Chapter 11
Water Quality Monitoring and Tracking Techniques

11.1 Introduction

Section 6217 of the CZARA of 1990 calls for a description of monitoring techniques that accompany the prescribed management measures to assess over time the success of the measures in reducing pollution loads and improving water quality. By tracking the management measures and water quality over time, Ohio will be in position to evaluate the performance and effectiveness of the management measures and to determine if additional management measures are needed.

To evaluate the effectiveness of the CNPCP, Ohio will employ existing monitoring efforts and BMP implementation tracking programs, and in addition will evaluate the feasibility of creating local watershed action plans, demonstration projects, paired watershed studies, statistical trend/cluster/regression analyses, or other techniques as data and funding allows.

11.2 Water Quality Monitoring Program

Surface water quality monitoring data have been gathered in Ohio's Lake Erie Basin for decades through four main monitoring programs—the Tributary Monitoring Program conducted by Heidelberg College, Ohio EPA's Water Quality Monitoring Program, monitoring of Lake Erie conducted as part of the Lakewide Management Plan (LaMP) effort, and localized special water quality studies conducted by universities and other special interest groups. Monitoring under these initiatives will continue to provide valuable data that will aid in efforts to assess the effectiveness of Ohio's ongoing nonpoint programs and to identify further actions for restoration and protection of water quality in the § 6217 management area.

The Water Quality Laboratory at Heidelberg College conducts a chemical monitoring program that has operated continuously since 1974. Their network of tributary monitoring stations in the Maumee, Sandusky, Huron, Cuyahoga, and Grand River watersheds provides data upon which to evaluate the effectiveness of Ohio's agricultural and urban NPS control programs in reducing phosphorus and sediment loading into Lake Erie, as well as reductions in pesticide and nitrate concentrations in rivers serving as public supplies. Under the Heidelberg program, stream water samples are collected by automatic sampling equipment located at USGS stream gauging stations. Samples are analyzed for suspended sediments, total phosphorus, soluble reactive phosphorus, nitrate and nitrite-N, total Kjeldahl nitrogen, chloride, silica, sulfate, and conductivity. In 1981, monitoring for current generation pesticides was added to the analytical program; and analyses for various metals and total and dissolved organic carbon were added in the early 1990s. The Water Quality Lab at Heidelberg also sponsors the Cooperative Private Well Testing Program, which analyzes groundwater quality for inorganic compounds, herbicides, volatile organic compounds, and metals. This program is a volunteer effort with SWCDs that has built a database on nitrate contamination in more than 18,000 private wells across Ohio. Beginning in 2000, Heidelberg will add a new station near the mouth of the Vermilion River as part of the effort to monitor the effectiveness of the CREP.

In 1990, Ohio EPA instituted a “5-Year Basin” approach to monitoring and NPDES permit reissuance for its intensive survey of surface waters (Figure 11-1). Provided sufficient resources are available, this effort should allow the Ohio EPA to monitor major sources of point and nonpoint pollution and to institute remediation efforts for these sources. This schedule has been devised so that monitoring data are collected ahead of permit reissuance or BMP implementation. The 16 plus years of using an integrated biosurvey approach to monitor major sources of pollution has put Ohio EPA in a position to monitor ambient conditions before and after the installation of water quality-based pollution control measures. The effort should result in a shift towards using environmental results as measures of the success of pollution control actions and away from the control actions themselves as a measure of success.

As part of the Great Lakes Water Quality Agreement, the development of a LaMP for Lake Erie began in 1994. The goal of the Lake Erie LaMP is to preserve, restore and protect the beneficial uses of Lake Erie, and the Great Lakes Water Quality Agreement lists 14 beneficial use impairments against which the health of Lake Erie is to be measured. Individual assessment reports are being written for each of the 14 potentially impaired uses of Lake Erie; current efforts are being focused on completing the following reports:

- Degradation of benthos
- Degraded fish populations
- Loss of fish habitat
- Fish tumors or other deformities
- Bird or animal deformities or reproductive problems
- Degraded wildlife populations and loss of wildlife habitat
- Added costs to agriculture and industry

Three LaMP technical subcommittees are working on identifying the water quality problems occurring in Lake Erie, identifying the key causes of those problems, and identifying a vision of the desired state of Lake Erie.

Additional water quality information is also provided through various special studies performed by universities, government agencies, and local special interest groups.

- The Ohio Sea Grant College Program promotes the wise use and management of Lake Erie resources by supporting university research and outreach projects that are partnered with universities, communities, industries, local organizations, and government agencies. Ohio Sea Grant leads the nation in research on forecasting models, sediment resuspension, the biological uptake and transfer of toxic substances, zebra mussels, underwater welding, and economic evaluations of the coastal economy. Projects at ten different Ohio colleges and universities are currently funded under this program.
- An interagency work group, including the Ohio EPA, ODNR, ODH, and ODA, was established in September 1987 to examine fish tissue contamination problems and to issue advisories.

- The Ohio/USGS Cooperative Program operates daily sediment monitoring stations and monitoring programs at public water treatment and sewage treatment plants.
- Two major volunteer monitoring programs of note in Ohio include the Stream Quality Monitoring program, coordinated by ODNR's Scenic Rivers Section, and the Citizen Lake Awareness and Monitoring Program, coordinated by the Ohio Lake Management Society and ODNR. The Stream Quality Monitoring Program involves approximately 3,000 participants who assess stream sites for stream biological quality and provide general water quality observations. The Citizen Lake Awareness and Monitoring Program involves more than 175 local citizens in data collection on 89 lakes and ponds across the state. The participants collect water clarity/color information and also provide general water quality and climatic observations.
- Various localized studies conducted by watershed groups, RAP groups, planning, and local government agencies.

11.3 Tracking of Management Measures

11.3.1 Introduction

The Ohio Nonpoint Source Program's evaluation and tracking is intended to include four general areas: water quality, BMP effectiveness, BMP installation, and administrative grant tracking.

The *Ohio Water Resource Inventory* (305b) is used to track overall trends in Ohio's water quality. This document, updated every two years, provides information on the overall status of water quality in Ohio's rivers, lakes, and streams and documents changes in specific water bodies.

Ohio watershed projects are required to provide specific water quality-based goals and objectives as well as to focus on critical areas and sources that contribute disproportionately to water quality problems. This helps ensure that projects are effectively designed to address the known water quality problem. Moreover, Ohio watershed projects are required to measure their effectiveness in terms of water quality improvement. In most cases, this requirement is met by reporting surrogates of water quality (number of critical acres treated with BMPs, tons of soil saved, etc.). In a few projects, actual water quality monitoring data is collected.

In 1997, Ohio EPA published the *Guide to Developing Watershed Action Plans in Ohio*. Ohio is directing all watershed-based projects to use this guide to develop watershed plans in advance of implementation. Currently, we have ten watershed planning projects underway to provide feedback and input for future editions of the Guide.

A survey from the 1994 Water Quality Projects Evaluation Workshop conducted by OSUE indicated Ohio watershed projects use a number of different evaluation methods. The nine most popular methods are counting number of people attending events, counting number of events, mail surveys, tallying amount of money spent, individual interviews, focus group interviews, telephone surveys, advisory teams, and opinion surveys. The survey further indicated the barriers to more extensive evaluation activities include:

- lack of time
- lack of personnel available to support evaluation
- lack of skilled personnel available to conduct evaluation
- funds not allocated in the project budget for evaluation
- lack of financial resources available to support evaluation
- lack of interest among project personnel

Evaluation of the SWCD-ODNR pollution abatement program is done by the Division of Soil and Water Conservation. SWCDs are periodically surveyed for their attitudes on practices and program performance, complaint handling, and similar issues. This information is used to realign program priorities and secure additional resources for SWCD technical assistance activities. The most recent survey was done in 1997. The Division of Soil and Water Conservation also periodically evaluates specific programs, such as the Manure and Nutrient Management Program, by convening ad hoc committees of SWCD staff, supervisors, and other agencies, particularly the NRCS. Recommendations of these committees are used to set program priorities and create legislative funding and legal agendas.

For administrative grant tracking, Ohio EPA follows auditing procedures to track all grant expenditures and grant outcomes according to established schedules. This helps to ensure project compliance with grant requirements as well as the timely completion of projects. Ohio EPA uses the Grant Reporting and Tracking System (GRTS) to comply with all the Section 319 technical reporting requirements. Project records are entered every year, and progress reports on all active Section 319 projects are entered twice a year. Ohio EPA also uses GRTS to electronically transmit the State's Annual Section 319 Report. Fiscal information is kept in a state database and quarterly reports are generated and submitted to USEPA. Ohio EPA enters into individual contracts with each sub-grant recipient. These contracts specify obligations and commitments for work plan activities, compliance with state and federal auditing and reporting requirements. Each project has a payment schedule developed to meet the needs of the project. Payments are made throughout the project period after Ohio EPA determines that the sub-grantee has demonstrated satisfactory fiscal and technical performance. Compliance with the contract is demonstrated by quarterly fiscal and semiannual technical reports and project reviews (e.g., inspections).

Overall, the evaluation and tracking of BMP installation and effectiveness has been a deficient part of Ohio's Nonpoint Source Program, especially after NRCS in Ohio downsized. Several work groups developing recommendations and strategies for Ohio's Nonpoint Source Program, identified evaluation of BMPs as a programmatic weakness.

Ohio acknowledges correcting this deficiency must be a priority for future program development. Ohio's commitment to improve its evaluating and tracking of BMPs includes:

- The OSUE has recently created an Extension Associate position to concentrate on evaluation and tracking of watershed programs and BMPs. Furthermore, five additional positions are being created within OSUE to assist in watershed plan development, program building, and education as a result of the Ohio Watershed Action Agenda.

- The ODNR Division of Soil and Water Conservation plans to create five area pollution abatement positions in order to evaluate and track Section 319 and state funded pollution abatement practices. Over the past two years, the Division has increased its emphasis on SWCD reporting of state cost shared practices; however, site visits are needed to confirm/correct reported data.
- Ohio EPA will continue to direct Section 319 applicants to incorporate an evaluation component as part of their proposals. Beginning in SFY 1999, the nonpoint source personnel in Ohio EPA district offices will document annual field visits to all active projects in their areas. Progress reports from grant recipients will continue to be monitored and tracked. Ohio EPA nonpoint source personnel will work with recipients to adjust work plans as needed to keep projects aligned with project goals.

11.3.2 Existing Tracking Techniques for Agriculture Measures

Since the early 1970s, numerous programs have been targeted to the Maumee and Sandusky River watersheds in northwest Ohio and adjacent parts of Indiana and Michigan as part of local, state, and federal efforts to reduce agricultural nonpoint source pollution. Because detailed water quality monitoring of these major Lake Erie tributaries has been underway since 1975, these watersheds offer a unique opportunity to evaluate the linkages between agricultural land use and water quality on a larger scale and over a longer period of time than is possible elsewhere. One pioneering project currently underway in Ohio to document and evaluate the effectiveness of BMPs at a large watershed level is the Lake Erie Agricultural Systems for Environmental Quality (LEASEQ) Project. The LEASEQ Project is one of nine projects nationwide supported by the USDA's Agricultural Systems for Environmental Quality Program, and is a retrospective evaluation of changes in agricultural practices and resulting changes in water quality in the Maumee and Sandusky River watersheds over the 20-year period, 1975–1995. Objectives of the LEASEQ Project are to:

- Document changes in conservation tillage and other farming practices designed to reduce agricultural pollution.
- Evaluate changes in numbers of farms and farm size, in crops, productivity, and soil fertility.
- Determine changes in water quality and relate them to changes in agricultural practices.
- Examine the possible impact of past climate change on agriculture and water quality.
- Clarify the mechanisms of nonpoint pollutant movement through agricultural watersheds.

Initial findings of the LEASEQ Project indicate the following conclusions can be drawn:

- Conservation tillage techniques, almost unknown in the early 1970s, are now practiced on 1.6 million acres—more than half of the row-crop acres in the LEASEQ study area. No-till cultivation of soybeans accounts for 68 percent of the total conservation tillage.
- Agriculture accounts for 88 percent of the land use in the study area. The number of farms has decreased by 37 percent during the two decades of the study, but the

average farm size has increased by 53 percent. The total agricultural acreage is almost unchanged. Soybean acreage has increased from 38 to 48 percent of this total, while corn has decreased from 37 to 32 percent and wheat from 18 to 15 percent.

- Total phosphorus concentrations in the rivers have been reduced by about 40 percent, while dissolved phosphorus, most available to algae, has been reduced by 75 percent. Sediment concentrations are down between 20 and 25 percent. However, nitrate concentrations have increased. Phosphorus fertilizer sales have decreased more than 40 percent, while nitrate sales have decreased by about 10 percent.
- Reductions of sediment and phosphorus concentrations in the rivers and in Lake Erie represent significant improvements in the health of these waters. The magnitude of the changes noted and their timing relative to changes in tillage and fertilizer use demonstrate that they are largely due to improved agricultural stewardship of the land and water resources in the Lake Erie Basin.

11.3.3 Tracking Techniques For Other Program Areas

To evaluate the effectiveness of the management measures, Ohio will use water quality monitoring and BMP implementation tracking programs already in place, where applicable. In addition, Ohio may evaluate the feasibility of employing demonstration projects, paired watershed studies, statistical trend/cluster/regression analyses, or other techniques to track the effectiveness of specific management measures as the CNPCP program is implemented.

11.4 Strategies and Recommendations

Throughout the statewide nonpoint source program discussion over the past two to three years, concerns have been raised over the need to evaluate the effectiveness of: (1) statewide nonpoint pollution programs, (2) individual watershed projects, and (3) pollution control practices (BMPs). In addition, the need for better data to classify waterbodies and to measure progress has been a major concern of the general public, working groups and agencies at all levels of government. Outputs from coastal and statewide work groups and priorities taken from the Ohio Nonpoint Source Program Upgrade 1999 regarding monitoring/tracking and evaluation have been integrated in the following tables.

Although several of the following recommendations are being implemented or are under consideration, taken as a whole they do not, at this time, represent policy adopted by the State of Ohio. Further evaluation and consensus building will be undertaken as part of the effort to fully upgrade the statewide nonpoint source plan and in revising the coastal management plan.

Objective 1

Expand the evaluation of currently used BMPs and the effectiveness of existing water quality programs.

Objective1 Recommendation	Measure(s) of Success	Resources Needed	Responsible Organization(s)	Time Frame
Evaluate effectiveness of existing lake protection projects in meeting WQ goals.	Improved program delivery	Federal and state grants	OSU ODNR Ohio EPA	Years 1-10
Increase OSU faculty/extension positions for livestock waste management and riparian area assessment	Greater research and applied research for WQ protection	None	OSU Extension & School of Natural Resources	Years 1-2
Employ regional pollution abatement specialists to increase tracking of 319 and other watershed projects	5 regional staff	Additional GRF	ODNR	Years2-5
Evaluate current ground water data collection & management efforts & identify gaps and/or duplication.	Improved analysis and data management	None	Ohio EPA ODNR ODH	Years 1-5
Encourage research & demonstration to assess impacts of NPS, especially urban stormwater on ground water, near shore areas (e.g., estuaries).	Greater efficiency in WQ improvement by BMPs	Federal and state grants	ODNR Ohio LE Office Ohio EPA	Years 1-10
Evaluate effectiveness of commonly used BMPs & newer practices (e.g., constructed wetlands).	Handbook of BMP effectiveness ratings	Section 319 funds	Ohio EPA OSU ODNR NRCS	Years 2-4
Encourage research initiatives to assess how streams assimilate sediment loads & determine effectiveness of existing sediment retention strategies.	Improved sediment retention BMPs and strategies	Coastal & ACOE funds	ODNR USGS ACOE Ohio LE Office	Years 3-6

Objective 2

Update watershed and impaired segment restoration priorities as new data become available.

Objective 2 Recommendation	Measure(s) of Success	Resources Needed	Responsible Organization(s)	Time Frame
Revise the 303(d) list of impaired waters as TMDL assessments are completed	Improved assessments based on more local data	State GRF and federal grants	Ohio EPA	Years 1-10
Review & update Ohio's NPS targeted lakes list & compare with UWA.	UWA updates	None	Ohio EPA	Years 1-3
Use UWA & source water priorities to make "short list" of high priority lakes to set funding priorities.	UWA updates	None	Ohio EPA	Years 1-3

Objective 3

Improve and increase water quality monitoring.

Objective 3 Recommendation	Measure(s) of Success	Resources Needed	Responsible Organization(s)	Time Frame
Increase state support for volunteer monitoring & set standards for QA/QC to guide volunteers.	Increased # of approved volunteer programs	319 and other federal funding, state GRF	Ohio EPA ODNR	Years 1-10
Develop standardized methodology for sampling ground water from private water supply wells & non-drinking water sources.	New GW sampling protocols	None	Ohio EPA	Years 2-5