U.S. Department of the Interior
U.S. Geological Survey

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM— LAKE ERIE–LAKE ST. CLAIR BASIN

NAWQA
Fact Sheet

In 1991, the U.S. Geological Survey (USGS) began to implement a full-scale National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources and to identify the major natural and human factors that affect the quality of these resources. In meeting these goals, the program will produce a wealth of water-quality information that will be useful to policymakers and managers at the National, State, and local levels.

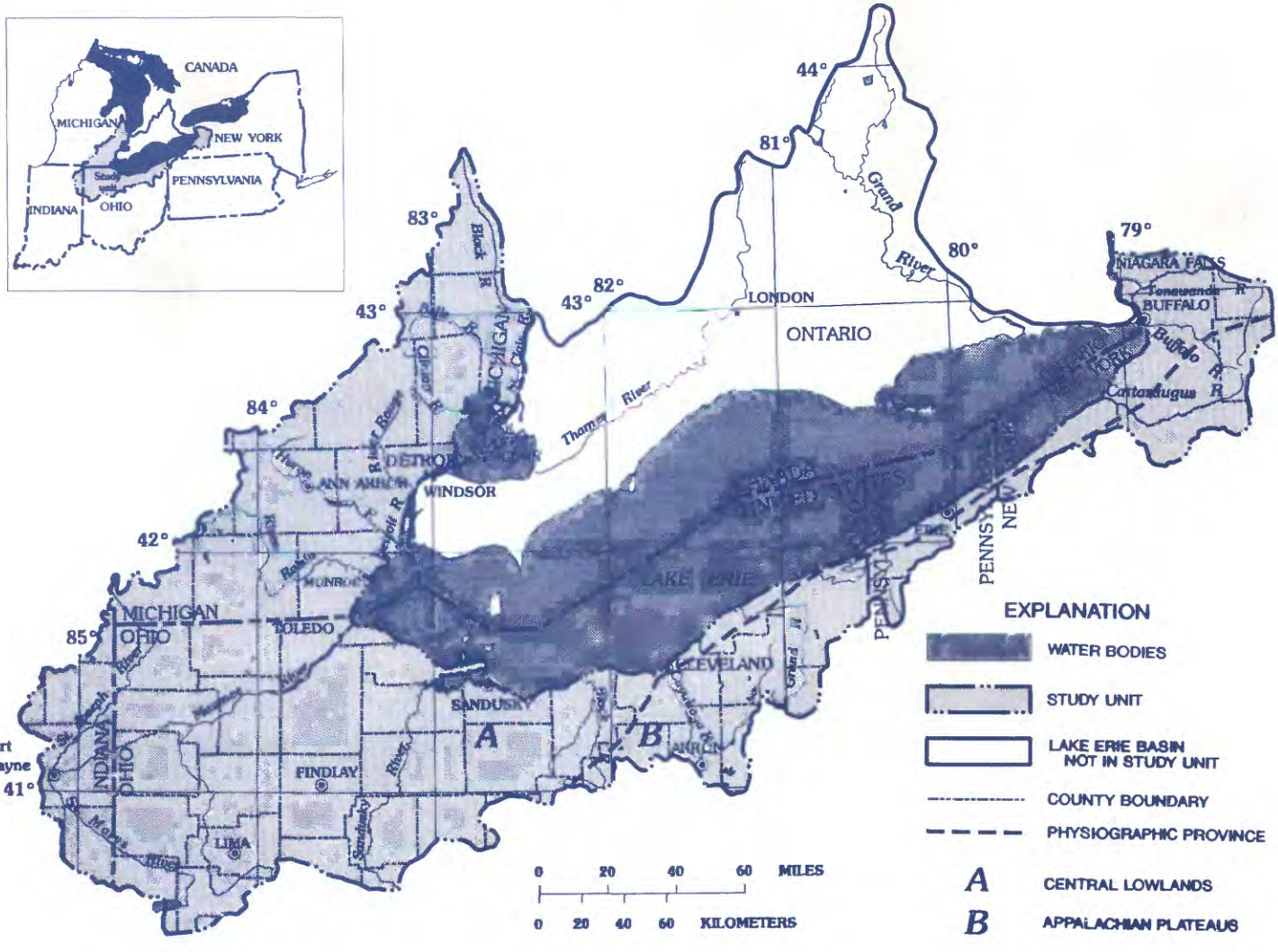
Studies of 60 hydrologic systems that include parts of most major river basins and aquifer systems (study-unit investigations) are the building blocks of the national assessment. The 60 study units range in size from 1,000 to more than 60,000 mi^2 (square miles) and represent 60 to 70 percent of the Nation's water use and population served by public water supplies. Twenty study-unit investigations were started in 1991, 20 additional are starting in 1994, and 20 more are planned to start in 1997. The Lake Erie–Lake St. Clair Basin was selected as one of the 20 study units to begin assessment activities in 1994.

DESCRIPTION OF THE LAKE ERIE-LAKE ST. CLAIR BASIN STUDY UNIT

The Lake Erie–Lake St. Clair Basin study unit (see figure) drains a 22,300-mi^2 area of northern Ohio (62 percent of the study unit), southeastern Michigan (27 percent), northeastern Indiana (6 percent), the northern tip of Pennsylvania, and southwestern New York (5 percent). The study unit represents all of the Lake Erie Basin in the United States and is about two-thirds of the total 30,140-mi^2 area of the Lake Erie Basin in the United States and Canada. The study unit drains to the St. Clair River (starting at the outflow of Lake Huron) and to Lake St. Clair, the Detroit River, and Lake Erie, which is the 11th-largest freshwater lake in the world. The study unit ends at the Niagara River, the outflow of Lake Erie. Principal streams in the study unit include the Maumee River in Ohio and Indiana, the Sandusky River in Ohio, the River Raisin in Michigan, and Cattaraugus Creek in New York.

Population density and growth in the Lake Erie Basin are among the highest in the Great Lakes Basin. About 40 percent of the total population of the Great Lakes Basin lives in the Lake Erie Basin in 17 urban areas having populations of 50,000 or more. The population of the study unit in 1990 was 9.76 million; 3.93 million reside in Ohio, 4.64 million reside in Michigan, 0.34 million reside in Indiana, 0.23 million reside in Pennsylvania, and 0.62 million reside in New York.

Water resources in the study unit are central to the economy and culture of the region. The value of Lake Erie and its tributaries with respect to sport fishing and related commerce was estimated to exceed $850 million in 1988. The study unit contains about 300 public recreational areas and about 90,000 acres of inland waters for public use. Lake Erie supports the largest fresh-water fishery in the Great Lakes (an estimated 50 million to 60 million pounds of fish are caught per year), and it is widely considered to be the best walleye fishery in the world. Lake Erie, Lake St. Clair, and the St. Clair, Detroit, and Niagara Rivers are vital shipping links that connect the upper Great Lakes to Lake Ontario and the St. Lawrence Seaway. Major commodities that are shipped are coal, iron ore, limestone, metal products, sand and gravel, and grains and soybeans.



Most of the study unit (northwestern and north-central Ohio, southeastern Michigan, and northwestern Indiana) is in the Central Lowlands Physiographic Province (see figure). The surficial deposits of this area consist primarily of ground moraine and end moraine of glacial origin; valleys are filled with glacial outwash. The area is characterized by broad, low ridges with smooth, gentle slopes separated by flat, gently undulating plains. The Eastern Lake Section and the Till Plains Section within the province consist of wide expanses of flat land underlain by clayey till or lake deposits; this flat land is interspersed with sandy ridges that are remnants of glacial-lake beaches. Wetlands dominated the landscape in the western part of the study unit before settlement. About 90 percent of the wetlands were drained for agricultural and urban development. The only sizable remnants are the shoreline wetlands of the Ottawa National Wildlife Refuge and Crane Creek State Park along Lake Erie and the freshwater delta marshes of the St. Clair Flats State Wildlife Area at the mouth of the St. Clair River. Because soils are fertile and the climate is temperate, the primary land use in this part of the study unit is agricultural, ranging from orchards and vineyards near the Lake Erie shoreline to cropland in corn and soybeans further inland.

The easternmost part of the study unit (northeastern Ohio, Pennsylvania, and New York) is within the Appalachian Plateaus Physiographic Province. Here, successive glaciations have subdued the relief and buried many preglacial valleys. The topographic relief in this province is greater than that of the Central Lowland Province and consists of irregular plains dissected by stream valleys. Land use is a mix of agriculture, forest, and urban areas. Orchards and vineyards are located along the Lake Erie shoreline in this part of the study unit because of the moderating effect of the Lake on the local climate.

From west to east, average annual temperature in the study unit is 48 to 51 degrees Fahrenheit, average annual precipitation is 31 to 40 in. (inches), average annual surface runoff is 8 in. to 22 in., and average water loss from evaporation and evapotranspiration is 22 to 25 in. Recharge of the ground-water reservoir in most of the study unit is limited by overlying fine-grained soils and is only about 2 in. annually. However, recharge can be as high as 6 in. annually in some areas.

The principal stream in the study unit, the Maumee River, drains an area of 6,608 mi^2, or roughly one-third of the total drainage area of the study unit. The average daily discharge of the Maumee River is 4,990 ft^3/s (cubic feet per second) at Waterville, Ohio. Between 1930 and 1993, the maximum streamflow recorded was 113,000 ft^3/s on March 14, 1982, and the minimum streamflow recorded was 17 ft^3/s on June 30, 1988. Other principal streams and their drainage areas in Ohio are the Sandusky River (1,420 mi^2), the Cuyahoga River (809 mi^2), and the Grand River (705 mi^2). Principal streams in Michigan are the River Raisin (1,070 mi^2), the Huron River (909 mi^2), and the Clinton River (742 mi^2). The principal stream in New York is the Cattaraugus Creek (554 mi^2).

Principal aquifers in the study unit consist of glacial or alluvial deposits and bedrock. The glacial and alluvial deposits are fine- to coarse-grained. The coarse-grained deposits generally consist of highly permeable sands and gravels of glaciofluvial origin commonly found along the courses of present-day streams. The coarse-grained deposits in the northwestern corner of the study unit underlie glacial till or lake deposits, contain ground water that is locally confined under artesian pressure, and form aquifers that can be highly productive. Extensive kame-terrace or other permeable glacial deposits of gravel and sand are widely tapped as sources of ground water throughout northeastern Ohio. Bedrock aquifers commonly consist of limestone and dolomite in the northwestern and extreme northeastern parts of the study unit, and sandstone and fractured shale in the central part of the study unit. The U.S. Environmental Protection Agency has designated three sole-source aquifers in the study unit: the Catawba Island/Bass Island aquifer and the Allen County area-combined aquifer system in Ohio, and the Cattaraugus Creek Basin aquifer system in New York.

In 1987, surface-water withdrawals in the study unit averaged about 8,250 million gallons per day. About 99 percent of the withdrawals were from Lake Erie, Lake St. Clair, the St. Clair and Detroit Rivers, and other principal tributaries. The St. Clair–Detroit River system supplies water to 50 percent of Michigan's population. Approximately 12 percent of the water withdrawn from the Lake Erie–Lake St. Clair Basin study unit is used for public supply; only 6 percent of the public supply is ground water. Power generation and industrial uses constitute 88 percent of the withdrawals, less than 2 percent of which is from ground water. Water users inland from the lakes rely to a greater degree on ground water for domestic, industrial, and agricultural supply than do water users near the lakes.

MAJOR WATER-QUALITY ISSUES

Recent and historical water-quality initiatives are an outgrowth of public concern about water quality. Among these initiatives are the Great Lakes Water Quality Agreement (1976, 1984, and 1987) between the United States and Canada, and the Great Lakes Water Quality Initiative to control toxic substances released to the Great Lakes. Impairments to use of the water resource have been identified in 43 Areas of Concern (AOC), and Remedial Action Plans to clean up these areas are being prepared. Eleven AOC's are in the study unit.

Improvements in scientific knowledge are needed to improve our understanding of processes that influence the occurrence, distribution, transport, fate, and effects of many of the contaminants of concern in the study unit. Although much progress has been made in the Lake Erie Basin to control and mitigate contamination and improve water quality since the early 1970's, water-quality managers must often implement best-management practices and regulate certain contaminants on the basis of incomplete or conflicting information. The following major water-quality issues have been identified in the Lake Erie-Lake St. Clair Basin study unit:

- Reproductive impairment in fish and wildlife as a result of exposure to and bioaccumulation of contaminants such as PCB's, pesticides, methyl mercury, and other trace-element and trace-organic compounds.
- The suitability of commercial and sport fish for human consumption as a result of elevated concentrations of PCB's and other substances in fish tissue.
- Impairment of the use of water resources for consumption and recreation and for aquatic life as a result of the discharge of nutrients, pesticides, trace elements, synthetic organic compounds, and pathogens to streams and lakes by way of storm runoff.
- Declines in biological diversity of aquatic communities as a result of habitat disturbance and alteration.
- Problems related to water-supply management and ecosystem management as a result of the proliferation of nonnative species.

COMMUNICATION AND COORDINATION

Communication and coordination between the USGS and other scientific and water-management organizations are critical components of the NAWQA program. Each study-unit investigation has a local liaison committee consisting of a manager, who represents Federal, State, and local agencies; universities; and the private sector. Each liaison committee will exchange information on water-quality issues of regional and local interest, identify sources of data and information, assist in the design and scope of project elements, and review project-planning documents and reports.

— Donna N. Myers and Dennis P. Finnegan

Information on technical reports and hydrologic data related to the NAWQA program can be obtained from:

Project Chief
Lake Erie–Lake St. Clair Basin
NAWQA Study
U.S. Geological Survey
975 West Third Avenue
Columbus, OH 43212-3192
(614) 469-5553, or
email dnmyers@dohclb.er.usgs.gov