CHAPTER 7
AGRICULTURE, DRAINAGE, AND HABITAT

I. Introduction

Land area in the Toledo Metropolitan Area Council of Governments (TMACOG) region is comprised mainly (80%) of agriculture and other rural uses (Figure 7-1), with the most common row crops being corn, soybean, and wheat. Agriculture is a vital component to the region's economy and provides a sustainable source of food. In addition, farming is a culture and long-standing tradition for many families in northwest Ohio and southwest Michigan. As described in **Chapter 2**, most of the region was once a lake bottom and is part of the Huron-Erie Lake Plain ecoregion. This area covers a portion of the former Great Black Swamp, a giant wetland, and consists of silt and clays soils with poor natural drainage that frequently floods after precipitation events. However, many soils in the region are highly productive and rate as prime agricultural land after being drained. Subsurface tile drainage systems allow groundwater to drain a field to control the water level and are very common systems in the region and throughout the Midwest.

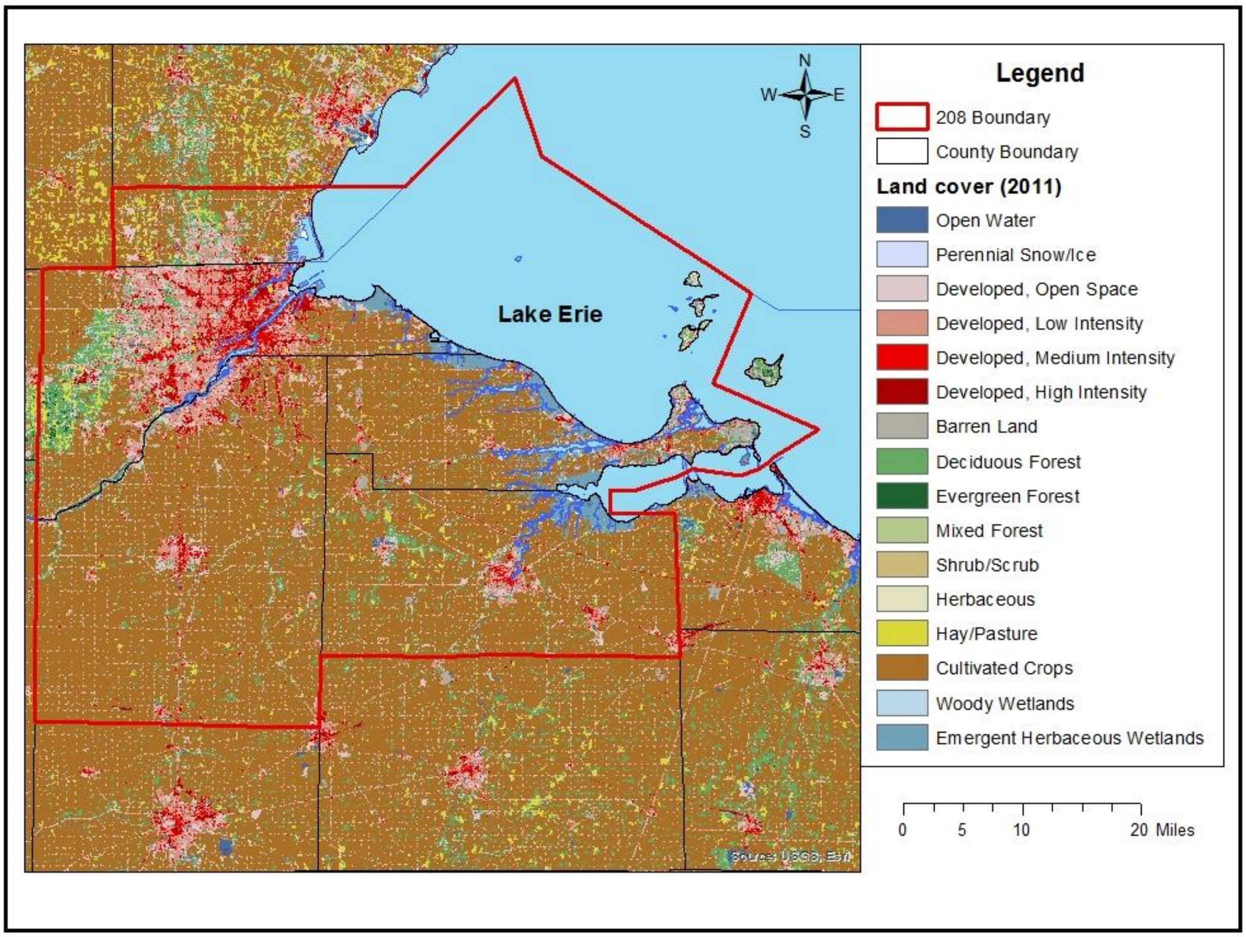

Figure 7-1: Land Use Coverage Within the 208 Plan Area
(Source: Land use data from Esri ArcGIS Online: USA National Land Cover Database, 2011)

Application of fertilizers to agricultural fields is needed to enhance the quality of soil to meet the nutrient demand of crops, and thereby maximize yield. Nitrogen, phosphorus, and potassium are the three major nutrients delivered as fertilizer, and the application rate for each nutrient varies based on the demand by the crop. For example, corn, soybean, and wheat remove greater amounts of nitrogen from the soil than phosphorus and potassium, but corn removes more phosphorus than soybean (Silva, 2017). Regardless of whether fertilizer is applied at the correct rate, there is potential for the nutrients to be transported off the farm field to adjacent drainage ditches by surface runoff or subsurface drainage during and after precipitation events.

Agriculture in the TMACOG region may potentially impact water quality based on two factors: (1) conversion of wetland to farm land and (2) water pollution from nutrients, sediments, and pesticides. The act of draining soils for productive agriculture alters the natural services provided by wetlands to improve water quality, such as filtration, flood control, nutrient cycling, and shoreline and storm protection. Draining wetlands also adversely impacts critical habitat for flora and fauna. Water pollution from agriculture is commonly known as non-point source (NPS) pollution, which is correlated to the amount of precipitation (Smith et al., 2015). Surface runoff may include soil, nutrients, and pesticides that flow overland into drainage ditches; subsurface drainage may include dissolved forms of the nutrients and pesticides. In addition to row crops, agricultural livestock such as confined animal feeding operations (CAFOs) are another potential source of pollution to surface water and groundwater.

At the present, we are facing a great challenge to maintain agricultural production while protecting the environment and critical ecosystem services. To meets these demands, an approach will be needed that addresses conservation stewardship, habitat protection, and innovative technologies.

This chapter complements **Chapter 2** with the purpose to recommend agricultural practices and policies, and to identify agency roles that support agriculture production and achieve goals of the Clean Water Act (CWA). Specific outcomes include:

1. Designation of management agencies with responsibilities to implement agricultural conservation practices and best management practices (BMPs).
2. Identification and prioritization of areas (including watersheds) for habitat protection and restoration, and where agricultural nonpoint pollutant load reductions are needed.

Details for BMPs identified to address priority areas are outlined in plans that have been approved by the United States Environmental Protection Agency (U.S. EPA) and Ohio EPA, which include Watershed Action Plans and Nine-Element Nonpoint Source Implementation Strategies (9-Element NPS-IS) (http://epa.ohio.gov/dsw/nps/index.aspx).

II. Lake Erie Studies

Collective results from several past studies and ongoing research programs guide our understanding of water quality in Lake Erie and assist in setting policies and goals.

Pollution from Land Use Activities (PLUARG)

Article VI of the Great Lakes Water Quality Agreement (GLWQA) signed in 1972, requested the International Joint Commission (IJC) to report on pollution of the boundary waters of the Great Lakes system from agricultural, forestry and other land use activities. The IJC established the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) to plan and implement the request (PLUARG, 1978).

Eutrophication, due to elevated nutrient inputs, particularly in the lower lakes (Erie and Ontario), and the increasing contamination of these water bodies by toxic substances, were identified as the major pollution problems in the Great Lakes basin. PLUARG concluded that the eutrophic condition of Lake Erie could not be related entirely to identifiable point sources, including municipal sewage treatment plants and industrial effluents. Major findings by PLUARG included:

1. The Great Lakes are being polluted from land drainage sources by phosphorus, sediments, some industrial organic compounds, previously used pesticides, and potentially some heavy metals.
2. The lakes most affected by phosphorus and toxic substances are Erie and Ontario.
3. Intensive agriculture is the major diffuse source contributor of phosphorus.
4. Erosion from crop production on fine textured soils and from disturbed soil in urbanizing areas were the main sources of sediment.
5. The most important land-related factors affecting the magnitude of pollution from land use activities were soil type, land use intensity, and materials (i.e. fertilizers) usage.

PLUARG issued several recommendations for agricultural nonpoint sources. Selected recommendations specific to Lake Erie are shown below.

- Development and implementation of management plans.
- Control of phosphorus – reduce phosphorus loads through implementation of point and non-point programs.
- Control of sediment – reduce the movement of fine-grained sediment from land surfaces.
- Agricultural land use – assist farmers to develop and implement water quality plans.
- Urban land use – control urban stormwater runoff.
- Wetlands and farmlands – preserve wetlands.

Lake Erie Wastewater Management Study

The Lake Erie Wastewater Management Study (LEWMS) was conducted by U.S. Army Corps of Engineers (USACE) in 1979 to i) identify and quantify phosphorus and sediment sources, ii) develop a management strategy to control the sources, and iii) assess the strategy's economic impact. The study evaluated the water quality conditions of Lake Erie to develop a recommended wastewater management program to restore and rehabilitate Lake Erie. The study identified diffuse (i.e. non-point) sources of phosphorus as a major problem that must be controlled to restore Lake Erie (USACE, 1979). Land management options to reduce sediment export from agricultural fields were analyzed and evaluated. Major conclusions from the study include:

- The bulk of the phosphorus from non-point and point sources reached Lake Erie in association with suspended sediment transported during storm events.
- The biological availability of sediment-bound phosphorus varied considerably with flow and between river basins.
- Reducing gross erosion would reduce phosphorus loads to Lake Erie.
- Non-point source phosphorus is derived principally from agricultural land use, particularly crop production.
- Adoption of conservation tillage and no-till practices appeared to be an economically feasible method of reducing potential erosion in the Lake Erie basin.
- A maximum rural non-point source phosphorus reduction of 4,100 to 5,100 metric tons per year would result if the maximum reduced tillage scenario was achieved and erosion reduction was 90% effective in reducing phosphorus.
- Tillage practices other than conservation tillage and no-till were shown to be unable to achieve significant erosion reductions.
- In addition to conservation tillage and no-till practices, other controls of sediments and phosphorus must be appropriately applied. These controls include animal waste management, gully erosion control via waterways and structures, and farm conservation plans.
- Long-term water quality monitoring is required to measure reductions in sediment and phosphorus transport resulting from non-point source management.
- Education and technical assistance programs are needed to accelerate the adoption of conservation tillage, no-till, and other cost effective BMPs.
- The environmental benefits of erosion control extend well beyond a reduction in phosphorus.

Overall, the Lake Erie basin-wide benefits resulting from sediment reductions included: reduced sedimentation and reduced dredging costs in Lake Erie harbors; lower water treatment costs for sediment removal from domestic water supplies; less movement and transport of other sediment attached pollutants such as insecticides and herbicides; reduced in-stream sedimentation which benefits the fishery resources. In addition, BMPs that help prevent sedimentation also improve aquatic habitat, such as riparian buffer zones.

National Center for Water Quality Research - Heidelberg University, Ohio

The National Center for Water Quality Research (NCWQR) was originally started as the River Laboratory by Dr. David Baker in 1969. The laboratory focuses on nutrient and sediment loadings from several Lake Erie tributaries, which requires sampling stations to collect frequent data on stream flow and pollutant concentrations. NCWQR partners with the U.S. Geological Survey (USGS) who provides the stream flow measurements, and laboratory staff collect and analyze the water samples. The tributary loading program is necessary to compare the amounts of pollutants derived from diffuse nonpoint sources, such as agricultural and urban storm runoff, with contributions from point sources, such as sewage treatment plants. NCWQR maintains three monitoring sites in the TMACOG region: Maumee River in Waterville (data available from 1975); Portage River in Woodville (data available from 2010); Sandusky River at Ballville near Fremont (data available from 1974). The laboratory has been successful in maintaining continuous funding for the tributary loading program and has numerous publications in peer reviewed scientific journals (https://ncwqr.org/).

Ohio Lake Erie Phosphorus Task Force I and II

The re-emergence of nuisance algal blooms in the mid-1990s and massive blooms in 2003 and 2006 led the Ohio EPA and NCWQR to convene the Ohio Lake Erie Phosphorus Task Force in 2007. The purpose of the Task Force was to review and evaluate the increasing dissolved reactive phosphorus (DRP) loading trends and the connection to the deteriorating conditions in Lake Erie. The goal of the Task Force was to identify and evaluate potential point and nonpoint sources and related activities that might be contributing to the increasing trend in the DRP load (Ohio EPA, 2010). The Task Force included personnel from federal, state and local agencies, stakeholder groups, educational institutions, and completed a broad-based review of studies throughout the region to gather data and information. Key observations made by the Task Force included:

- Point source and lawn care products are not major contributors to the increase in algal blooms.
- Zebra and quagga mussels influence the internal cycling of phosphorus within Lake Erie, but their influence is expected to be short-lived.
- There is a lack of evidence that differentiates the relative contributions of commercial fertilizers and the land application of manure.
- Agricultural phosphorus applications have decreased, but DRP concentrations have increased. There have been changes in agriculture practices on the methods, amount, form, placement, and timing of nutrient applications. Management practices that focus on the application of nutrients will have the greatest potential for reducing phosphorus levels in Lake Erie.
- Improved and more frequent soil testing is recommended to identify the correct rate of phosphorus application needed for crop production. Along with testing, precision nutrient management technology can control nutrient applications at the optimum rate.
- There is no single agricultural practice that will result in lowering nutrient runoff. A suite of BMPs is needed that address methods of application, amount, form, and placement, and practices that inhibit runoff delivery to local streams.
- Changing seasonal patterns of rainfall and runoff have contributed to increased runoff of DRP to Lake Erie. Stream corridors can provide assimilative capacity for the uptake of in-stream nutrients in stream runoff, but benefits are primarily localized to stream condition. Addressing upland measures such as on-the-field, will yield the most beneficial results for phosphorus control.
- DRP concentrations and loads from the Maumee and Sandusky rivers are much higher than other Ohio Lake Erie rivers, making them a priority.

In 2012, Ohio EPA, in partnership with Ohio Lake Erie Commission (OLEC), Ohio Department of Agriculture (ODA), and Ohio Department of Natural Resources (ODNR) reconvened the Ohio Lake Erie Phosphorus Task Force as a Phase II effort. A wide range of participants including members of the original Ohio Lake Erie Task Force, agri-business representatives, and crop consultants came together to build upon the findings of the 2010 Phosphorus Task Force report. The purpose of Phase II was to i) develop reduction targets for total phosphorus and DRP that can be used to track future progress, and ii) develop policy and management recommendations based on new and emerging data and information (ODA et al., 2013). Recommendations made by Phase II include:

- A robust monitoring program to measure progress toward loading and concentration targets and harmful algal bloom (HAB) reduction, and to allow annual evaluation and modification of the targets in the future.
- A 37% reduction in the average spring total phosphorus load of 1,275 metric tons for 2007-12, or a target of 800 metric tons. A 39% reduction from the average annual total phosphorus load of 2,630 metric tons for 2007-12, or a target of 1,600 metric tons.
- A 41% reduction in the average spring DRP load of 256 metric tons for 2007-12, or a target of 150 metric tons.
- Applying loading reduction targets to all western basin tributaries.
- Efforts should be made to improve the regional soil health. Agricultural practices should attempt to increase organic matter, reduce compaction, and minimize pesticide use.
- Drainage management structures and other edge-of-field runoff reduction and storage practices need to be a part of the overall management practices across the northwest Ohio landscape while acknowledging that they may not be well suited for some agricultural fields.

Ohio EPA Mass Balance Study for Ohio's Major Rivers

Ohio EPA initiated their study to serve as a baseline and aid in tracking progress of the goals established by the 2012 GLWQA and Gulf of Mexico Hypoxia Task Force 2008 Action Plan. Ohio EPA is required by Ohio law (Ohio Revised Code 6111.03) to complete the nutrient accounting for the Maumee, Portage, Sandusky, Cuyahoga, Great Miami, Scioto, and Muskingum watersheds on a two-year basis and coinciding with the release of the Ohio EPA's Integrated Water Quality Monitoring and Assessment Report. The study computed nutrient loadings for these seven major watersheds that comprise 63% of Ohio's land area for the water years 2013 and 2014 (Ohio EPA, 2016a). Major findings include:

- The Maumee watershed generated the highest annual total phosphorus load for both water years (2013 and 2014) – an average of 2,200 metric tons per annum.
- Non-point sources were the highest contributors to the phosphorus load in the Sandusky (93% of the total load), Maumee (88%), and Portage (85%) watersheds.
- National Pollutant Discharge Elimination System (NPDES) permitted facilities accounted for 4-11% for total phosphorus and 2-10% for total nitrogen in the Maumee, Portage, and Sandusky watersheds.

- Home sewage treatment systems (HSTS) accounted for 3-8% for total phosphorus and 1-2% for total nitrogen in the Maumee, Portage, and Sandusky watersheds.

Ohio's Domestic Action Plan

The Ohio Domestic Action Plan (DAP) was prepared in accordance with the GLWQA by OLEC, Ohio EPA, ODA, ODNR, and Ohio Department of Health (ODH) (OLEC et al., 2017). The Ohio DAP was in draft form at the time this chapter was updated in early 2018.

The U.S. and Canada renegotiated the GLWQA in 2012 to establish Annexes focused on critical issues. Specifically addressing HABs is Annex 4, which focuses on nutrients and problems associated with excessive phosphorus loading. To control algal species and cyanobacterial biomass, the GLWQA recommends a 40 percent reduction in spring total P and DRP for several rivers in the U.S. and Canada, including the Maumee, Portage, and Sandusky (U.S. EPA, 2018).

The Ohio DAP was developed to advance efforts toward the proposed 40% nutrient reduction target put forth by the GLWQA of 2012 (OLEC et al., 2017). The Ohio DAP outlines a list of action items for each of the state agencies based on the following types of actions (Kosek-Sills, 2018).

- Agricultural Land Management
  - Agricultural BMPs
  - Guidance actions
  - Education and outreach actions
- Community-Based Nutrient Reduction
  - Review and revise NPDES permits
  - Nutrient specific combined sewer overflow study
  - Continue infrastructure funding
  - Develop watershed implementation plans
  - Evaluate new technologies
  - HSTS operations and maintenance
- Restoration and Support of Ecosystem Services
  - Identify potential areas suitable for restoration
  - Continue restoration funding
- Monitoring, Tracking, Research, and Support
  - Continue to sample water quality at fixed shoreline and nearshore stations
  - Establish monitoring network as a starting point for state prioritized funding

III. Background and History of Non-Point Source Pollution in Lake Erie

Phase 1: Blue-Green Algae Blooms

Excessive nutrient loading into Lake Erie in the 1960s and 1970s resulted in large blue-green algae blooms in the western basin and dead zones (areas of hypoxia/anoxia or no dissolved oxygen) in the western and central basins. As stated above, the LEWMS identified excessive phosphorus loading as the principal cause of accelerated eutrophication and anoxic conditions in Lake Erie (USACE, 1979). Non-point sources accounted for nearly 50% of the total phosphorus load to Lake Erie, with contributions from non-point sources increasing in agricultural dominated watersheds. For example, non-point sources accounted for 80% of the total phosphorus in the Maumee River watershed.

In 1975, the total phosphorus load to Lake Erie was approximately 20,000 metric tons per year, and in 1978 the GLWA set a target of 11,000 metric tons per year. The required reduction was divided between the U.S. and Canada, and within the U.S. between nonpoint and point sources; nonpoint source reduction targets were ultimately set for individual Ohio Lake Erie counties. LEWMS predicted that reaching this target would reduce the area of anoxia in the central basin by 90 percent within a few years.

Phase 2: Success of Sewage Treatment Improvements and Conservation Tillage

To address phosphorus loading from point sources, U.S. EPA created the NPDES in Section 402 of the CWA in 1972. The NPDES permit program controls water pollution by regulating discharge of point source pollutants into waters of the U.S. The CWA established a total phosphorus concentration limit of 1.0 milligram per liter (mg/L) in the effluent for wastewater treatment plants with flows greater than 1.0 million gallons per day (MGD). Improvements to the water quality in Lake Erie were observed within 10 years after implementation of the NPDES program. This is demonstrated by the LEWMS, which noted the total phosphorus loading from point sources was 11,900 metric tons per year in 1970 and reduced to 4,500 metric tons per year by 1980.

Conservation tillage or reduced tillage was identified by the LEWMS as a BMP to reduce losses of phosphorus and soil from farm fields. The practice of conservation tillage expanded rapidly in the Lake Erie basin, starting with little adoption in the early 1970s and increased to 22% on the basin's cropland in 1981; no tillage was used on 4% of the cropland (Yaksich, 1982). Annex 3 of the 1978 GLWQA, prepared by the U.S. EPA in 1981 reaffirmed the target total phosphorus load of 11,000 metric tons per year. The re-evaluation indicated that if all municipal wastewater treatment plants with flow greater than 1.0 MGD achieved the phosphorus concentration of 1.0 mg/L in effluents, loadings in Lake Erie would be reduced to 13,000 metric tons per year. Therefore, an additional 2,000 metric tons per year would be required to achieve the target goal of 11,000 metric tons per year. The LEWMS indicated that a conservation tillage program could ultimately achieve the 2,000 metric tons per year reduction in total phosphorus at a benefit/cost ratio of 10:1 (Yaksich, 1982).

Agricultural agencies promote conservation tillage through technical assistance, demonstration projects, education, and cost-share incentives. In the 1980s, Wood and Ottawa County Soil and Water Conservation Districts (SWCDs) promoted conservation tillage by purchasing equipment with grant funding and then renting it to farmers. This approach allowed farmers to try no-till farming without having to spend money on a no-till drill. These types of cost-share programs, notably through the U.S.

Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS): at the time known as the Soil Conservation Service, ODA, Ohio EPA, and ODNR supported use of conservation tillage. By the late 1980s and into the 1990s, conservation tillage became widely applied.

Improvements to water quality in Lake Erie were achieved through the combination of enforcing regulations for municipal wastewater treatment plants effluent and application of conservation tillage. During the 1980s and 1990s phosphorus loads declined and the impacts by algal blooms were alleviated (Figure 7-2). It's worth noting that between 1983-2006, the phosphorus target load was met 19 times out of the 24 years. Point source loadings have declined to around 2,000 metric tons per year, which is less than half the load in 1980, and less than one-fifth of the 1970 load. Nonpoint source loads varied widely, depending on the weather and storm event patterns (Ohio EPA, 2010). Lake Erie seemed to be well on its way to recovery.

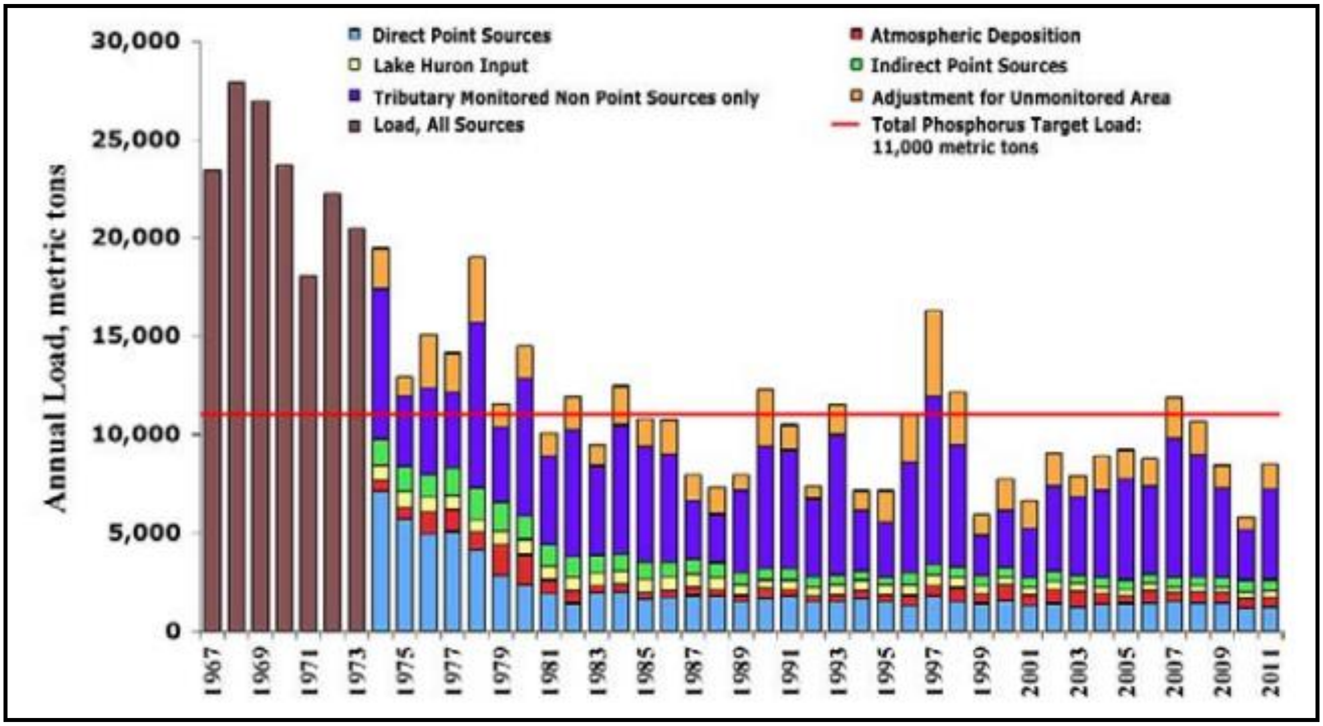

Figure 7-2: Lake Erie Annual Loads of Total Phosphorus

(Source: Scavia et al., 2014)

Phase 3: The invasion of the Zebra and Quagga Mussels

Zebra and then quagga mussels quickly spread throughout the western Lake Erie basin (WLEB) and its tributaries in the early 1990s. The mussels immediately became a nuisance to public water supply systems, as they grew in thick colonies on water intakes and interfered with the ability to provide drinking water. Water treatment costs increased because of the need to kill the mussels and remove their shells during the treatment process. Despite the mussels making the lake water clearer though their filter feeding, it was unknown at the time that the mussels were changing the pathways of phosphorus in the lake ecosystem. Lake total phosphorous levels continued to decline during the explosive spread of the mussels, reaching the lowest levels in 1995 (Scavia et al., 2014).

Phase 4: Re-emergence of Harmful Algal Blooms

DRP loads in the Maumee and Sandusky Rivers decreased from the 1970s to the mid-1990s, but have been on the rise since 1995 (see discussion below on tributary loads). Total phosphorus is comprised of both particulate phosphorus (phosphorus attached to soil particles), and dissolved phosphorus (phosphorus dissolved in water). Whereas particulate phosphorus is approximately 25% bioavailable (usable by plants and algae), DRP is 100% bioavailable (Johnson, 2017).

Elevated levels of cyanobacteria in the WLEB began to reappear in the late 1990s and have grown rapidly since 2002 with the worst blooms occurring in 2011 and 2015 (Figure 7-3). In 2014, an algal bloom dominated by the species *Microcystis aeruginosa* produced the toxin microcystin (a liver toxin) at levels exceeding the World Health Organization (WHO) drinking water standard of 1.0 microgram per liter (µg/L) or part per billion (ppb). The elevated level of microcystin resulted in the City of Toledo to post a “do no drink” advisory to approximately 500,000 residents of the region for parts of three days (Toledo Blade, 2018).

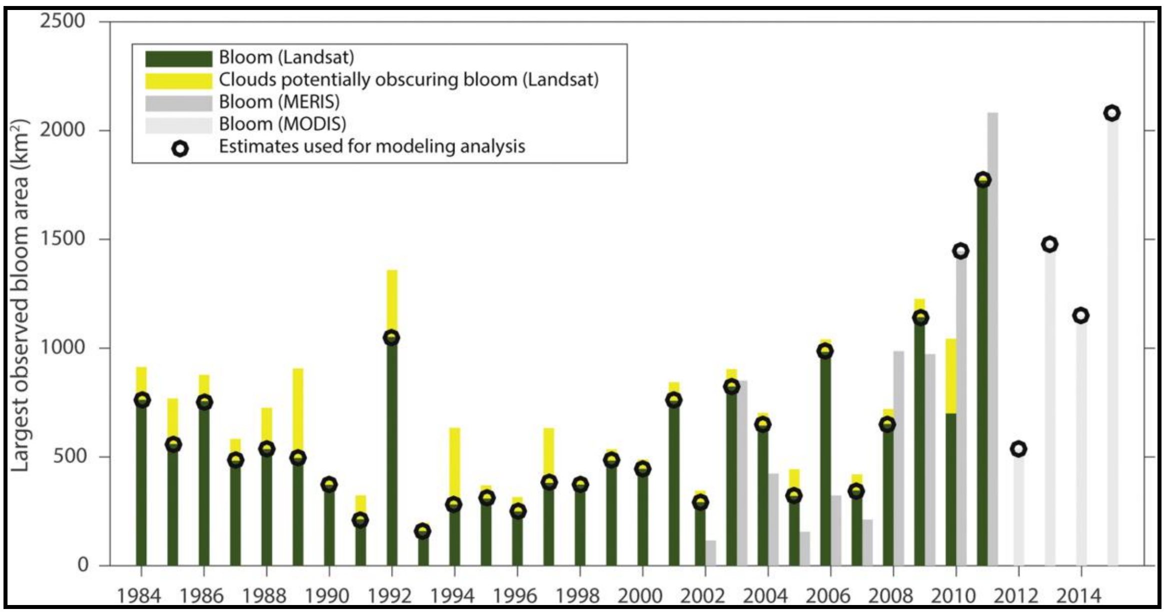

Figure 7-3: Historical Record of Maximum Summertime Algal Bloom Extents
(Source: Ho and Michalak, 2017)

Despite regional efforts that successfully reduced suspended solids and particulate phosphorus loads, a consensus was made by the regional stakeholders that phosphorus control measures may be needed that differ from controls used previously. As noted above, the GLWQA of 2012 recommends a 40 percent reduction in spring total phosphorus and DRP for several rivers in the U.S. and Canada, including the Maumee, Portage, and Sandusky (U.S. EPA, 2018). Ohio’s DAP outlines actions that several of the state agencies will implement to advance efforts toward the proposed 40% nutrient reduction target.

Researchers recently identified nitrogen as a potential growth limiting nutrient of harmful algal blooms (Chaffin et al., 2013) and a major factor in production of the toxins (Davis, 2017). These findings indicate that nitrogen is now a major component to addressing harmful algal blooms.

IV. Western Basin Tributary Nutrient Loads

The principal rivers of the region include the Maumee, Portage, and Sandusky and descriptions for each river are provided in **Chapter 2**. These three rivers share many common characteristics, including predominant agricultural land use, flat terrain with little elevation change, and fine-textured soils such as silts and clays. Available long-term data for the Maumee and Sandusky Rivers demonstrates similar annual trends in water quality parameters (Figures 7-4 and 7-5), while the short-term data for the Portage River supports different trends in discharge, total phosphorus, DRP, and particulate phosphorus (Figure 7-6).

Lake Erie: Phosphorus Load Overview

Broadly classified, nutrients enter Lake Erie from the Detroit River, Maumee River, and all other tributaries. While the Detroit River comprises 94% of the total flow into Lake Erie, the river's phosphorus load is less than the Maumee River (Table 7-1). It is important to note the total phosphorus levels in the Detroit River are approximately 25 times smaller than the Maumee River (0.014 mg/L versus 0.42 mg/L, respectively).

Table 7-1: Lake Erie Phosphorus Load Sources

Source	Lake Erie Basin Land Area (%)	Flow into Lake Erie (%)	Average Total Phosphorus Load (Metric tons / year)	Flow-weighted Phosphorus Level (milligrams / liter)
Detroit River	22.4	94	2,233 (41%)	0.014
Maumee River	42.6	4	2,568 (47%)	0.42
Other Tributaries	35.0	2	689 (12%)	0.27

Data from 2011-2013. (Source: U.S. EPA, 2015)

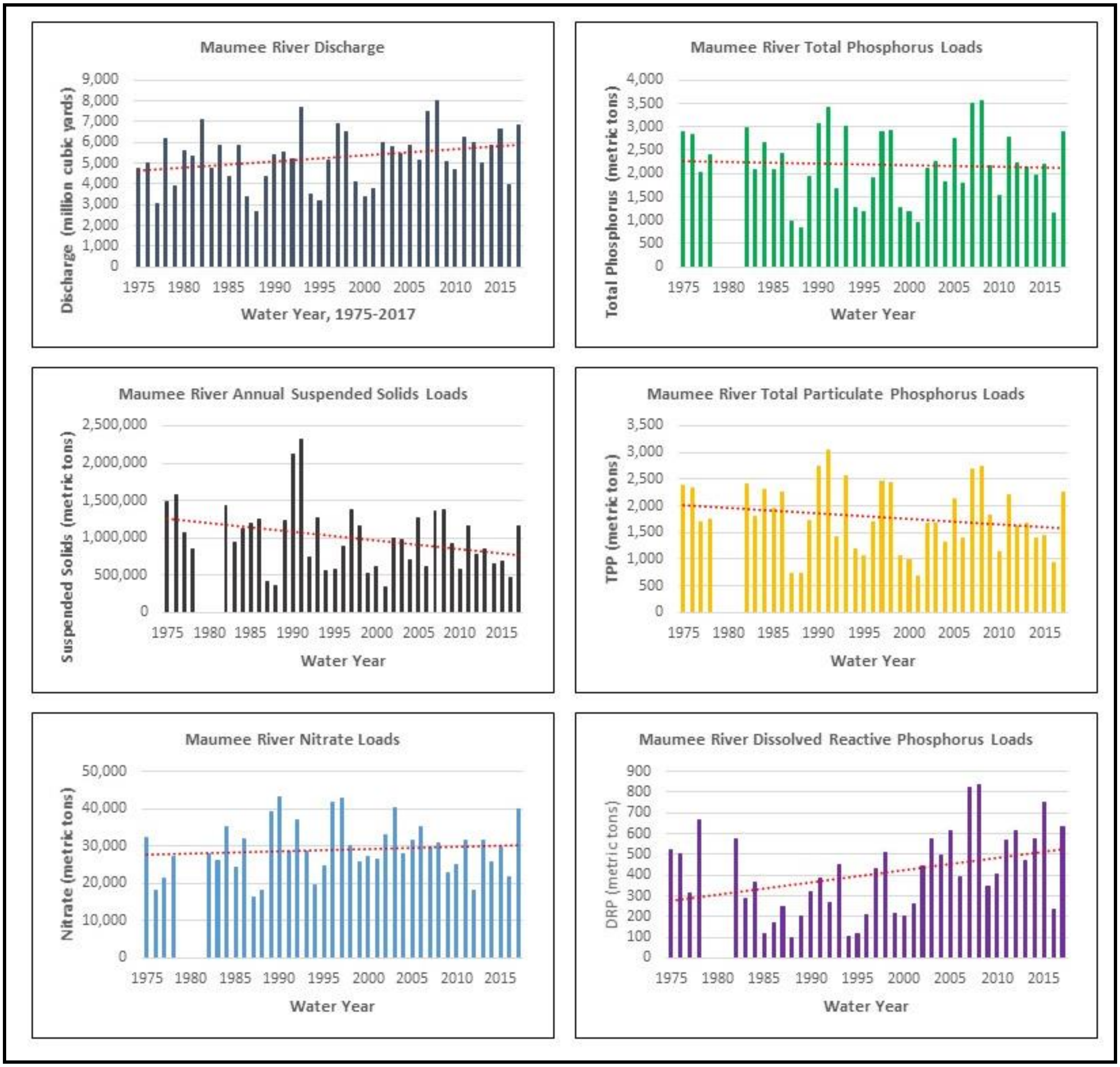

Figure 7-4: Maumee River Water Quality Data, 1975 to 2011

(Source: National Center for Water Quality Research, Heidelberg University, 2018)

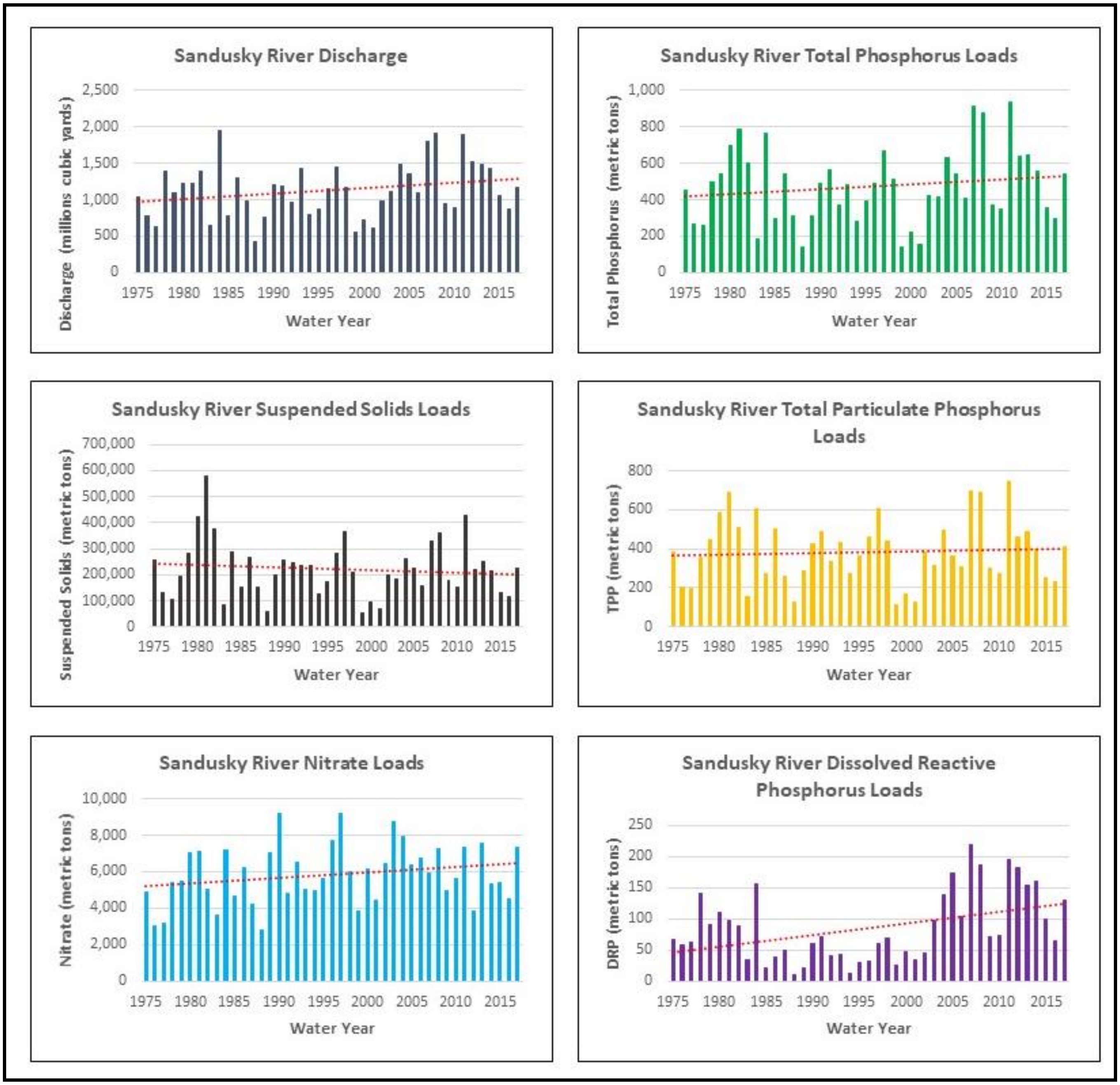

Figure 7-5: Sandusky River Water Quality Data, 1975 to 2011
(Source: National Center for Water Quality Research, Heidelberg University, 2018)

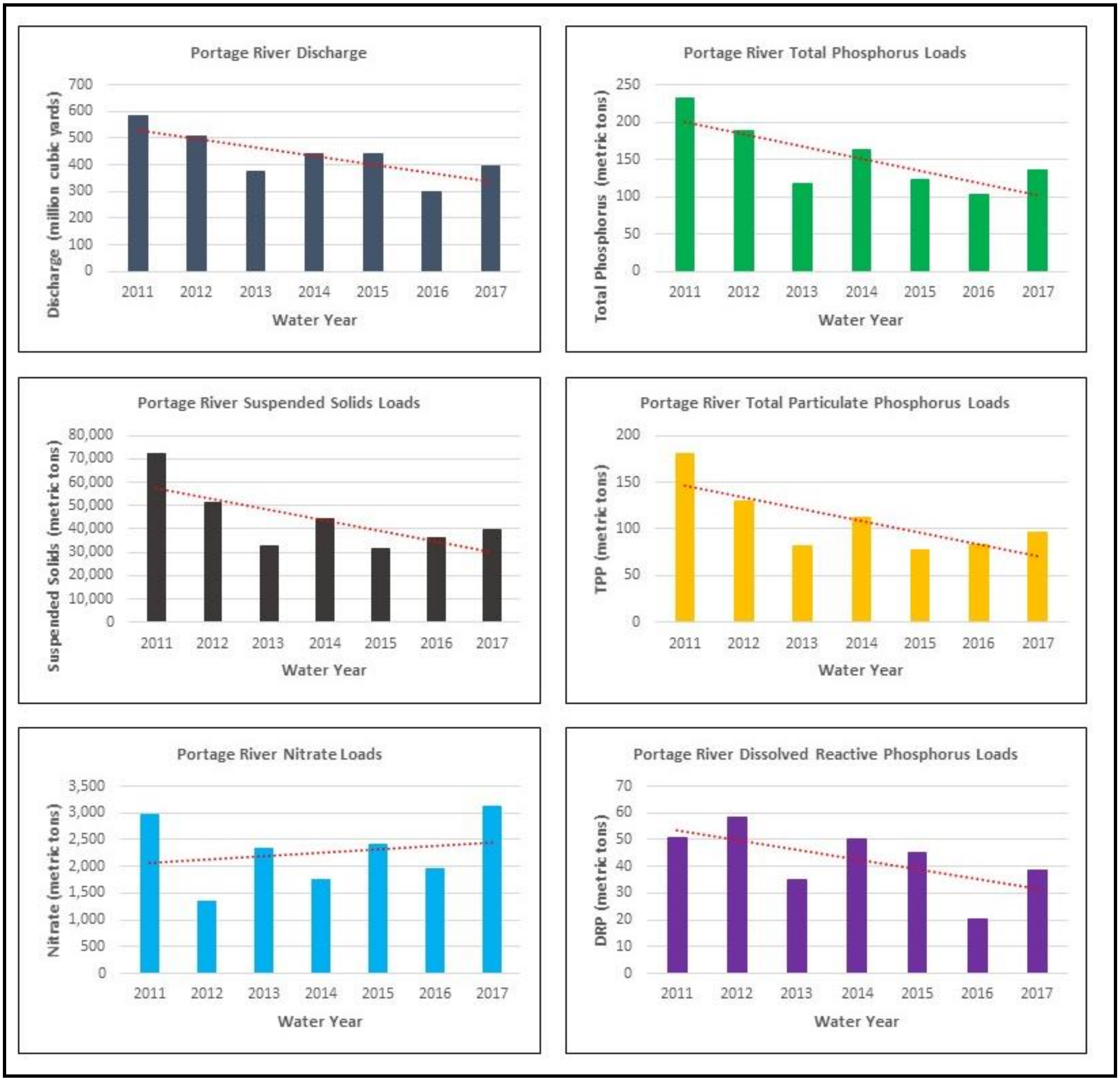

Figure 7-6: Portage River Water Quality Data, 2011 to 2017
(Source: National Center for Water Quality Research, Heidelberg University, 2018)

General Conclusions

- Although the Maumee River contributes only 4% of the flow into Lake Erie, the river contributes nearly half of the total phosphorus load to Lake Erie. This is because of the elevated levels of phosphorus compared to other tributaries.
- Long-term available data for the Maumee and Sandusky Rivers demonstrates similar annual trends in water quality parameters. This is not surprising, since both rivers share similar geography, soil types, and land use.

V. Western Lake Erie Basin Agricultural Best Management Practices

Achieving sustainable agricultural productivity while conserving soil and water is a national priority. Implementation of agricultural conservation practices or BMPs have made significant headway in reducing nutrient and sediment losses from agricultural fields; however, no single practice can meet the needs for each field or farm. The USDA-NRCS identified five major resource concerns that impact soil health and off-site water quality in the WLEB (USDA-NRCS, 2016a), including: sediment loss, soil organic carbon change, subsurface nitrogen loss, total phosphorus loss, and soluble phosphorus loss.

In 2012, the USDA-NRCS completed an assessment on the effects of conservation practice adoption on cultivated cropland in the WLEB (USDA-NRCS, 2012a). Major findings included:

- Ninety-nine percent (99%) of cropland acres are managed with at least one conservation practice.
- Thirty-five percent (35%) of cropland acres have conservation practices in place that adequately address all five resource concerns, and 59% of cropland acres have practices that adequately address at least four resource concerns.
- Ninety-six percent (96%) of cropland acres are adequately managed to prevent average annual sediment losses of more than two tons per acre.
- Seventy percent (70%) or more of nitrogen applied is removed by crop harvest on nearly 95% of cropland acres.
- Fifty-eight percent (58%) of cropland acres are managed with phosphorus application rates at or below crop removal rates.
- Forty-two percent (42%) of cropland acres are the source of 78% of total annual phosphorus losses and 80% of total sediment losses.
- Winter application rates were unchanged and remained low, with 13% of total phosphorus applied between November and February.
- More than 8.9 million gallons of diesel fuel consumption equivalents were saved from conservation tillage adoption, translating to a reduction of over 99,500 tons of CO_2 emissions.

USDS-NRCS compared the results from 2012 to their previous assessment made between 2003-06. Major environmental improvements included:

- Average sediment loss at the edge of the field decreased from 1.1 to 0.5 tons per acre per year, largely due to the increased adoption of edge-of-field trapping practices.
- Average phosphorus application rates declined, with average annual application rates decreasing by nearly 2.7 pounds per acre, declining from 21.5 to 18.7 pounds per acre (lbs/acre) per year. Crop removal rates remained constant.
- Average total phosphorus loss declined from 2.3 to 1.9 lbs/acre per year. The decrease was driven by a reduction in surface losses, which correlates with the reduction in sediment losses. Soluble phosphorus losses remained the same, at 1.3 lbs/acre annually delivered past the edge of the field.
- Average nitrogen losses to surface flows decreased from 7.1 to 4.6 lbs/acre per year, although nitrogen inputs and subsurface losses did not change significantly, nor did nitrogen removal by crops at harvest.

Types of Agricultural Conservation and Best Management Practices

Agricultural conservation and BMPs are techniques that address soil and water resources for a specific region or field. These practices may be categorized as on-field and off-field, with a few examples summarized below and in Table 7-2.

On-field practices include:

- Conservation tillage – any tillage or planting system that covers an area of soil surface with crop residue, after planting to reduce runoff and soil erosion.
- Cover crops – plants grown during the off-season when cash crops are not being produced to protect soil surface from raindrop impact, improve infiltration relative to bare soil, and trap eroded soil particles.
- Crop rotation – growing different crops in the same area in sequenced seasons. Crop rotation reduces soil erosion and increases soil fertility and crop yield.
- Nutrient management – manipulates the application of plant nutrients to reduce their loss via surface runoff and subsurface drainage and maximize crop production. In general, "4 R" principles of applying nutrients that use the right source applied, at the right rate, at the right time, and in the right place (https://4rcertified.org/).

Off-field practices include:

- Conservation buffers – strips or small areas of land in permanent vegetation that help reduce pollutants transported off fields from entering surface waters. Types of conservation buffers include: filter strips, grassed waterways, windbreaks, contour grass strips, and riparian buffers.
- Drainage control – structures used to modify the timing and amount of discharge from subsurface drainage systems. Drainage control reduces pollutant loads entering surface waters and increases crop yield.

- Stream restoration – the process of returning a stream as closely as possible to conditions and functions prior to a disturbance. Restoration promotes ecological diversity and natural filtration and utilization of nutrients.

Table 7-2: Agricultural Conservation and Best Management Practices

Practice	Resource Concerns Addressed				
	Sediment Loss	Soil Organic Carbon Change	Subsurface Nitrogen Loss	Total Phosphorus Loss	Soluble Phosphorus Loss
Conservation tillage	x	x	x	x	x
Cover crops	x	x	x	x	x
Crop rotation	x	x			
Nutrient management	x	x	x	x	x
Conservation buffers	x		x	x	x
Drainage control			x	x	x
Stream restoration	x		x	x	x

VI. Drainage

Soils of the region are fertile and support highly productive agricultural practices. However, this is only possible by using subsurface tile drains and/or extensive systems of drainage ditches that promote drainage from the fields. Ohio and Michigan have laws and regulations pertaining to how local agencies may provide adequate agricultural drainage.

Ohio Drainage Law

The Ohio Revised Code (http://codes.ohio.gov/orc) provides several mechanisms for constructing and maintaining drainage facilities.

- **Chapter 6131: Single County Ditches** invests County Commissioners with the authority to construct ditch improvements when petitioned by land owners of the affected drainage area.
- **Chapters 6133 and 6135** provide mechanisms for **Joint County Ditches** and **Interstate County Ditches**, respectively.
- **Chapter 6137: Ditch Maintenance Fund** establishes rules and procedures for levying and using property assessments.
- **Chapter 6151: Watercourses** establishes the authority of the County Commissioners to straighten watercourses.
- **Chapter 1515: Soil and Water Conservation Commission** establishes the authority of Boards of SWCD Supervisors to plan, construct, and maintain measures to control soil and water resources.

- **Chapter 6101: Conservancy Districts** establishes a mechanism for a district to undertake studies or projects addressing a wide variety of water resources or environmental issues, including flooding, stream channel or floodplain modification, water supply, or sanitary sewerage.
    - Conservation Districts of the region include:
        - Reno Beach-Howard Farms Conservancy District
        - Maumee Watershed Conservancy District
        - Wightman's Grove Conservancy District

Several other mechanisms are available that could be used for managing agricultural drainage, but are not currently used in the region:

- **Chapter 1710: Special Improvement Districts** may develop and adopt one or more written plans for public improvements or public services that benefit all or any part of the district.
- **Chapter 6105: Watershed Districts** may obtain the orderly development and the most beneficial use of the water resources.
- **Chapter 6115: Sanitary Districts** may be established for several purposes, including mosquito control and cleaning or improving stream channels or regulating the flow of streams for sanitary purposes.
- **Chapter 6117: County Sewer District** provides water, sewerage, and/or stormwater management services in unincorporated areas.
- **Chapter 6119: Regional Water and Sewer Districts** provide water supply, sewerage, and/or stormwater management services under a district plan, which may encompass more than one county.

Michigan Drainage Law

The Michigan Drain Code of 1956, Michigan Compiled Laws Section 280, is commonly referred to as "Act 40" (Michigan Legislature, 2018). Act 40 authorizes the county drain commissioner referred to as "commissioner", drainage board, city, village, or township to construct ditch improvements when petitioned by land owners of the affected drainage area. The commissioner has jurisdiction over all drains within the county.

VII. Federal, State, and Local Agencies

Many federal, state, and local agencies have roles and responsibilities for agricultural practices, drainage, and habitat. The plan summarizes the roles fulfilled by such agencies (Tables 7-3, 7-4, and 7-5).

Table 7-3: Federal Agencies

<table>
<tr><th colspan="2">Federal</th></tr>
<tr><th>Agency</th><th>Description</th></tr>
<tr><td>U.S. Department of Agriculture (USDA)</td><td>Provides technical assistance and funding through two agencies:
<u>Farm Services Agency (FSA)</u>
• Conservation Reserve Program administration
• Conservation Reserve Enhancement Program administration
• Farmable wetlands program administration
<u>Natural Resources Conservation Service (NRCS)</u>
• Farm Bill program financial and technical assistance for conservation planning and practice implementation
• Great Lake Restoration Initiative (GLRI) grants
• Co-chair of the WLEB Partnership with the USACE
• Maintain Ohio Field Office Technical Guide on conservation practices and standards</td></tr>
<tr><td>U.S. Environmental Protection Agency (U.S. EPA)</td><td>Responsible for regulations to implement the Clean Water Act.
• Great Lakes Water Quality Agreement administration
• Total Maximum Daily Load (TMDL) review
• NPDES permit review
• Nine-Element Watershed Plan oversight</td></tr>
<tr><td>US Fish & Wildlife Service (USFWS)</td><td>Conducts programs to protect fish and wildlife species, and their habitat; provides grant funding under some programs.
• Endangered Species Program
• International affairs
• Law enforcement
• Migratory birds</td></tr>
<tr><td>National Oceanic and Atmospheric Administration (NOAA)</td><td>Conducts weather and climate forecasts and studies.
• Ohio Sea Grant
• Satellite imaging
• Coastal Resource Management</td></tr>
</table>

Table 7-4: State Agencies

State	
Agency	**Description**
Ohio Environmental Protection Agency (Ohio EPA)	Responsibility for water quality protection throughout Ohio. • NPDES permit approval and oversight • Wastewater treatment technical and feasibility studies • Stormwater management program and administration • Water quality monitoring (watersheds and Lake Erie) • Section 319 Grant, Surface Water Improvement Fund (SWIF), GLRI fund administration • Areas of Concern program • Harmful algal bloom program administration • TMDL studies
Ohio Department of Agriculture (ODA)	Responsibility for agricultural non-point sources. Specific areas of involvement include: • Agricultural non-point program implementation • Agriculture fertilizer applicator certification programs • CAFO permitting and regulatory oversight • Certified livestock manager training and inspections • Manure and fertilizer application enforcement • Fertilizer sales records • Watershed coordinator program administration • Agricultural non-point BMP technical assistance and oversight • Agricultural pollution abatement program • Ohio runoff risk forecast website • Conservation reserve enhancement program implementation
Ohio Department of Natural Resources (ODNR)	Responsibility for coastal program coordination, habitat, and fisheries. • Private and public lands wildlife habitat management • Posting of bathing beach advisories on state park beaches and boat ramps • Lake Erie fisheries • In-water beneficial reuse of dredged material • In-water coastal wetland for habitat restoration and nutrient reduction
Ohio State University Extension	Conducts research and educational programs, and provides extensive technical recommendations to the agricultural community.

State	
Agency	**Description**
Michigan Department of Environment, Great Lakes, and Energy (Michigan EGLE)	Responsible for water quality protection throughout Michigan. • NPDES permit approval and oversight • Wastewater treatment technical and feasibility studies • Stormwater management program and administration • Water quality monitoring (lakes and streams) • Areas of Concern program • Harmful algal bloom program administration • Wetlands protection and restoration programs administration • TMDL studies • Section 319 Grant, and GLRI fund administration
Michigan Department of Agriculture and Rural Development (MDARD)	Use a customer-driven, solution-oriented approach to • Cultivate and expand new economic opportunities for the food and agricultural sector • Safeguard the public's food supply • Inspect and enforce sound animal health practices • Control and eradicate plant pests and diseases threatening the food and agriculture system • Preserve the environment by which the farming community makes their living and feeds consumers • Protect consumers by enforcing laws relating to weights and measures.
Michigan Department of Natural Resources (Michigan DNR)	Responsible for the conservation, protection, and management of the state's natural and cultural resources. • Similar activities as ODNR
Michigan State University Extension	Conducts research and educational programs, and provides extensive technical recommendations to the agricultural community.

Table 7-5: Local Agencies

Local	
Agency	**Description**
Watershed Councils	Local non-profit organizations that are volunteer-based take on coordination of watershed programs to protect clean water and habitat. • Partners for Clean Streams • Duck-Otter Creek Partnership • Swan Creek Balanced Growth Committee • Wolf Creek Committee • Sandusky River Watershed Coalition • Portage River Basin Council
County Soil and Water Conservation Districts (SWCD)	Designated Management Agencies (DMAs) for agricultural pollution abatement. • Offer voluntary programs that promote the use of agricultural conservation practices and BMPs • Provide technical assistance and conduct educational programs at the local level, working directly with land owners • Support legislation essential to agricultural pollution abatement • Pursue funding from conservation programs
County Engineer / Drain Commissioner	Responsible for drainage and may have responsibilities for county roads, water supply, or sanitary sewage. • Provide technical assistance with planning and design, and oversight of construction • Provides maintenance for infrastructure • Maintains records

VIII. Habitat

Priority Agricultural Watersheds

Ohio EPA conducts water quality monitoring to assess stream attainment of water quality standards. This is commonly completed during a Biological and Water Quality Study. Waters identified as impaired, are placed on a list under Section 303(d) list of the CWA, within the Integrated Water Quality Monitoring and Assessment Report that indicates the general condition of Ohio's waters and identifies water that are not meeting water quality goals. For each impaired water, Ohio EPA typically prepares a TMDL analysis to identify causes and sources of water quality impairments (http://epa.ohio.gov/dsw/tmdl/index.aspx). The TMDL specifies the amount a pollutant needs to be reduced to meet the water quality standards, allocates pollutant load reductions, and provides the basis for taking actions needed to restore a water body. Table 7-6 shows common parameters analyzed during the development of a TMDL and sources and causes of identified impairments due to agriculture (there is no direct relationship between columns; each column is a separate list).

Table 7-6: Water Quality Impairments Related to Agriculture

TMDL Parameter	Sources of Impairments	Causes of Impairments
Acid	Agriculture – Row Crop	Ammonia
Alkalinity	Agriculture - Runoff	Dissolved Oxygen / Organic Enrichment
Ammonia	Agriculture – Subsurface Drainage	Flow Alteration
Atrazine	Channelization	Habitat Alteration
Bacteria	Crop Production with Subsurface Drainage	Nitrate / Nitrite
Chemical Oxygen Demand	Flow Modification	Nutrient Enrichment / Eutrophication
Chlorides	Habitat Alteration	Pesticides
Dissolved Oxygen	Manure Runoff	Phosphorus (total)
Metals	Riparian Vegetation Removal	Sediment
Nitrate		Sediment Screening (exceedance)
Pesticides		Sedimentation / Siltation
pH		Siltation
Sediment		
Total Dissolved Solids		
Total Nitrogen		
Total Phosphorus		
Total Suspended Solids		
5-day Carbonaceous Biochemical Oxygen Demand		

In many cases, the Biological and Water Quality Study and TMDL provides the only source of current water quality data for streams. As of July 2017, Ohio TMDLs approved by U.S. EPA within the 208 region included the Maumee (lower) and Lake Erie Tributaries, Portage River, Sandusky River (lower) and Bay Tributaries, Swan Creek, and Toussaint River (http://epa.ohio.gov/dsw/tmdl/index.aspx). Currently, there are several watersheds with a TMDL under development (http://epa.ohio.gov/Portals/35/tmdl/TMDL_status_July2017_TSD.pdf). In Michigan, the Surface Water Assessment Section of Michigan EGLE oversees the protection of the quality of surface waters. Michigan EGLE performs several monitoring assessments (www.mi.gov/waterquality).

This plan identifies priority watersheds (hydrologic unit code [HUC] 12 digit) based on the number of causes for water quality impairments that may be related to agricultural practices. This means the cause of an impairment is the result of a source linked to agricultural practices. Priority HUC-12 watersheds in the 208 Plan area are shown in Figure 7-7, with specific sources and causes for water quality impairments detailed in Table 7-7 (Ohio EPA 2016b).

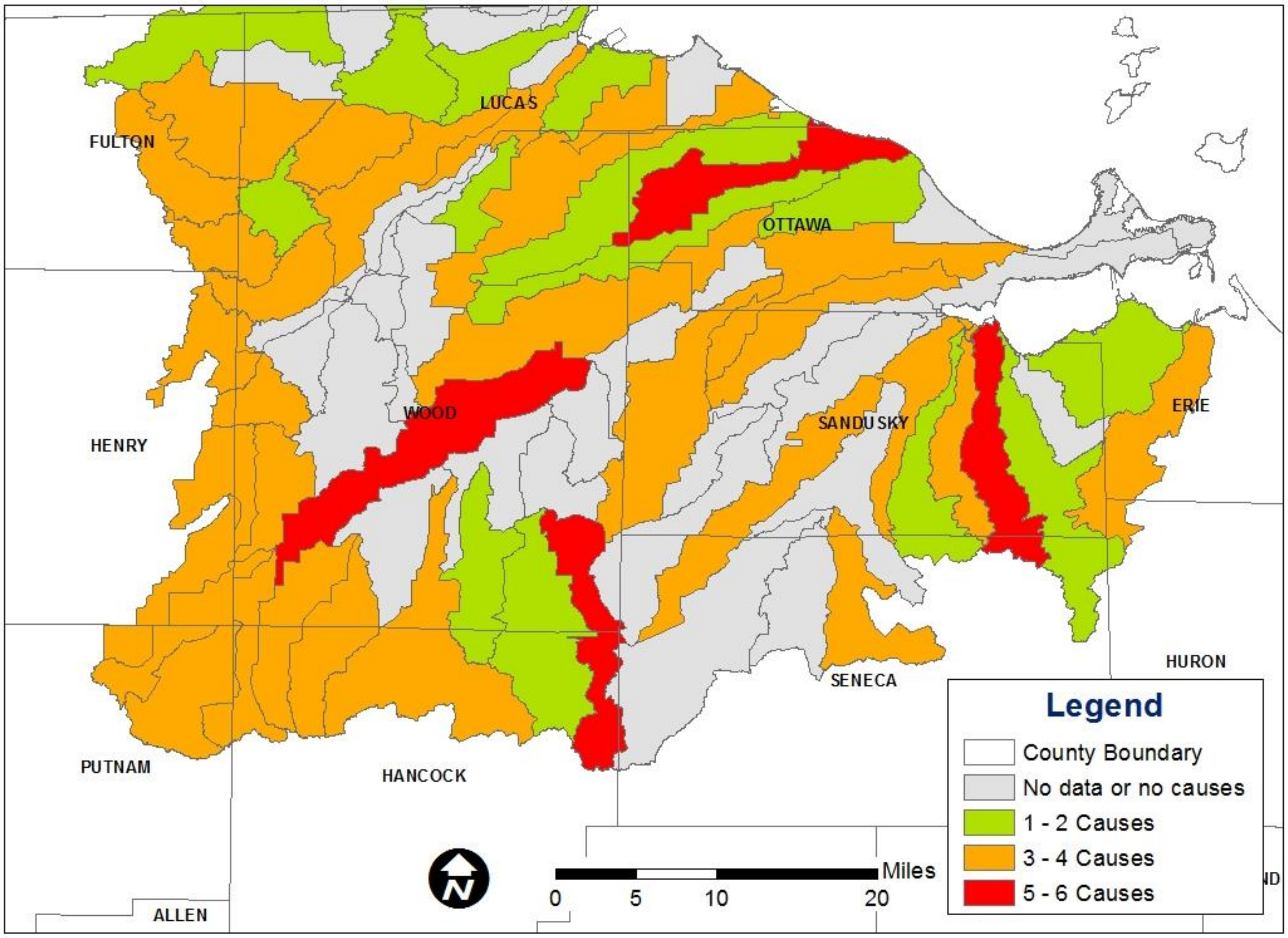

Figure 7-7: Priority Agricultural Watersheds

Table 7-7: Watershed Impairments

Watershed		Sources							Causes												
Watershed Name	**12-Digit Watersheds**	Agriculture - Row Crop	Agriculture Runoff	Agricultural Subsurface Drainage	Channelization	Manure Runoff	Riparian Vegetation Removal			Ammonia	Dissolved Oxygen / Organic Enrichment	Flow Alteration	Habitat Alterations	Nitrate / Nitrite	Nutrient Enrichment / Eutrophication	Pesticides	Phosphorus (total)	Sediment	Sediment Screening (exceedance)	Sedimentation / Siltation	Siltation
Plum Creek	041000010201																				
Gray Drain	041000010203																				
Otter Creek	041000010204																				
Shantee Creek	041000010301																				
Halfway Creek	041000010302																				
Prairie Ditch	041000010303																				
Headwater Tenmile Creek	041000010304				♦															♦	
North Tenmile Creek	041000010305			♦								♦									
Heldman Ditch-Ottawa River	041000010307				♦															♦	
Sibley Creek-Ottawa River	041000010308				♦								♦							♦	
Detwiler Ditch-Frontal Lake Erie	041000010309																				
Hammer Creek	041000090502	♦			♦							♦	♦		♦						
Upper Yellow Creek	041000090504	♦			♦							♦	♦		♦						
Brush Creek	041000090505	♦			♦							♦	♦		♦						
Lower Yellow Creek	041000090506	♦			♦							♦	♦		♦						
Cutoff Ditch	041000090507	♦			♦							♦	♦		♦						
Middle Beaver Creek	041000090508	♦			♦							♦	♦		♦						
Lower Beaver Creek	041000090509	♦			♦							♦	♦		♦						
Lick Creek	041000090510	♦			♦							♦	♦		♦						
Tontogany Creek	041000090601																				
Sugar Creek-Maumee River	041000090602																				
Haskins Road Ditch	041000090603																				
Ai Creek	041000090701	♦			♦								♦		♦			♦			

Watershed		Sources							Causes												
Watershed Name	12-Digit Watersheds	Agriculture - Row Crop	Agriculture Runoff	Agricultural Subsurface Drainage	Channelization	Manure Runoff	Riparian Vegetation Removal			Ammonia	Dissolved Oxygen / Organic Enrichment	Flow Alteration	Habitat Alterations	Nitrate / Nitrite	Nutrient Enrichment / Eutrophication	Pesticides	Phosphorus (total)	Sediment	Sediment Screening (exceedance)	Sedimentation / Siltation	Siltation
Fewless Creek-Swan Creek	041000090702	♦			♦								♦		♦			♦			
Gale Run-Swan Creek	041000090703	♦													♦			♦			
Upper Blue Creek	041000090801	♦			♦								♦		♦			♦			
Lower Blue Creek	041000090802	♦			♦								♦		♦			♦			
Wolf Creek	041000090803	♦			♦								♦		♦			♦			
Heilman Ditch-Swan Creek	041000090804				♦								♦		♦			♦			
Grassy Creek Diversion	041000090901																				
Grassy Creek	041000090902				♦															♦	
Crooked Creek	041000090903																				
Delaware Creek-Maumee River	041000090904				♦							♦		♦			♦			♦	
Rader Creek	041000100101	♦			♦						♦			♦			♦			♦	
Needles Creek	041000100102	♦			♦							♦	♦							♦	
Rocky Ford	041000100103	♦			♦							♦	♦							♦	
Town of Rudolph-Middle Branch Portage River	041000100104																				
Bull Creek	041000100201				♦								♦							♦	
East Branch Portage River	041000100202	♦			♦					♦		♦		♦	♦					♦	
Town of Bloomdale-South Branch Portage River	041000100203	♦			♦								♦							♦	
Rhodes Ditch	041000100204																				
Cessna Ditch-Middle Branch Portage River	041000100205																				
North Branch Portage River	041000100301	♦			♦						♦		♦	♦			♦			♦	
Town of Pemberville-Portage R.	041000100302																				
Sugar Creek	041000100401	♦			♦								♦		♦					♦	

Watershed		Sources							Causes												
Watershed Name	12-Digit Watersheds	Agriculture - Row Crop	Agriculture Runoff	Agricultural Subsurface Drainage	Channelization	Manure Runoff	Riparian Vegetation Removal			Ammonia	Dissolved Oxygen / Organic Enrichment	Flow Alteration	Habitat Alterations	Nitrate / Nitrite	Nutrient Enrichment / Eutrophication	Pesticides	Phosphorus (total)	Sediment	Sediment Screening (exceedance)	Sedimentation / Siltation	Siltation
Little Portage River	041000100501	♦			♦							♦	♦		♦					♦	
Portage River	041000100502														♦		♦			♦	
Lacarpe Creek	041000100503																				
Upper Toussaint Creek	041000100601	♦			♦		♦						♦		♦						♦
Packer Creek	041000100602	♦	♦		♦										♦						♦
Lower Toussaint Creek	041000100603	♦													♦						♦
Turtle Creek-Frontal Lake Erie	041000100701	♦			♦					♦	♦		♦				♦			♦	
Crane Creek-Frontal Lake Erie	041000100702				♦												♦			♦	
Cedar Creek-Frontal Lake Erie	041000100703	♦			♦					♦	♦									♦	
Wolf Creek-Frontal Lake Erie	041000100704																				
Berger Ditch	041000100705				♦						♦						♦			♦	
Otter Creek - Frontal Lake Erie	041000100706				♦															♦	
Mills Creek	041000110103		♦												♦		♦			♦	
Frontal South Side of Sandusky Bay	041000110201	♦		♦																♦	
Strong Creek	041000110202																				
Pickerel Creek	041000110203	♦	♦																	♦	
Raccoon Creek	041000110204	♦											♦	♦	♦	♦	♦			♦	
South Creek	041000110205	♦													♦		♦	♦		♦	
Snuff Creek	041000111003																				
Plum Run	041000111004																				
Spicer Creek	041000111105	♦		♦		♦					♦				♦		♦				
Flag Run-Green Creek	041000111203			♦																♦	
Muskellunge Creek	041000111301			♦											♦		♦			♦	
Indian Creek	041000111302																				

Watershed		Sources							Causes													
Watershed Name	**12-Digit Watersheds**	Agriculture - Row Crop	Agriculture Runoff	Agricultural Subsurface Drainage	Channelization	Manure Runoff	Riparian Vegetation Removal			Ammonia	Dissolved Oxygen / Organic Enrichment	Flow Alteration	Habitat Alterations	Nitrate / Nitrite	Nutrient Enrichment / Eutrophication	Pesticides	Phosphorus (total)	Sediment	Sediment Screening (exceedance)	Sedimentation / Siltation	Siltation
Yellow Swale	041000111303			♦	♦								♦		♦		♦			♦	
Greis Ditch	041000111401																				
Town of Helena-Muddy Creek	041000111402																				
North Side Sandusky Bay Frontal	041000111405																				

IX. Best Management Practice Funding Programs

Federal and state agencies, such as USDA, ODNR, Ohio EPA, ODA, and SWCDs cooperate and jointly provide assistance to farmers through various programs to address non-point pollution control and habitat restoration. These programs use two techniques to implement their goals: 1) Provide technical expertise from professional staff who advise farmers on appropriate BMPs to facilitate conservation of natural resources and make farming profitable, and 2) Provide financial incentives for participating in voluntary use of BMPs, known as cost sharing. Program summaries are provided below:

Agricultural Conservation Easement Program (ACEP)

The USDA-NRCS administers the ACEP as a voluntary conservation program to provide financial and technical assistance to help protect, restore and enhance critical wetlands and agricultural lands. Under the Land Easements component, the program assists American Indian tribes, state, and local governments and non-governmental organizations to protect working agricultural lands and limit non-agricultural use of the land. Under the Wetlands Reserve Easements component, the program assists to restore, protect, and enhance wetlands.

The 2014 Farm Bill replaced the Wetland Reserve Enhancement Program with the Wetland Reserve Enhancement Partnership (WREP), which continues to provide the following benefits:

- Wetland restoration and protection
- Ability to cost-share restoration or enhancement beyond NRCS requirements
- Ability to participate in the management or monitoring of selected project locations
- Ability to use innovative methods and practices

Additional information on ACEP is available at:

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/easements/acep/?cid=stelprdb1242695

Conservation Reserve Program (CRP)

The USDA-FSA administers the CRP as a voluntary program for agricultural landowners. The program provides land rental payments to farmers who agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Agricultural land may be converted to filter strips, riparian forest buffers, wetlands, windbreaks, or other. Contracts through the program may be 10-15 years in length. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. Additional information about CRP is available at:

- https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

Conservation Reserve Enhancement Program (CREP)

The USDA-FSA administers the CREP as part of the CRP. CREP targets high priority conservation concerns identified by a state, and federal funds are supplemented with non-federal funds to address those concerns. For example, the CREP is offered only to areas in the Lake Erie basin within Ohio. In exchange for removing environmentally sensitive land from production and establishing permanent resource conserving plant species, farmers and ranchers are paid an annual rental rate along with other federal and state incentives as applicable per each CREP agreement. Participation is voluntary, and the contract period is typically 10–15 years. Additional information about CREP is available at:

- https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index

Environmental Quality Incentive Program (EQIP)

The USDA-NRCS administers the EQIP as a voluntary conservation program for agricultural producers who face challenges with natural resources, such as soil, water, and air. The program provides financial and technical assistance to agricultural producers through contracts up to a maximum term of 10 years in length. Contracts provide assistance to help plan and implement conservation practices that address natural resource concerns to improve and conserve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. EQIP also helps producers meet federal, state, and local environmental regulations. Types of conservation practices implemented by EQIP are generalized below:

- Cropland Soil Quality
- Fish and Wildlife Habitat
- Forest Land Conservation
- Irrigation Efficiency
- Water Quality
- Wetlands

Additional information about EQIP is available on the following websites:

- https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/
- https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/fb08_cp_eqip.html

Clean Water Act §319 Non-Point Source Grants

Ohio EPA and Michigan EGLE offer financial assistance to implement activities through their Non-point Source Pollution Control programs. These programs were established because of the 1987 amendments to the Clean Water Act that created a national program to control non-point source pollution under Section 319 of the Act. The goal of the program is to restore waters impaired by non-point source pollution and protect high quality waters from degradation. The 319 grants are a significant resource for the TMACOG region because they have funded many educational, planning, and cost share projects. Additional information about the 319 grants in Ohio and Michigan is available on the following websites:

- http://epa.ohio.gov/dsw/nps/index.aspx#120979052-background
- http://www.michigan.gov/deq/0,4561,7-135-3307_3515-314500--,00.html

ODNR Cost Share Eligible Practices

Ohio Administrative Code 1501:15-5-13 enables ODNR Division of Soil and Water Resources to provide cost share funding to assist landowners through the Agricultural Pollution Abatement Cost Sharing Program. The program focuses on installing BMPs that abate manure pollution, soil erosion, or degradation of the waters of the state by soil sediment. Available information about the ODNR Cost Share Eligible Practices is available at http://codes.ohio.gov/oac/1501:15-5-13. Further details should be requested from ODNR.

Northwest Ohio Windbreak Program

The NW Ohio Windbreak program is an interagency effort of USDA, ODNR, and county SWCDs to assist land owners in establishing field windbreaks. Applications may be made through the County SWCDs or ODNR Divisions of Forestry or Wildlife. The program provides cost share funds to landowners for establishing windbreak vegetation and covers a total of 15 counties on a rotating basis. The program is available in Ottawa and Sandusky counties in even years, and in Lucas and Wood counties every year.

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