.

Portions of Oconto Marsh are heavily wooded (U.S.G.S. quadrangle map, Oconto Wisconsin, 1956; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). It was not determined through the literature search whether these wooded areas are used for commercial production.

Public Utilities and Facilities

Transmission lines run along the western edge and across the northern portion of Oconto Marsh (U.S.G.S. quadrangle maps, Oconto, Wisconsin 1956; Porterfield, Wisconsin, 1963).

Pollution Sources

There are several NPDES permit holders discharging into the Oconto River, which passes through the southern portion of Oconto Marsh. The city of Oconto Municipal Sewage Treatment Plant is adjacent to Oconto Marsh and discharges into the Oconto River (Wisconsin Division of Environmental Standards, 1976). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

There are no known historical sites within 500 feet of Oconto Marsh, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1978).

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

PHYSIOGRAPHIC SETTING LM 284

Setting

Peshtigo River Wetland is located on the western shoreline of Green Bay at the mouth of the Peshtigo River. This large wetland is situated in Marinette County, Wisconsin, adjacent to the bay and three miles southeast of the city of Peshtigo (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961; Marinette West, Wisconsin-Michigan, 1976). Part of this wetland lies within the Peshtigo Harbor Wildlife Area, which is managed by the Wisconsin State Department of Natural Resources. Peshtigo River Wetland features abandoned oxbow lakes and a series of channels within the river delta which offer excellent waterfowl habitat. Part of the wetland is non-wooded, but much of the wetland supports Lacustrine forest, a portion of which has recently been clear-cut. The character of this low, Lacustrine System is periodically altered by fluctuations in the level of Green Bay-Lake Michigan (Wisconsin Scientific Areas Perservation Council, 1976).

Topography

The total relief of Peshtigo River Wetland is approximately 10 feet. Wetland elevations range from 580 to 590 feet above sea level (lake level to 10 feet above the approximate mean elevation of Lake Michigan). The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; the topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain.

Surficial Geology

The surficial geology of Peshtigo River Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Peshtigo River Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Hole et al., 1968).

Hydrology

The Peshtigo River flows through Peshtigo River Wetland. The last two miles of the river, which contain the wetland, consist of a delta complex at the river mouth. This delta complex includes old river channels and cutoff areas,

some of which are now lagoons. Dyers Slough, located in the central portion of Peshtigo River Wetland, forms a complex of lagoons as it empties into Green Bay. There are also several intermittent streams flowing into the upper section of Peshtigo River Wetland (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961; Marinette West, Wisconsin-Michigan, 1976).

The Peshtigo River is light brown in color, and bottom sediments consist of sand and vegetative detritus. Biological samples of the benthic community reveal that the mouth of the Peshtigo River is either polluted or adversely affected by pollution from upstream dischargers of sludge deposits, silamentous slimes, and algae growths which limit dissolved oxygen levels. Water quality data for the Peshtigo River sampled several miles upstream from the wetland are available in Wisconsin Division of Environmental Standards (1976). The effect of the Peshtigo River on Peshtigo River Wetland is unknown.

Peshtigo River Wetland is influenced by Lake Michigan. A slight lowering in the lake level can expose large areas of peat, muck, sedge hummocks, and detritus (Wisconsin Scientific Areas Preservation Council, 1976). The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Peshtigo River Wetland. Water level fluctuations in Green Bay have been known to reduce the size of the wetlands along the western shore, including Peshtigo River Wetland, to one-third normal size during high water periods. This seiche activity influences the type of vegetation as well as wildlife habitat.

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. Current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

The Scientific Areas Preservation Council has sampled water quality in Peshtigo River Wetland. The pH value on September 9, 1969, was 7.7, and Kjeldahl nitrogen and total phosphorus values were 0.65 and 0.20 parts per million, respectively (Wisconsin Scientific Areas Preservation Council, 1969). Additional data are available from the files of the Wisconsin Scientific Areas Preservation Council.

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Water quality data sampled in Green Bay near the Peshtigo River are presented in Table 11-42. These data may reflect conditions in Peshtigo River Wetland, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al. (1975). Streams and groundwater provide high quality water compared to the present low quality of Green Bay (Dundas, 1968).

Table 11-42. Water Quality Data for Green Bay Sampled Offshore of Peshtigo River Wetland[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
5/21/74	9.0	12.2	0.047	0.200
9/ 5/74	16.0	10.6	0.025	0.100

[a] Patterson et al. (1975)

The groundwater level in Peshtigo River Wetland is either at or near the surface (Wisconsin Division of Environmental Protection, 1971). The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Peshtigo River Wetland.

Climate

The closest weather station providing climatic data for Peshtigo River Wetland is located in Marinette, Wisconsin. In 1975, the average monthly temperature was 46.0°F, the average daily low for January was 13.3°F and the average daily high in July was 86.4°F. The average annual precipitation is 30.68 inches, with a mean monthly precipitation of 1.29 inches in January and 1.32 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Peshtigo River Wetland (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961, and Marinette West, Wisconsin-Michigan, 1976; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING

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Vegetation

In 1976, much of Peshtigo River Wetland was inundated, including large tracts of the sedge *Carex stricta*, shrub carr, and upland trees. Extremely dense colonies of coontail (*Ceratophyllum demersum*) and pondweeds (*Potamogeton* spp.) were present (Bedford et al., 1976). Howlett (1974) provides a general analysis of the vegetation of western Green Bay from the mouth of the Fox River to Peshtigo Point. However, the literature search yielded no site-specific information pertaining to density and productivity, or relationship to water levels of the vegetation in Peshtigo River Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Peshtigo River Wetland.

Invertebrates

Information on the composition and relative abundance of the invertebrate fauna of Peshtigo River Wetland is available in the files of the Wisconsin Department of Natural Resources (1970). The oligochaetes, tendipedids (Diptera), and amphipods have been the major species collected at the sample sites, and can probably still be found there.

The literature search produced no site-specific information pertaining to seasonal distribution, density and productivity, major food sources or relationship to water levels of the invertebrates present in this wetland.

Reptiles and Amphibians

According to Wendel J. Johnson (University of Wisconsin Center-Marinette, personal communication) and Leroy Lintereur (Wisconsin Department of Natural Resources, personal communication) the bullfrog (Rana catesbeiana) is common in Peshtigo River Wetland and the wood turtle (Clemmys insculpta) is present but rare where the Peshtigo River crosses the wetland. The red-backed salamander (Plethedon c. cinereus), American toad (Bufo americanus), green frog (Rana clamitans), northern leopard frog (R. pipiens), wood frog (R. sylvatica), snapping turtle (Chelydra serpentina), painted turtle (Chrysemys picta), and Blanding's turtle (Emydoidea blandingi) also occur in Peshtigo River Wetland (L. Lintereur, personal communication).

Mathiak and Kleinert (Wisconsin Department of Natural Resources, 1969) recorded the presence of the American toad, spring peeper (Hyla crucifer), bullfrog, green frog, leopard frog, common snapping turtle, and painted turtle in Peshtigo River Wetland. These observers noted bullfrogs calling on July 18 and 30 and green frogs calling on July 30, which may suggest dates within the breeding season. On July 30, 1969, a large number of leopard frogs had recently metamorphosed. According to these observers, snapping turtles were being harvested for home consumption.

Appendix C-11 contains general information on amphibians and reptiles of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Peshtigo River Wetland.

Avifauna

The Wisconsin Department of Natural Resources, in its fish and wildlife study of the coastal zone, designated Peshtigo River Wetland as Class I wildlife habitat. With the exception of a small northern piece along the Peshtigo River, this wetland is "most desirable" to waterfowl and gulls and terns, and "desirable" to shore birds (Thompson et al., 1976). A major portion of Peshtigo

River Wetland lies in the Peshtigo Harbor State Wildlife Area administered by the Wisconsin Department of Natural Resources-Marinette Game Office. A list of 24 breeding birds has been compiled for this wetland (Table 11-43). However, given the geographical location, size, diversity of habitat (i.e. open water, cattail marsh, sedge meadow, lowland forest, and Green Bay shoreline), and undisturbed nature of Peshtigo River Wetland, this breeding bird list must be considered incomplete.

Scharf et al. (1977) report on the colonial nesting birds near the mouth of the Peshtigo River. Seven to ten pairs of green herons (Butorides striatus) nested in flooded willows near the river channel. An estimated 60 to 70 black tern (Chlidonias nigra) nests were scattered throughout the area, predominantly in sedge meadow habitat; a few nests were located in small cattail stands. High water levels have reduced the available nesting sites for the common tern (Sterna hirundo), which is currently being considered for endangered status in Wisconsin (Hine, Wisconsin Endangered Species Committee, personal communication), and have resulted in non-colonial nesting. A total of ten nests were observed; five were on a small island of cattails (100 sq. ft.), and five were scattered in cattails and on muskrat houses. Forster's terns (Sterna forsteri), which are also being considered for state endangered status (Hine, personal communication), have also been affected by high water levels. This species has nested on a cattail stand adjacent to the Peshtigo River since at least 1972. In 1976, however, the colony (30 to 40 pairs) was decreasing in numbers. According to Tessen (1976), Peshtigo River Wetland is rich in nesting birds during the summer, but productivity is variable due to fluctuating water levels (both short and long term). Periods of high water submerge a great deal of excellent nesting habitat, and seiches are disruptive to nesting activity.

The northern tip of Peshtigo River Wetland, along the Peshtigo River, is "most desirable" to songbirds, "desirable" to ruffed grouse (Bonasa umbellus), and of "supplemental value" to waterfowl and pheasant (Phasianus colchicus) (Thompson et al. 1976). Tessen (1976) indicates that summer residents include the great blue heron (Ardea herodias), mallard (Anas platyrhynchos), blue-winged teal (A. discors), wood duck (Aix sponsa), ruffed grouse, and the common flycatchers, thrushes, and vireos (Vireo spp.). The red-shouldered hawk (Buteo lineatus), a threatened species in Wisconsin, (Hine et al., 1975), is also found in this wooded river bottom. The blue-gray gnatcatcher (Polioptila caerulea) and the cerulean warbler (Dendroica cerulea) are known to nest here.

A summary of bird observations in Peshtigo River Wetland between April and July of 1969 and 1970 is presented in Table 11-44. These censuses included both spring migrants and summer residents. A total of 72 species were recorded. The elusive and rare yellow rail (Coturnicops noveboracensis) was not observed during these censuses but has been sporadically reported in Peshtigo River Wetland (Lintereur, 1970). The breeding status of this bird is unknown.

Peshtigo River Wetland is a very important waterfowl, shore bird, gull, tern, and raptor staging area during migration (Scharf et al., 1977). Thousands of migratory Canada geese (Branta canadensis), snow geese (Chen caerulescens), whistling swans (Olor columbianus), and a wide range of ducks visit the wetland, especially during periods of high water. Numerous shore birds stop over during migration, occasionally including dowitchers (Limnodromus griseus), stilt (L.

Table 11-43. Breeding Birds of Peshtigo River Wetland

green heron[c]	common tern[c]
least bittern[b]	black tern[a]
American bittern[a]	barn swallow[a]
mallard[a]	long-billed marsh wren[a]
black duck[b]	blue-gray gnatcatcher[a]
green-winged teal[b]	yellow warbler[a]
blue-winged teal[a]	cerulean warbler[a]
sandhill crane[c]	yellow-headed blackbird[a]
Virginia rail[a]	red-winged blackbird[a]
sora[a]	Brewer's blackbird[a]
killdeer[c]	brown-headed cowbird[a]
Forster's tern[c]	song sparrow

[a]nest records in Wisconsin Department of Natural Resources (1969d)
[b]probably a breeding bird (although no nest records) - Wisconsin Department of Natural Resources
[c]nest records in Scharf et al. (1977)

Table 11-44. Bird Observations at Peshtigo River Wetland[a]

	1969	1970		1969	1970
common loon	2		herring gull	19	150
horned grebe	3		Bonaparte's gull	6	
pied-billed grebe	1	3	common tern	16	30
great blue heron	6		Caspian tern	7	
green heron	2		black tern	107[b]	71
great egret	1		mourning dove	2	
black-crowned night heron	1		downy woodpecker	1	
least bittern	1		eastern kingbird	3	
American bittern	8[b]	10	tree swallow	15[b]	115
whistling swan	31		barn swallow	10	5
Canada goose	283		cliff swallow		8
snow goose	1		blue jay	85	1
black duck	12	2	crow	1	
mallard	53[b]	20	short-billed marsh wren	6[b]	87
pintail	1	2	gray catbird	1[b]	
green-winged teal	6		brown thrasher	1	
blue-winged teal	87	25	American robin	7	1
northern shoveler	11		veery		1
American wigeon	3		starling	7	
wood duck	17		yellow warbler	16	7
ring-necked duck	6	4	blackburnian warbler	1	
canvasback	1		common yellowthroat	5	2
scaup spp.	35	16	redstart		2
common goldeneye	28		bobolink	33	5
bufflehead	29	4	meadowlark spp.	2	1
hooded merganser		2	yellow-headed blackbird	11	2[b]
common merganser	20	3	red-winged blackbird	6[b]	81
harrier	1	1	northern oriole	--[b]	
osprey	1		Brewer's blackbird	--[b]	52
kestrel	1		brown-headed cowbird	4[b]	
Virginia rail	1		rose-breasted grosbeak		1
sora	5[b]	17	goldfinch	7	
American coot	3	5	rufus sided towhee	2	
common snipe	4[b]	3	white-crowned sparrow		1
spotted sandpiper		1	swamp sparrow	--b	10
greater yellowlegs	6	9	song sparrow	--b	20

[a]Observation dates in 1969 were April 16, 17, 27, and 30; May 1, 15, 21, and 29; June 18; and July 30. In 1970 observation dates were April 21; May 15 and 28; and June 25 and 26 (Wisconsin Department of Natural Resources, 1969e and 1970).

[b]Birds were observed but not counted

scolopaceus), sandpipers (Micropalama himantopus), pectoral sandpipers (Caladris melanotus), red knots, (C. canutus), greater and lesser yellowlegs (Tringa melanoleuca, T. flavipes) and peep sandpipers. A raptor flyway passes over Peshtigo River Wetland. In addition to the more common species, the bald eagle and the osprey are frequently observed during migration. Passerine birds rest and feed here during both migrations, including species of flycatchers, thrush, vireo, warbler, grosbeak, finch, and sparrow.

Appendices D-23 to D-28 contain additional information on wetland birds. General studies on Lake Section 11 related to the Peshtigo River Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to recreational and commercial use, life histories, or food sources of the birds utilizing Peshtigo River Wetland.

Mammals

Substantial populations of beaver (Castor canadensis) and river otter (Lutra canadensis) are found on Peshtigo River Wetland (Bertrand et al., 1976). This wetland has been classified as "most desirable" habitat for muskrat (Ondatra zibethicus) (Thompson et al., 1976; Wisconsin Department of Natural Resources, open file report).

A comprehensive discussion of the Green Bay watershed (Bertrand et al., 1976) provides some general information which may be useful in characterizing the wetlands of the western shore of Green Bay. This area provides high quality wildlife habitat. Muskrat and mink (Mustela vison) are common in most wetlands. Trapping of beaver, muskrat, mink, and river otter is an important activity in the wetlands inhabited by these species.

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting Peshtigo River Wetland.

Endangered Species

The wood turtle (Clemmys insculpta) endangered in Wisconsin, is present but rare along the lower section of the Peshtigo River, which includes Peshtigo River Wetland (Wendel J. Johnson, University of Wisconsin Center-Marinette, and Leroy Lintereur, Wisconsin Department of Natural Resources, personal communications).

The peregrine falcon (Falco peregrinus), the bald eagle, (Haliaeetus leueocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are observed in the vicinity of Peshtigo River Wetland during migration. The bald eagle and the osprey historically nested along the western shore of Green Bay but no longer do (Dundas, 1968).

Forster's and common terns (Sterna forsteri, S. hirundo), which are being considered for state endangered status (Hine, Wisconsin Endangered Species Committee, personal communication) nest in this wetland. The red-shouldered hawk (Buteo lineatus), a species threatened in Wisconsin, is a summer resident of the lowland forest area along the Peshtigo River.

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Peshtigo River Wetland by the literature search.

Health

Site-specific information indicates that the environmental quality of Peshtigo River Wetland is good. The area is an important resting area for migrating waterfowl, and has been designated as Class I wildlife habitat by the Wisconsin Department of Natural Resources. Several NPDES permit holders discharge into the Peshtigo River, which flows through part of Peshtigo River Wetland and may have some effect on its health.

CULTURAL SETTING

LM 284

Population

Peshtigo River Wetland is located in Peshtigo Township of Marinette County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Marinette County experienced a moderate rate of population growth between 1970 and 1975, but Peshtigo Township experienced a rapid rate of population growth during the same time period. Projections for 1990 indicate that moderate population growth is expected to continue in Marinette County.

Table 11-45. Population Data for the Vicinity of Peshtigo River Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Marinette County	37,555	3.3	40,130
Peshtigo Township	3,166	7.3	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin, State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Peshtigo River Wetland and most of the surrounding area is rural open space. A few rural residences are scattered throughout the area.

Several access roads and two secondary highways cross Peshtigo River Wetland. A navigation light lies offshore and drainage ditches are located near the center of the wetland (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961, and Marinette West, Wisconsin-Michigan, 1976; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The wetland is under mixed state and private ownership; private ownership is primarily concentrated around the periphery of the wetland. However, two sites in the approximate center of the wetland are privately owned. The major portion of the wetland is under state ownership (Bay-Lake Regional Planning Commission, personal communication). The wetland is within the Peshtigo Harbor Wildlife Area (U.S.G.S. quadrangle map, Little Sturgeon, Wisconsin, 1956). The location of Peshtigo River Wetland within this wildlife area suggests that the wetland is subject to minimal development pressure.

Recreation

Peshtigo River Wetland is situated within the Peshtigo Harbor Wildlife Area. Specific information on the recreational usage of this wildlife area was not obtained. However, the wildlife areas on the west shore of Green Bay generally receive a multiplicity of recreational uses. The most significant use is hunting, but the areas also are used for sport and commercial fishing and trapping. In the summer the areas receive boating use with some large craft, while in the winter snowmobiling and cross-country skiing are popular (Dan Olson, Wisconsin Department of Natural Resources, personal communication).

Mineral, Energy, and Forest Resources

Peshtigo River Wetland is situated in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). No known oil, gas, or coal resources are present in Oconto Marsh.

Peshtigo River Wetland is partially wooded (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961, and Marinette West, Wisconsin-Michigan, 1976; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978). A portion of this wooded area has been recently clear cut.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Peshtigo River Wetland (U.S.G.S. quadrangle maps, Little Sturgeon, Wisconsin, 1961; Marinette West, Wisconsin-Michigan, 1976).

Pollution Sources

There are several NPDES permit holders in Peshtigo discharging into the Peshtigo River, which passes through the wetland. However, there are no NPDES permit holders adjacent to Peshtigo River Wetland (Wisconsin Division of Environmental Standards, 1976). No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

The Slough Bridge, an important local historical site, spans a section of the Peshtigo River mouth within the wetland. Information related to this site is available from the Marinette County Historical Logging Museum (Wisconsin Historic Preservation Division, 1978). A village and an historical Indian cemetery are also within the wetland.

An archaeological site is situated approximately one mile west of the Slough Bridge, where skeletons were discovered after plowing near the river bank (Wisconsin Historic Preservation Division). Information regarding the research, field reports, and analysis of this site can be obtained from the Wisconsin Historical Society (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS

LM 284

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

SEAGULL BAR WETLAND

PHYSIOGRAPHIC SETTING

LM 285

Setting

Seagull Bar Wetland is located on the cuspate delta of the Menominee River adjacent to the western shoreline of Green Bay in Marinette County, Wisconsin. The wetland lies at the base of Seagull Bar, approximately one mile south of the Menominee River mouth. Seagull Bar is a sand spit consisting of ridges and low dunes. The bar shelters a lagoon of shallow water with mud flats and emergent vegetation. Seagull Bar Wetland is located within the city of Marinette, Wisconsin, and occupies a low, non-wooded, Lacustrine site (U.S.G.S. quadrangle map, Marinette East, Wisconsin-Michigan, 1976).

Topography

The total relief of Seagull Bar Wetland is less than 5 feet. Elevations within the wetland range from 580 feet to approximately 583 feet above sea level (lake level to three feet above the approximate mean elevation of Lake Michigan). The wetland is located in the northern portion of the Green Bay-Lake Winnebago-Rock River Lowland; topography at higher elevations in this region is generally rolling. The shoreline along this portion of Green Bay is flat, low, sandy, and poorly drained. Fluctuations in the level of Green Bay-Lake Michigan considerably alter the size of the wetlands in the area (Harris et al., 1977). The Great Lakes Basin Commission (1975) describes this portion of the Green Bay shoreline as an erodible low plain. The littoral zone lakeward of the shoreline is generally flat and sloped, with shallow depths. Substantial portions of sandy beach are exposed during periods of low water levels.

Surficial Geology

The surficial geology of Seagull Bar Wetland is characterized by glaciolacustrine deposits of sand, silt, and clay. These lake sediments include associated deltas, sand dunes, and organic deposits (Hadley and Pelham, 1976).

Soils

The soil type in Seagull Bar Wetland is Peat, a poorly drained soil consisting of organic material derived from sedges, reeds, wood, and mosses (Hole et al., 1968).

Hydrology

There are no streams flowing through Seagull Bar Wetland (U.S.G.S. quadrangle map, Marinette East, Wisconsin-Michigan, 1976). Wave action in Green Bay and the swirling waters of the Menominee River mouth formed Seagull Bar (Lintereur et al., 1970). This long sand spit may protect Sea Gull Bar Wetland from wave action.

The western shore of Green Bay is subject to irregular water level fluctuations caused by seiches. These fluctuations are large enough to have an impact on Seagull Bar Wetland. Since the wetland has a maximum elevation of three feet above lake level, a fluctuation of several inches in the water level can drastically change the amount of wetland that is submerged. Recent high water levels in Green Bay have reduced the wetland by at least ninety percent (Scharf et al., 1977). However, during periods of low water, additional coastal wetland, beach, and shore vegetation are exposed (Wisconsin Scientific Areas Preservation Council, 1976).

The wetlands along the western shore of Green Bay are considered to be "pulse stable" systems; periodic, short- and long-term changes in lake level may be important to the maintenance and productivity of the wetland ecosystem. Current high water levels have reduced the general quality of these wetlands (Bertrand et al., 1976).

The Scientific Areas Preservation Council has sampled water quality in Seagull Bar Wetland (Table 11-46). Additional data are available in the files of the Wisconsin Scientific Areas Preservation Council.

Table 11-46. Water Quality Data for Seagull Bar Wetland[a]

Date	Kjeldahl nitrogen (ppm.)	Total phosphorus (ppm.)	pH	Temperature (^{o}F)	Dissolved oxygen (ppm.)
4/16/69	0.64	0.20	7.7	44.0	8.3
9/25/69	0.71	0.10	7.7	--	--

[a] Wisconsin Scientific Areas Preservation Council (1969)

Lower Green Bay is heavily polluted; dissolved oxygen levels and nutrient enrichment are significant water quality problems. Chlorinated hydrocarbons and polychlorinated biphenyls are found throughout the Green Bay ecosystem (Bertrand et al., 1976). Water quality data for Green Bay sampled near Seagull Bar are presented in Table 11-47. These data may reflect conditions in Seagull Bar Wetland, especially during high water periods. Additional water quality data for Green Bay are available in Patterson et al. (1975).

Table 11-47. Water Quality Data for Green Bay Sampled at Seagull Bar[a]

Date	Temperature (°C)	Dissolved oxygen (mg/l)	Phosphorus (mg/l)	Nitrogen (mg/l)
9/24/73	13.5	9.3	0.003	0.100
5/21/74	7.5	12.2	--	--

[a] Patterson et al. (1975)

The literature search provided no site-specific information pertaining to groundwater drainage patterns and runoff, depth, or seasonal changes in Seagull Bar Wetland.

Climate

The closest weather station providing climatic data for Seagull Bar Wetland is located in Marinette, Wisconsin. In 1975, the average monthly temperature was 46.0°F, the average daily low for January was 13.3°F and the average daily high in July was 86.4°F. The average annual precipitation is 30.68 inches, with a mean monthly precipitation of 1.29 inches in January and 1.32 inches in July based on the normal period from 1941-1970. The growing season is approximately five months long, with the last killing frost (28°F) in 1975 occurring on April 21 and the first killing frost on October 2 (National Oceanic and Atmospheric Administration, 1975).

Special Features

No natural special features are found in the vicinity of Seagull Bar Wetland (U.S.G.S. quadrangle map, Marinette East, Wisconsin-Michigan 1976; Wisconsin Coastal Zone Management Development Program aerial photograph, 1975).

BIOTIC SETTING LM 285

Vegetation

The literature search yielded no site-specific information pertaining to major species composition and distribution, density and productivity, or relationship to water levels of the vegetation of Seagull Bar Wetland.

Fish

A search of the literature provided no site-specific information pertaining to major species, species composition, spawning and hatching areas, seasonal locations and abundance, life histories, recreational and commercial use, or food sources of the fish populations in Seagull Bar Wetland.

Invertebrates

Information on the composition and relative abundance of the invertebrate fauna of Seagull Bar Wetland is available in the files of the Wisconsin Department of Natural Resources (1970). The oligochaetes, tendipedids (Diptera), and amphipods have been the major species collected at the sample sites, and can probably still be found in this wetland.

The literature search produced no site-specific information pertaining to seasonal distribution, density and productivity, life histories, major food sources, or relationship to water levels of the invertebrates present in Seagull Bar Wetland.

Reptiles and Amphibians

Appendix C-11 contains general information on amphibians and reptiles of Lake Section 11, but care should be exercised in the interpretation of the relevance of these studies to Seagull Bar Wetland.

The literature search yielded no site-specific information pertaining to major species, seasonal distribution and abundance, density, recreational and commercial use, life histories, major food sources, or relationship to water levels of the reptiles and amphibians in this wetland.

Avifauna

Seagull Bar Wetland is part of a state wildlife area, administered by the Wisconsin Department of Natural Resources-Marinette Game Office. This wildlife area is well known for its large concentrations of birds. According to Scharf et al. (1977), Seagull Bar has historically been a productive waterfowl area as well as a heavily used staging area for migrating waterfowl and shore birds. Recent high water levels have reduced the wetland area by at least ninety percent. This has greatly reduced the amount of nesting and staging substrate available to wetland birds.

A summary of bird observations on Seagull Bar between April and June of 1969 is presented in Table 11-48. These data are divided into April, May, and June observation periods to loosely separate spring migrants from summer (i.e., June) residents of the area. During spring migration, Seagull Bar Wetland is heavily used by herons, waterfowl, shore birds, gulls, terns and passerines. Some common spring migrants not observed in the 1969 census include the whistling swan (*Olor columbianus*), canvasback (*Aythya valisineria*), Hudsonian curlew (*Numenius phaeopus*) and least sandpiper (*Calidris minutilla*). Lintereur (1966) mentions that large numbers of American wigeon (*Anas americana*), mallard (*A. platyrhynchos*), and scaup use the Seagull Bar area during the fall migration.

A list of 22 known breeding birds of Seagull Bar is presented in Table 11-49. The mallard and blue-winged teal (*Anas discors*) are the most abundant nesting ducks, followed by the green-winged teal (*A. crecca*) and black duck (*A. rubripes*) (Lintereur, 1966). Other common wetland nesters include the Virginia rail (*Rallus limicola*), black tern (*Chlidonias nigra*), red-winged blackbirds

Table 11-48. Bird Observations on Seagull Bar During 1969[a]

Common name	April	May	June
common loon	2	1	
horned grebe	4		
pied-billed grebe	2		
great blue heron	4	9	6
black-crowned night heron		36	5
least bittern			1
American bittern		2	1
mallard	33	23	3
black duck		1	
gadwall		2	
pintail	2	6	
green-winged teal	31	4	2
blue-winged teal	34	39	2
northern shoveler	11	6	
American wigeon	19		
ring-necked duck	2		
scaup, spp.	622	82	
common goldeneye	4		
bufflehead	22		
common merganser	32	20	
red-breasted merganser	6		
sora		7	
American coot	40		
killdeer	**[b]	8	5
ruddy turnstone		15	
spotted sandpiper		14	8
greater yellowlegs	1		
willet		1	
dunlin	1	40	
sanderling		3	
glaucous gull		1	
herring gull	80	480	100
ring-billed gull	8	150	70
Bonaparte's gull		521	5
common tern		156	80
Caspian tern	25	18	40
black tern	7	46	40
great horned owl	1		1
short eared owl	1		
common flicker	11[c]		2
tree swallow	**[b]	**[b]	**[b]
bank swallow			3
barn swallow			2
purple martin			6
long-billed marsh wren		6[c]	
short-billed marsh wren		**[b]	

-continued-

Table 11-48. (concluded)

Common name	April	May	June
brown thrasher		2	3
American robin	15[c]	14	
ruby-crowned kinglet	11		
starling	100	**[b]	
yellow warbler		14	5
yellow-rumpted warbler	1		
common yellowthroat		4	
meadowlark spp.	2	3	
yellow-headed blackbird		5	6
red-winged blackbird	**[b]	**[b]	**[b]
northern oriole		1	
rusty blackbird	6		
Brewer's blackbird		10[c]	
common grackle	**[b]	8	
brown-headed cowbird	23+	32	
American goldfinch		2	
dark-eyed junco	10		
white-throated sparrow	1		
swamp sparrow			
song sparrow	5		
snow bunting	**[b]	14	6
		8	

[a]Observation dates were April 15, 16, 27 and 30; May 14, 20, 21 and 30; and June 17 (Wisconsin Department of Natural Resources, 1969)
[b]**species observed but not counted
[c]more individuals may have been present

(Agelaius phoeniceus), and Brewer's blackbirds (Euphagus cyanocephalus); yellow-headed blackbirds (X. xanthocephalus) are uncommon nesters. No nests of the American coot (Fulica americana), common gallinule (Gallinula chloropus), or pied-billed grebe (Podilymbus podiceps) were found in a 1969 nest census of Seagull Bar (Wisconsin Department of Natural Resources, 1969). On July 16, 1976, Scharf et al. (1977) observed a black tern nesting colony (53 individuals) in Seagull Bar Wetland.

Table 11-49. Breeding Birds of Seagull Bar

mallard[a]	long-billed marsh wren[a]
black duck[a]	brown thrasher[a]
pintail[a]	American robin[a]
green-winged teal[b]	yellow warbler[a]
blue-winged teal[a]	yellow-headed blackbird[a]
northern shoveler[b]	red-winged blackbird[a]
ring-necked pheasant[a]	Brewer's blackbird[a]
Virginia rail[a]	brown-headed cowbird[a]
spotted sandpiper[a]	swamp sparrow[a]
black tern[a]	song sparrow[a]
eastern kingbird[a]	

[a] nesting records from Wisconsin Department of Natural Resources (1969)
[b] nesting records from Lintereur (1966)

Lintereur (1966) indicates that gulls, great blue herons (Ardea herodias), and black-crowned night herons (N. nycticorax) nest on Green Island (located about four miles to the east). These birds use Seagull Bar Wetland for nocturnal feeding and resting. Herons are not currently breeding on the island, but old black-crowned night heron nests indicate a potential for future colonies. Wilson's phalarope (Phalaropus tricolor) and common snipe (Capella gallinago) also breed in the vicinity, but documentation of their use of Seagull Bar Wetland is lacking. The piping plover (Charadrius melodus), a species threatened in Wisconsin, (Hine et al., 1975), has been observed on Seagull Bar.

The Wisconsin Department of Natural Resources files indicate that both birdwatchers and hunters use Seagull Bar Wetland during appropriate seasons. These files also include a small study of brown-headed cowbird (Molothrus ater) nest parasitism of red-winged and Brewer's blackbirds, swamp sparrows (Melospiza georgiana), and song sparrows (M. melodia).

Appendix D-10 contains additional information on wetland birds. General studies on Lake Section 11 related to Seagull Bar Wetland are included, but care should be exercised in the interpretation of the relevance of these studies to this wetland.

The literature search provided no site-specific information pertaining to density and productivity, commercial use, health, life histories, or major food sources of the birds utilizing Seagull Bar Wetland.

Mammals

Beaver (Castor canadensis), muskrat (Ondatra zibethicus), mink (Mustela vison), and white-tailed deer (Odocoileus virginianus) have been noted on Seagull Bar Wetland (Wisconsin Department of Natural Resources, open file reports, 1969 and 1970).

The literature search provided no site-specific data pertaining to seasonal distribution and abundance, density and productivity, recreational and commercial use, life histories, food sources, or relationship to water levels of the mammals inhabiting this wetland.

Endangered Species

The piping plover (Charadrius melodus), a species threatened in Wisconsin, has been observed on Seagull Bar Wetland.

The peregrine falcon (Falco peregrinus), the bald eagle, (Haliaeetus leuocephalus), and the osprey (Pandion haliaetus), all endangered in Wisconsin, are occasionally observed in southern Green Bay, especially during migration. The bald eagle and the osprey historically nested along the western shore of the bay but no longer do (Dundas, 1968). The double-crested cormorant (Phalacrocorax auritus), also endangered in Wisconsin, historically nested on Green Island (located about four miles west).

No other plants or animals appearing on the federal or state lists of endangered or threatened species (U.S. Fish and Wildlife Service, 1977; Hine et al., 1975) were documented in Seagull Bar Wetland by the literature search.

Health

Site-specific information indicates that the environmental quality of Seagull Bar Wetland is good. The area is widely used as breeding, nesting, or resting habitat by a large diversity of birds.

CULTURAL SETTING LM 285

Population

Seagull Bar Wetland is located within the city of Marinette in Marinette County, Wisconsin. The county is sparsely populated, having a density of 26 persons per square mile. Marinette County experienced a moderate rate of population growth between 1970 and 1975, but the city of Marinette experienced a moderate decline in population during the same time period. Projections for 1990 indicate that Marinette County may continue to undergo a moderate rate of population growth.

Table 11-50. Population Data for the Vicinity of Seagull Bar Wetland

	Estimated Population 1975[a]	Estimated %Δ 1970-1975[a]	Projected Population 1990[b]
Marinette County	37,555	3.3	40,130
City of Marinette	12,240	-4.7	--

[a] U.S. Bureau of the Census (1977)
[b] Wisconsin State Bureau of Program Management (1975)

Land Use and Ownership

Land use within Seagull Bar Wetland is urban open space. The surrounding area is characterized primarily by residential uses to the west (the eastern edge of the city of Marinette). The limited amount of land lying east of the wetland is in urban open space, including the municipally-owned Red Arrow Park (Wisconsin Coastal Zone Management Development Program aerial photograph, 1975). The 20-acre Seagull Bar Scientific Area also lies to the east of the wetland. This scientific area is owned by the Wisconsin Department of Natural Resources (Wisconsin Scientific Areas Preservation Council, 1977). The wetland is under private ownership (Bay-Lake Regional Planning Commission, personal communication). The coastal location of the wetland and its proximity to the city of Marinette suggest that the wetland may be subject to high development pressure.

Recreation

There are no known state or federal recreational facilities in Seagull Bar Wetland. However, Red Arrow Park and Seagull Bar Scientific Area, located to the east of the wetland, are used for recreational purposes, including hunting, trapping, fishing, picnicking, and camping.

Mineral, Energy, and Forest Resources

Seagull Bar Wetland is located in an area underlain by Trenton-Galena limestone (Hotchkiss and Steidtmann, 1914), but there are no active limestone operations in close proximity to the wetland (Ostrom, 1970).

A band of clean, abundant, and well-sorted sand about three or four miles wide and over 40 miles long extends along the western shore of Green Bay. Although not currently exploited, it is accessible to hydraulic mining and could be commercially exploited (Bertrand et al., 1976). No known oil, gas, or coal resources are present in Oconto Marsh.

There are no significant forest resources present in Seagull Bar Wetland (U.S.G.S. quadrangle map, Marinette East, Wisconsin-Michigan, 1976; Indiana University, Environmental Systems Application Center aerial reconnaissance, 1978), nor are there any known oil, gas, or coal resources.

Public Utilities and Facilities

There are no public utilities within 0.5 mile of Seagull Bar Wetland (U.S.G.S. quadrangle map, Marinette East, Wisconsin-Michigan, 1976).

Pollution Sources

There are no NPDES permit holders adjacent to Seagull Bar Wetland. No site-specific information was located through the literature search pertaining to non-point sources of pollution.

Historical and Archaeological Features

No known historical sites exist within 500 feet of Seagull Bar Wetland, nor are there any known archaeological sites in the vicinity. However, the area has not been systematically surveyed by a professional archaeologist (Wisconsin Historic Preservation Division, 1978).

RESEARCH PROJECTS LM 285

H. J. Harris (University of Wisconsin Sea Grant College Program, Green Bay Subprogram Coordinator, personal communication) is undertaking a study of the coastal wetlands of Green Bay. The purpose of the project is to provide information on the ecological dimensions of these coastal wetlands, which can be utilized in the development of sound management policies regarding land use and acquisition. The study will also provide information relevant to the merits or consequences of diking coastal wetlands, as well as data on the natural succession of coastal wetlands relevant to the Dredged Material Research Program of the U.S. Army Corps of Engineers. The project is funded by the Wisconsin Sea Grant College Program and is scheduled to continue through 1980, pending budget approval.

Table 11-51. Data Gaps - Lake Section 11

Data Gap*		Wetland Number	256	256A	257	258	259-261	262-269	270-273	274-275	276	277	278-279	280-282	283	284	285
Physiographic Setting		Setting															
		Topography															
		Surficial Geology															
		Soils															
	Hydrology	Water Level Fluctuations	*														
		Groundwater	*	*			*	*	*	*	*	*	*	*	*	*	*
		Water Quality	*								*	*	*	*			
		Depth	*	*		*	*	*	*	*	*	*	*	*	*	*	*
		Seasonal Changes	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Climate															
		Special Features															
Biotic Setting	Vegetation	Major Species Distribution	*	*	*	*	*	*	*	*	*	*	*	*		*	
		Major Species Composition	*	*	*	*	*	*	*	*	*	*	*	*		*	
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Fish	Major species	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Species Composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Spawning and Hatching Areas	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Commercial/Recreational Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Invertebrates	Species Composition	*	*	*	*		*	*	*	*	*	*	*			
		Seasonal Distribution	*	*	*	*		*	*	*	*	*	*	*	*	*	
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Amphibians/Reptiles	Major Species	*	*	*	*	*	*	*	*	*	*	*				*
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Recreational/Commercial Use	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Avifauna	Major Species	*							*	*		*				
		Seasonal Distribution	*			*				*	*	*	*	*			
		Density/Productivity	*	*	*	*				*	*	*	*	*			*
		Recreational/Commercial Use	*	*	*	*		*	*	*	*	*	*	*		*	
		Life Histories	*	*	*	*		*	*	*	*	*	*	*		*	
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Relationship to Water Levels	*		*	*		*	*	*	*	*	*	*	*		
	Mammals	Major Species	*	*			*		*	*							
		Seasonal Distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Density/Productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Recreational/Commercial Use	*	*	*	*	*	*			*	*	*	*	*	*	
		Life Histories	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Food Sources	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Relationship to Water Levels	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
		Endangered Species															
		Health	*	*	*					*	*	*	*	*			
Cultural Setting		Population															
		Land Use and Ownership															
		Recreation															
		Mineral, Energy, Forest Resource															
		Public Utilities/Facilities															
		Point Pollution Sources															
		Non-Point Pollution Sources	*	*							*	*	*	*	*	*	*
		Historic Features															
		Archaeologic Features		*	*								*		*		*