

Michigan

Wetland Resources

Wetlands cover about 15 percent of Michigan. They are ecologically and economically valuable to the State. Wetlands provide shoreline protection as well as temporary flood storage. Wetlands protect water quality by removing excess nutrients and sediments from surface and ground water. Michigan's wetlands, such as Tobico Marsh shown in figure 1, provide important wildlife habitat and have a significant role in maintaining a high level of biological diversity. Most freshwater fish depend on wetlands at some stage in their life cycle. Birds use wetlands as migratory resting places, for breeding and feeding grounds, and as cover from predators. Wetlands, such as those in Seney National Wildlife Refuge, are a preferred habitat for muskrat, beaver, otter, mink, and raccoon. Some rare or threatened animals rely on wetlands, and 91 of 238 plant species listed as threatened or endangered by the State grow in wetland habitats (Cwikiel, 1992). Wetlands benefit the State's tourist and outdoor recreation industries by providing opportunities for activities such as hunting, fishing, trapping, hiking, canoeing, birdwatching, nature photography, and viewing wildflowers. Blueberries and wild rice are produced commercially in Michigan wetlands. In the early 1980's, Michigan was one of five States that together produced 75 percent of the peat mined in the United States.

TYPES AND DISTRIBUTION

Wetlands are lands transitional between terrestrial and deep-water habitats where the water table usually is at or near the land surface or the land is covered by shallow water (Cowardin and others, 1979). The distribution of wetlands and deepwater habitats in Michigan is shown in figure 2A; only wetlands are discussed herein.

Wetlands can be vegetated or nonvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed by Cowardin and others (1979), which is used by the U.S. Fish and Wildlife Service (FWS) to map and inventory the Nation's wetlands. At the most general level of the classification system, wetlands are grouped into five ecological systems: Palustrine, Lacustrine, Riverine, Estuarine, and Marine. The Palustrine System includes only wetlands, whereas the other systems comprise wetlands and deep-water habitats. Wetlands of the systems that occur in Michigan are described below.

System	Wetland description
Palustrine	Wetlands in which vegetation is predominantly trees (forested wetlands); shrubs (scrub-shrub wetlands); persistent or nonpersistent emergent, erect, rooted, herbaceous plants (persistent- and nonpersistent-emergent wetlands); or submersed and (or) floating plants (aquatic beds). Also, intermittently to permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep.
Lacustrine	Wetlands within an intermittently to permanently flooded lake or reservoir. Vegetation, when present, is predominantly nonpersistent emergent plants (nonpersistent-emergent wetlands), or submersed and (or) floating plants (aquatic beds), or both.
Riverine	Wetlands within a channel. Vegetation, when present, is same as in the Lacustrine System.

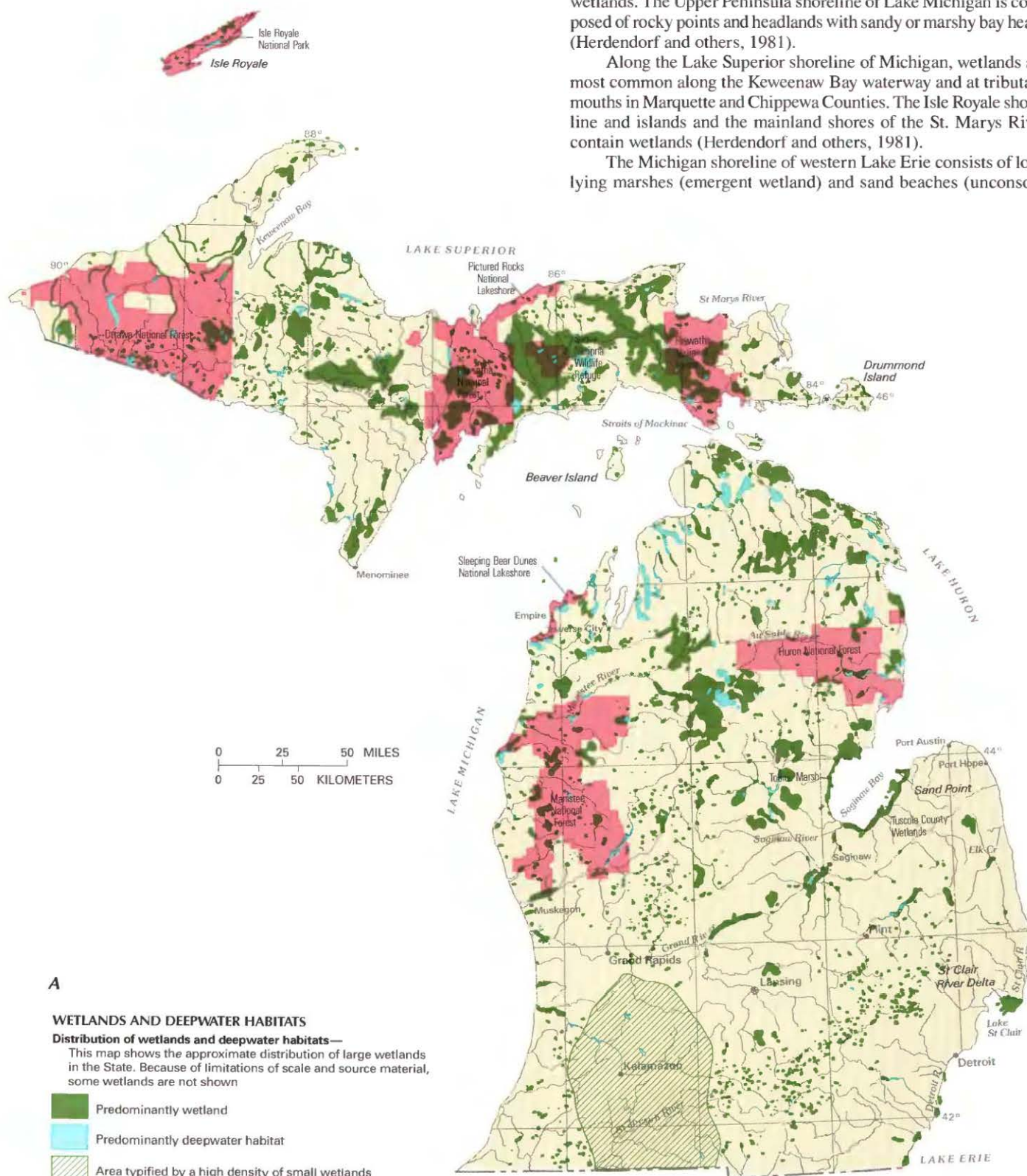
There is no current (1993) estimate of statewide wetland acreage in each of the systems. However, the Michigan Department of Natural Resources has inventoried land cover and land use; the result is the Michigan Resource Inventory System (MIRIS). Wetland classifications were developed specifically for this inventory system. Classes of wetlands under this scheme are lowland conifers, 1,826,402 acres; lowland hardwoods, 2,484,430 acres; wooded wetland, 263,684 acres (palustrine forested wetlands under the Cowardin and others [1979] classification system); shrub/scrub wetland, 1,186,150 acres (palustrine scrub-shrub wetlands); aquatic-bed wetland, 60,863 acres (rooted and floating vascular aquatic-bed wetlands); emergent wetland, 419,061 acres (persistent- and nonpersistent-emergent wetlands); and unvegetated flats, 3,926 acres (unconsolidated-shore wetlands). The results of the MIRIS inventory are similar to the 1953 U.S. Fish and Wildlife Service inventory (U.S. Fish and Wildlife Service, 1955); wooded and scrub/shrub wetlands are the most common wetland types in Michigan. Emergent wetlands make up a relatively small percentage of the State's total wetlands.

Wetlands were estimated by Dahl (1990) to occupy about 5.6 million acres of Michigan in the mid-1980's. There are more than 6.2 million acres of wetlands classified under MIRIS. However, under the classification scheme for MIRIS, lowland conifers and lowland hardwoods are primarily wetlands but may also include some areas that would be defined as uplands based on regulatory definitions (Michigan Department of Natural Resources, 1992).

In 1972, the Department of Natural Resources conducted a shorelands inventory and identified 105,855 acres of Great Lakes coastal wetlands (Michigan Department of Natural Resources, 1973). It has been estimated that coastal wetland acreage in Michigan has been as much as 369,000 acres in the past (Jaworski and Raphael, 1978). Michigan coastal wetlands are distributed among the Great Lakes in the following proportions: 37 percent along Lake Huron; 28 percent along Lake Michigan; 16 percent along the St. Clair River, Lake St. Clair, and the Detroit River area; 13 percent along Lake Superior; and 6 percent along Lake Erie (Michigan Department of Natural Resources, 1992).



Figure 1. Tobico Marsh, a coastal wetland along the shore of Saginaw Bay. (Photograph by Erin A. Lynch, U.S. Geological Survey.)



Along Lake Michigan from Muskegon north to Empire, wetlands are associated with wide, low-gradient tributary mouths that extend inland for several miles. Beaver Island has extensive wetlands. The shoreline from Empire to the Straits of Mackinac contains few wetlands. The Upper Peninsula shoreline of Lake Michigan is composed of rocky points and headlands with sandy or marshy bay heads (Herdendorf and others, 1981).

Along the Lake Superior shoreline of Michigan, wetlands are most common along the Keweenaw Bay waterway and at tributary mouths in Marquette and Chippewa Counties. The Isle Royale shoreline and islands and the mainland shores of the St. Marys River contain wetlands (Herdendorf and others, 1981).

The Michigan shoreline of western Lake Erie consists of low-lying marshes (emergent wetland) and sand beaches (unconsoli-

dated-shore wetland). The shoreline of Lake Huron from the Straits of Mackinac to Drummond Island generally consists of plains alternating with outcrops of limestone and dolomite. These plains are generally composed of clays and contain marshes. The beaches along the northern part of the Saginaw Bay are occasionally interrupted by wetlands. Most of the southeastern part of Saginaw Bay is marshy with shallow water inshore. From Sand Point to Port Austin the shore is composed of sand beaches with a bluff of uneven sand ridges. The sand ridges parallel the shoreline and alternate with wetlands. The area from Port Hope to the St. Clair River contains few wetlands. Along Lake St. Clair, the St. Clair River, and the Detroit River, the only extensive natural areas that have not been developed are the St. Clair River Delta wetlands and wetlands on islands at the mouth of the Detroit River (Herdendorf and others, 1981).

Approximately 18,000 acres of wetlands line Saginaw Bay (15 percent of the drainage basin) and comprise the largest remaining freshwater coastal wetland system in the Nation. Tobico Marsh (fig. 1) is an enclosed lagoon bordered on the east by a narrow coastal barrier at Saginaw Bay and on the west by sand ridges. Emergent wetlands occupy approximately 1,260 acres of Tobico Marsh. They contain many bird species and are attractive to waterfowl during migration. The Tuscola County Wetlands also are a part of the Saginaw Bay shoreline. They lie south of the Tobico Marsh and are confined to a relatively thin coastal and nearshore zone. In contrast to the Tobico Marsh, the Tuscola County Wetlands are open to wave action from Saginaw Bay. The wetlands occupy depressions within the premodern shoreline, clay flats, and lagoons at present lake level, and sandbars in the nearshore zone (Michigan Department of Natural Resources, 1993).

HYDROLOGIC SETTING

Wetlands form where there is a persistent water supply at or near the land surface. The location and persistence of the supply is

a function of climatic, physiographic, and hydrologic factors such as precipitation and runoff patterns, evaporation potential, topography, and configuration of the water table. In Michigan, a favorable water budget coupled with impeded drainage promotes ample soil moisture for wetland development in depressions, many of which were formed by glaciation. Precipitation (fig. 2B) in the form of rain and snow averages approximately 31 inches annually. Lake-effect precipitation is prevalent in near-shore areas but also affects areas farther inland. Surface waters, including wetlands, are constantly replenished by precipitation. Runoff (fig. 2C) varies geographically and seasonally. It is greatest in areas where snowfall accumulation is heaviest (Miller and Twenter, 1986).

The topographic character of Michigan was largely determined by glaciation. Glacial lobes channeled through parts of the Great Lakes and deposited thick layers of drift material. The bulk of this drift accumulation may have been developed before the latest glacial period. Areas bordering the Lower Peninsula and in a broad belt extending southwest from the Saginaw River Basin beyond Lansing consist of flat drift deposits. Glacial lake waters covered much of these areas. There are more than 35,000 mapped lakes and ponds, and 36,350 miles of rivers and streams in Michigan (Sweat and Van Til, 1987). Nearly all of the lakes and associated wetlands in the lower peninsula occupy depressions in the surface of the glacial deposits. The Escanaba River Basin, in the center of the Upper Peninsula of Michigan, covers an area of 925 square miles. As much as 400 square miles of the southern part of the basin is covered by wetlands (Miller and Twenter, 1986). These wetlands are the remnants of an old glacial lake.

Kettle lake wetlands are common in upland areas within the Great Lakes Basin. Kettle lakes are formed by the incorporation of ice blocks in material that washed out from a melting glacial ice front. Where the melting ice block left a basin in the drift that penetrated the water table, kettle lakes were formed. These lakes differ in shape and size. In general, depth does not exceed 165 feet. The most common wetlands in kettle lakes are bogs. Kettle lakes can

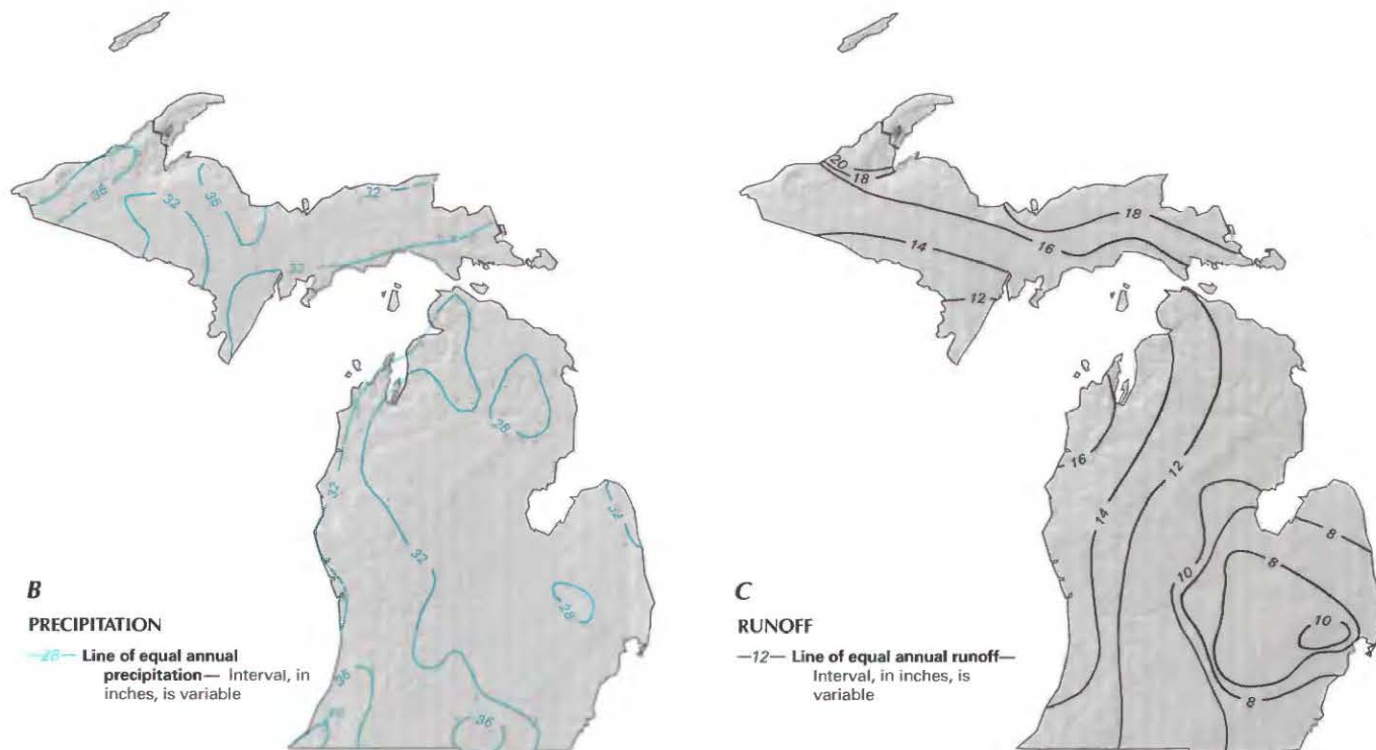


Figure 2. Continued. Wetland distribution and climatological features in Michigan. **B**, Annual precipitation. **C**, Runoff. (Sources: **B** and **C**, Miller and Twenter, 1986; landforms data from EROS Data Center.)

eventually become bog lakes through a series of steps. First, the lake is fringed by floating mats of sedges that grow inward and encroach upon the open water. Eventually the mat covers the entire lake surface, and sphagnum moss and shrubs of the heath family become established. When growth exceeds decomposition, the lake basin begins to fill and peat deposits form. Ultimately, a succession of vegetation types may lead to a climax terrestrial forest (Herdendorf and others, 1981).

Freshwater coastal wetlands are extensive in Michigan. The occurrence, distribution, and diversity of coastal wetlands is, in part, determined by the morphology of the Great Lakes shoreline. Most Great Lakes wetlands develop in lagoons or flood ponds that form just landward of the shoreline. Glacial drift generally forms the upland boundaries, whereas barriers are created by water-laid sand, gravel, or cobble. Upland peninsulas formed by bedrock outcrops or resistant soil provide protection for shallow water areas cut into the shoreline. Riparian (streamside) wetlands extend inland along the flood plains and banks of tributary streams entering the lake basin. Their extent is a function of flood-plain width, which is greatest along larger streams with broad flood plains and least where streambanks are steep. It is difficult to distinguish between some riparian wetlands and those of embayed or barrier-lagoon systems because most tributary streams enter the lakes through lagoons and bays (Geis, 1985).

Sediments in the lagoon of the Tobico Marsh where emergent and submergent wetlands are present are composed of peats of variable consistency or a mixture of peat with fine sand. Tobico Marsh has one outlet—a small creek at the southern end of the marsh. During low water levels the lagoon is effectively sealed from Saginaw Bay. Because the lagoon becomes sealed and, therefore, lacks the flushing action that occurs in more open coastal wetlands, it could evolve into a peat bog (Herdendorf and others, 1981).

Coastal wetlands are, in general, younger than inland wetlands in Michigan because glacial ice receded from most of the Lower Peninsula approximately 12,000 years ago and the Great Lakes reached their present water levels less than 3,000 years ago. Therefore, coastal wetlands are at most 3,000 years old, whereas inland wetlands can be as old as 12,000 years. Coastal wetlands do not mature to the same extent as inland wetlands. Short-term, temporary water-level fluctuations and long-term, cyclic water-level changes can cause vegetation dieback, wetlands erosion, or lateral displacements of vegetative zones. These changes result in constant rejuvenation of coastal wetlands (Herdendorf and others, 1981).

TRENDS

The FWS has estimated that, from the 1780's to the 1980's, wetland area in Michigan decreased by 50 percent—from about 11.2 million to about 5.6 million acres (Dahl, 1990, p. 6). Most wetland loss in Michigan has been caused by drainage for agricultural purposes. Most drainage occurred before 1930. However, from 1934 through 1940, the Works Progress Administration and Federal Relief Agencies drained parts of Michigan to control malaria-carrying mosquitoes. Most drainage occurred in the southern one-third of the State—the area containing most of the important agricultural lands. Notations of bogs of 50 to 100 acres along Elk Creek and a swamp as far as the eye could see were in an 1852 diary entry of O.H. Perry describing a trip across the "thumb district" of eastern Michigan; most of these bogs have been drained. Industrialization has damaged wetlands along the Saginaw River and from the St. Clair River to Lake Erie. The moraine-till plain area of the central Lower Peninsula is the only other major area significantly damaged by drainage (U.S. Fish and Wildlife Service, 1955).

Approximately 37,000 acres of emergent marsh are thought to have existed around Saginaw Bay prior to development in the area. More than one-half of the basin's original wetlands have been drained, filled, altered, or destroyed (Michigan Department of Natu-

ral Resources, 1993). Since the 1850's, 9,420 acres of wetlands have been lost on the southeast coast of Saginaw Bay (Herdendorf and others, 1981).

CONSERVATION

Many government agencies and private organizations participate in wetland conservation in Michigan. The most active agencies and organizations and some of their activities are listed in table 1.

Federal wetland activities.—Development activities in Michigan wetlands are regulated by several Federal statutory prohibitions and incentives that are intended to slow wetland losses. Some of the more important of these are contained in the 1899 Rivers and Harbors Act; the 1972 Clean Water Act and amendments; the 1985 Food Security Act; the 1990 Food, Agriculture, Conservation, and Trade Act; the 1986 Emergency Wetlands Resources Act; and the 1972 Coastal Zone Management Act.

Section 10 of the Rivers and Harbors Act gives the U.S. Army Corps of Engineers (Corps) authority to regulate certain activities in navigable waters. Regulated activities include diking, deepening, filling, excavating, and placing of structures. The related section 404 of the Clean Water Act is the most often-used Federal legislation protecting wetlands. Under section 404 provisions, the Corps issues

Table 1. Selected wetland-related activities of government agencies and private organizations in Michigan, 1993

[Source: Classification of activities is generalized from information provided by agencies and organizations. ●, agency or organization participates in wetland-related activity; —, agency or organization does not participate in wetland-related activity. MAN, management; REG, regulation; R&C, restoration and creation; LAN, land acquisition; R&D, research and data collection; D&I, delineation and inventory]

Agency or organization	MAN	REG	R&C	LAN	R&D	D&I
FEDERAL						
Department of Agriculture						
Consolidated Farm Service Agency	—	●	—	—	—	—
Forest Service	●	—	●	—	●	●
Natural Resources Conservation Service	—	●	—	—	—	●
Department of Defense						
Army Corps of Engineers	●	●	●	●	●	—
Marine Reserve	—	—	●	—	—	—
National Guard	—	—	●	—	—	—
Department of the Interior						
Fish and Wildlife Service	●	—	●	●	●	●
Geological Survey	—	—	—	—	●	—
National Biological Service	—	—	—	—	—	—
National Park Service	—	—	●	●	●	●
Environmental Protection Agency	—	●	—	—	●	●
STATE						
Department of Natural Resources						
Fisheries Division	●	—	—	—	—	—
Forest Management Division	●	—	—	—	—	—
Land and Water Management Division	●	—	—	—	—	—
Surface Water Quality Division	●	●	—	—	—	—
Wildlife Division	—	—	●	●	—	—
Department of Transportation	—	—	—	—	—	—
SOME COUNTY AND LOCAL GOVERNMENTS						
PRIVATE ORGANIZATIONS						
Clinton River Watershed Council	—	—	—	—	—	●
Detroit Audubon Society	—	—	—	●	—	—
Dow Chemical Company	—	—	●	—	—	—
Ducks Unlimited	—	—	●	●	—	—
Future Farmers of America	—	—	—	—	—	—
General Motors	—	—	●	—	—	—
Michigan Duck Hunters Association	—	—	●	—	—	—
Michigan Wildlife Habitat Foundation	—	—	●	—	—	—
The Nature Conservancy	●	—	●	●	●	●
Tipp of the Mitt Watershed Council	—	—	—	—	—	●
Waterfowl USA	—	—	●	●	—	—
Wetlands Conservation Association	—	—	●	—	—	—

permits regulating the discharge of dredged or fill material into wetlands. Permits are subject to review and possible veto by the U.S. Environmental Protection Agency (EPA), and the FWS has review and advisory roles. Section 401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny section 404 permit applications on the basis of a proposed activity's probable effects on the water quality of a wetland.

Most farming, ranching, and silviculture activities are not subject to section 404 regulation. However, the "Swampbuster" provision of the 1985 Food Security Act and amendments in the 1990 Food, Agriculture, Conservation, and Trade Act discourage (through financial disincentives) the draining, filling, or other alteration of wetlands for agricultural use. The law allows exemptions from penalties in some cases, especially if the farmer agrees to restore the altered wetland or other wetlands that have been converted to agricultural use. The Wetlands Reserve Program of the 1990 Food, Agriculture, Conservation, and Trade Act authorizes the Federal Government to purchase conservation easements from landowners who agree to protect or restore wetlands. The Consolidated Farm Service Agency (formerly the Agricultural Stabilization and Conservation Service) administers the Swampbuster provisions and Wetlands Reserve Program. The Natural Resources Conservation Service (formerly the Soil Conservation Service) determines compliance with Swampbuster provisions and assists farmers in the identification of wetlands and in the development of wetland protection, restoration, or creation plans.

The 1986 Emergency Wetlands Resources Act and the 1972 Coastal Zone Management Act and amendments encourage wetland protection through funding incentives. The Emergency Wetlands Resources Act requires States to address wetland protection in their Statewide Comprehensive Outdoor Recreation Plans to qualify for Federal funding for State recreational land; the National Park Service (NPS) provides guidance to States in developing the wetland component of their plans. Coastal and Great Lakes States that adopt coastal-zone management programs and plans approved by the National Oceanic and Atmospheric Administration are eligible for Federal funding and technical assistance through the Coastal Zone Management Act.

Federal agencies are responsible for the proper management of wetlands on public land under their jurisdiction. The U.S. Forest Service manages as much as 588,000 acres of wetlands in three National Forests in Michigan: Huron-Manistee (65,000 acres), Hiawatha (as much as 423,000 acres), and Ottawa National Forests (as much as 100,000 acres). The NPS manages approximately 3,600 acres of wetlands in Sleeping Bear Dunes National Lakeshore, as well as wetland acreage in Isle Royale National Park and Pictured Rocks National Lakeshore.

State wetland activities.—The Michigan Department of Natural Resources assumed administration of the section 404 wetlands program in October 1984. The principal statutory authority for the Michigan wetlands program is Public Act 203, the Goemaere-Anderson Wetland Protection Act of 1980. This act, in conjunction with several other State statutes and regulations, is the basis for Michigan's wetland conservation program. The act requires persons involved in the following activities to obtain a permit from the Michigan Department of Natural Resources: placing fill in a wetland; dredging or removal of soil or minerals from a wetland; constructing, operating, or maintaining any use or development in a wetland; and draining surface water from a wetland. The act also authorizes regulation of wetlands by local governments through wetland ordinances (Warbuch and others, 1990).

The EPA maintains Federal oversight of the State program, including veto authority. The EPA routinely reviews Public Notices for permit applications for "major discharges." Major discharges are defined, in part, as (1) greater than 10,000 cubic yards of fill; (2) discharges that contain toxic materials; and (3) discharges into areas determined to be unique, or where the waterway's commercial

value could be significantly reduced. The Corps retains jurisdiction over Rivers and Harbors Act and section 404 permitting in Great Lakes coastal areas, their connecting waterways, and major tributaries to the upstream limit of Federal navigability. In these areas, both a Corps and a Michigan Department of Natural Resources permit are required for activities in wetlands (Cwikiel, 1992).

Michigan currently (1993) is developing a Wetland Conservation Strategy. The strategy will focus on nonregulatory efforts throughout the State by (1) wetland education and outreach, (2) reclamation of wetlands to restore lost public benefits, (3) attention to wetland water-quality concerns, (4) coordination of existing wetland-management practices (including support of the North American Waterfowl Management Plan), and (5) identification and protection of Michigan's rare and unique wetlands. The strategy is due to be completed by January 1995.

County and local wetland activities.—In addition to their usual planning and zoning responsibilities, several municipalities in the following Michigan counties have adopted ordinances or guidelines to protect wetlands or to mitigate unavoidable wetland losses: Allegan, Antrim, Charlevoix, Cheboygan, Genesee, Grand Traverse, Ingham, Kalamazoo, Livingston, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties.

Private wetland activities.—The Tipp of the Mitt Watershed Council offers a wetland-delineation service and a planning and zoning program to promote water-quality protection. The Wetlands Conservation Association is actively pursuing wetland restoration projects. The Wetlands Foundation of West Michigan assists with the design, funding, and permitting of projects that restore, enhance, or create wetlands primarily for habitat values.

Other organizations and industries that participate in wetland-protection activities in the State include Citizens for Alternatives to Chemical Contamination, Clean Water Action, Clinton River Watershed Council, Detroit Audubon Society, Dow Chemical Company, East Michigan Environmental Action Council, Environmental Protection Council of Oakland County, Friends of Rose Township, Friends of the Crystal River, Friends of the Rouge, Galien River Watershed Council, General Motors, Grand River Preservation Coalition, Huron River Watershed Council, Lake Michigan Federation, League of Women Voters of Michigan, Leelanau Conservancy Watershed Council, Michigan Audubon Society, Michigan Lake and Stream Associations Inc., Michigan United Conservation Clubs, Northern Michigan Environmental Action Council, Sierra Club Mackinac Chapter, Upper Peninsula Environmental Coalition, Water and Air Team for Charlevoix, and West Michigan Environmental Action Council. The activities of these groups are diverse and include participating in the planning and zoning process, serving as information clearinghouses, commenting on or assisting citizens in commenting on dredge and fill applications, engaging in or providing expert witnesses for wetland litigation, restoring wetlands, obtaining conservation easements, and many others.

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FOR ADDITIONAL INFORMATION: District Chief, U.S. Geological Survey, 6520 Mercantile Way, Suite 5, Lansing, MI 48911; Regional Coordinator, U.S. Fish and Wildlife Service, BHW Building, 1 Federal Drive, Fort Snelling, MN 55111

Prepared by
Erin A. Lynch and Marcus C. Waldron,
U.S. Geological Survey