While significant progress has been made in reducing water pollution caused by point sources since the Clean Water Act was passed over 20 years ago, much work remains to be done to reduce nonpoint source pollutants that impair the quality of streams, rivers, lakes, ground water, and other bodies of water throughout the country.

Many local government officials, as well as citizens, are becoming increasingly interested in taking action to address local water quality problems caused
primarily by nonpoint source pollutants. These groups recognize that water-quality problems do not occur in isolation, but that many activities within a watershed can degrade water resources downstream. Surface and ground waters are directly connected, so management strategies aimed at protecting water quality must often be designed to address the impacts of human activities on watersheds (surface water) as well as aquifer-recharge areas (ground water).

This publication is designed to provide assistance to local and state government officials and staff, concerned citizens, educational and technical assistance agencies, farmers, and other people who are interested in protecting or restoring the quality of a local water resource.

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**Causes of Water Quality Problems**

Most watersheds encompass many land uses (farms, homes, industries, forests, mines). Each land use has an impact on water quality. Even in uninhabited watersheds, natural sources of pollution exist. These include sediment from stream-bank erosion, bacteria and nutrients from wildlife, and chemicals deposited by rainfall.

Water pollution caused by human activities results from either point sources or nonpoint sources. These terms indicate how pollutants are released to surface water or ground water.

A point source is a single, identifiable source of pollution, such as a pipe through which factories or treatment plants release water and pollutants into a river. Point source pollution is often controlled through water-quality standards and permitting programs, which establish limits on the kind or amount of pollutants each point source may discharge into a body of water.

A nonpoint source is an activity that takes place over a broad area and results in the release of pollutants from many different locations. Agriculture, forestry, residential, and urban development are examples of nonpoint sources of pollutants. Common pollutants from these activities include:

- sediment from cropland, lawns and gardens, forestry activities, roadways, construction sites, and stream-bank erosion;
- nutrients from cropland, lawns and gardens, livestock operations, wildlife, septic systems, and land receiving waste application;
- bacteria from livestock, wildlife, septic systems, land receiving waste application, and urban runoff; and
- man-made chemicals, including pesticides, from roadways, mining operations, cropland, lawns and gardens, and forestry.

**Watersheds and Ground-Water Recharge Areas**

Wherever you are, you are in a watershed. Every stream, reservoir, lake, and estuary has one. Some of the water that falls on the land as rain, sleet, and snow evaporates. The rest drains into
streams, rivers, and lakes, or soaks into the ground. A watershed is the land that contributes water to a particular body of water, such as a lake or stream. Ridges of higher ground generally separate one watershed from another. Rain falling on one side of the ridge flows toward the low point of one watershed, while rain on the other side flows toward the low point of a different watershed.

Ground water lies under the surface of the land in aquifers—underground areas that hold large quantities of water in the spaces between rocks and particles of soil. The source of ground water in each aquifer is the rain (or sleet or snow) that falls in the recharge area of the aquifer, or centuries-old stored water. If recharge occurs, the recharge area is the land area through which water percolates into an aquifer.

Since underground recharge areas and watershed areas do not always coincide, the hydrogeological area for a project must be defined for either the surface water (watershed) or the ground water (recharge area) resource, or both, depending on the objectives of the project.

**Steps to a Successful Voluntary Project**

1. **Choose a Viable Project**

The first step in a successful nonpoint source pollution control project is to identify a water resource whose water quality needs restoration or protection. Focus on a water resource that is valued by the community and on a problem that is neither too complex nor too difficult to solve. Talk to or formally survey community members who live and work near the water resource. Find out whether the impairment of the water body is of concern to them. For example, does it impair their recreational use (such as fishing, swimming, or boating) or aesthetic enjoyment of the water?

If the source of the water-quality problem is not clear and well-documented, or if the source is one that cannot be affected by changes in project participants' behavior (for example, if the source is a point source versus agricultural runoff), there is likely to be dissention about what is causing the problem and how to resolve it. If people do not agree that a problem exists, if the source of the problem is not clear, or if agencies cannot work effectively together, a project is unlikely to be successful. In such cases, limited resources for addressing water-quality problems may well be better spent on another project or program.

If project funds are restricted to one source of nonpoint source pollutants, such as agricultural sources, avoid choosing a watershed that contains major point sources. Pollutants from point sources often mask water-quality changes associated with best management practices (BMPs) installed to address nonpoint source pollution, thus making it difficult to document the benefits of a nonpoint source pollution control project. Other approaches, such as total watershed management, that seek to reduce both point and nonpoint sources of pollution, can be effective if adequate technical and financial resources are available.
Select a watershed of a size that matches the level of available funding for the project; if funds for installing BMPs are limited, treating a small watershed will be likely to result in greater water-quality improvements than treating a small land area in a large watershed.

2. Identify and Document the Water Quality Problem

Clearly identify and document the water-quality problem or impairment, and the source or sources of the problem. For example, a popular swimming beach at the community lake may have algal blooms (rapid growth of algae) at certain times of year. The results are color changes, odor, and fish kills all of which impair swimming and other uses of the water resource for recreation. In order to plan an effective approach to this problem, the specific pollutants causing the blooms must be identified and their sources determined. Which nutrient is causing the problem? Is there too much nitrogen or too much phosphorus?

After identifying the pollutant, find out where it originates. Possible sources of nitrogen or phosphorus include runoff from animal operations, over-application of commercial fertilizers on farms or lawns, leakage from septic tanks, or discharges from a sewage treatment plant or industry. It is critical to first identify the source of the problem, so that targeting those activities which are actually affecting water quality. Taking action to address a problem whose source is not clearly understood can often waste time and money.

Request water-quality data and other relevant information from agencies listed under "Information Resources for Environmental Data" in this publication. If adequate information about the problem and its sources has not already been collected, find assistance in securing the technical and financial resources necessary to design and implement a water-quality monitoring program for the water body and its tributaries. (Relevant state and federal programs are discussed in the section entitled "Secure Funding." Expertise in interpreting the significance of existing water-quality data may be available from the North Carolina Division of Environmental Management's regional or state offices, local health or planning departments, or county centers of the North Carolina Cooperative Extension Service.

To identify the exact nature of the problem and its sources implement a monitoring program lasting from six to 18 months. Monitor sites suspected of contributing pollutants during both base flow (normal flow) and storm conditions, especially during the seasons when the highest amount of the pollutant enters the water and during the season when water-quality problems have been noticed. For example, in North Carolina, during winter and spring there is often a great deal of runoff carrying nutrients, sediment, and other pollutants.

Before initiating a project, write a problem statement that (1) states what the impaired water use is, (2) identifies the location of the problem, (3) specifies the pollutant or pollutants, and (4) identifies the major sources or suspected sources of each pollutant. The process of writing a problem statement often helps clarify the problem in the minds of project staff, documents the problem for reference in the future, and clearly states the problem and its sources for participants and other community members, thereby contributing to consensus.

3. Define Project Goals
Well-defined goals clearly convey the purpose of the project to potential participants and the public. Goals also provide a basis for evaluating progress during the course of a project. Goals need to be quantitative—or measurable. For example, progress toward the goal "reduce the phosphorus load to Blue Reservoir by 45 percent" can be measured, while the achievement of a goal such as "reduce pollution in the reservoir" is very difficult to evaluate.

Set specific goals at the beginning of a project. Be sure to include local agencies, project participants, and representatives from the community in this process.

4. Involve Potential Participants and Community Members

Public support and sufficient participation are essential for project success. A high rate of participation is key in voluntary projects because nonpoint sources of pollution are widespread. The following are suggestions for increasing participation:

- Educate potential participants and the community about the water quality problem. They need to agree that there is a problem, that it is important to solve it, and that the right approach has been chosen to address the problem.
- Encourage potential participants to accept responsibility for the effects of their activities. However, awareness of the impacts of human activities on water quality does not necessarily translate into ownership of the problem and a willingness to change patterns of behavior. On-going education of project's participants about the impacts of their land uses on water quality is necessary.
- Involve potential participants early in the planning to help foster a feeling of ownership, which often results in a higher rate of participation in the project.
- Find out if federal, state, or local funds are available to project participants. Financial assistance, such as cost-share funds, is necessary for many potential participants to be able to afford to implement BMPs designed to reduce nonpoint source pollution. (See also the section "Secure Funds.")
- Recommend the lowest-cost BMPs that can effectively reduce nonpoint source pollution. Poor economic conditions and high costs of recommended BMPs can decrease participation in voluntary programs.
- One-to-one contact between project personnel and potential participants is much more effective than mass media for educating and gaining their cooperation in a project. Because of their importance as a means of encouraging producers to participate, initiate information and education efforts well in advance of BMP installation.
- Provide technical assistance seen by participants as valuable, such as soil testing and assistance in designing affordable site-specific BMPs.
- Ask project participants to talk with their neighbors about the project and why they decided to become involved.
- Where relevant, make potential participants aware that regulation may be considered if voluntary implementation of BMPs does not improve water quality. This can provide incentive for them to become involved in a nonpoint source pollution control project.

5. Secure Funding
Funds to support each aspect of the project must be obtained. Cost-share funds that can be used to assist participants in installing BMPs are often critical to the success or failure of a voluntary nonpoint source project. Monitoring water quality and BMP implementation are also important before, during, and after the project, as are educational activities. It may be necessary to tap different resources for each of these essential project components.

Cost-share funds from the North Carolina Agriculture Cost Share Program are allocated to counties based on water-quality protection needs and severity of nonpoint source problems. The program is administered by the state Soil and Water Conservation Commission and implemented by local Soil and Water Conservation Districts. For information, contact: Division of Soil and Water Conservation, North Carolina Department of Environment, Health, and Natural Resources, 512 N. Salisbury St., P.O. Box 27687, Raleigh, NC 27611 (919-733-2302).

Cost-share assistance for implementation of forestry BMPs may be available through the state Forestry Stewardship Program. For information, contact the Division of Forest Resources, North Carolina Department of Environment, Health, and Natural Resources, 512 N. Salisbury St., P.O. Box 27687, Raleigh, NC 27611 (919-733-2162).

For watershed programs addressing agricultural or forestry nonpoint sources of pollution, information about federal cost-share programs can be obtained from county U.S. Department of Agriculture Agricultural Stabilization and Conservation Service offices.

Project funds for water quality and land treatment monitoring may be available from the Nonpoint Source Branch, Water Quality Section, North Carolina Division of Environmental Management (919-733-5083) through Section 319 funds given to each state by the U.S. Environmental Protection Agency (EPA).


6. Clarify Agency Roles and Responsibilities and Administer the Project Effectively

Inter-agency cooperation and coordination is essential. Potential participants within the project area need to receive clear messages about the project, its purpose, and its value. Conflicting messages from local, state, or federal agencies participating in a project can result in low rates of participation. Clearly define each agency's role and how agencies will interact with each other to avoid confusion, duplication of efforts, or competition. Urge agency administrators to express support for the project and emphasize the need for inter-agency communication and cooperation. When key agencies are unable to agree on the value of a proposed project, or when turf battles seem unresolvable, consider choosing another project.
Designate a project manager to coordinate the project as a whole and assess progress. Ideally, the project manager should have a background in water resources and project management.

Establish a local coordinating committee consisting of project participants, agency personnel, and community leaders to support the project. The committee should set direction, establish objectives and goals, assure adequate public involvement, enlist agency assistance, oversee information and education, and determine priorities for water quality monitoring. The committee should also develop plans for selecting the critical area, choosing BMP systems, and linking land-treatment and water-quality data.

7. Define the Critical Area

Apply BMP systems to the areas where land treatment will have the greatest effect. Where available, pre-project water-quality monitoring and modeling can be used to identify or refine the critical area—the land area that contributes the most to the water-quality problem. In the absence of such resources, the critical area can be roughly outlined based on distance to the water body and its tributaries, or other obvious location or land-use characteristics. Within the critical area, significant pollutant sources (such as animal operations, farm fields, forestry operations, and residential neighborhoods) can be assigned a priority for BMP installation based on the expected impact of the source on the impaired water resources.

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**Land Treatment and BMP Systems**

Water-quality best management practices (BMPs) are designed to control the delivery of pollutants from land-use activities to water resources. BMPs can be either structural (for example, waste lagoons or storage tanks, terraces, sediment basins, or fencing) or managerial (for example, rotational grazing, fertilizer or pesticide management, or conservation tillage).

Any two or more BMPs used together to control a pollutant from the same source constitute a BMP system. A BMP system can be tailored for a specific pollutant, source, geographical location, as well as to a project participant's economic situation.

Systems of BMPs control nonpoint source pollution more effectively than do individual BMPs because systems can minimize the impact of the pollutant at several points: at the source, during transport from the source to the water body, and at the water body.

Systems of BMPs, however, are just part of a land treatment strategy to reduce nonpoint source pollution. In addition to selection of a BMP system that will effectively address the primary pollutants, project managers must be sure that BMPs are placed in the correct locations in the watershed (critical areas contributing the most pollutants) and that a sufficient amount of land treatment is implemented to achieve the desired water-quality improvement.

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8. Choose a Land Treatment Approach
Encourage participants to implement systems of best management practices. Systems of practices are often more effective in controlling a nonpoint source pollutant from the critical area than is a single BMP. Resources for assistance in identifying BMP systems that will effectively address a particular water quality problem and source include county agents of the North Carolina Cooperative Extension Service, and personnel from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service and from Soil and Water Conservation Districts.

9. Design a Monitoring and Evaluation Plan

Monitoring and evaluating water quality and land treatment can be important tools for conducting an effective project. Monitoring and data analysis document water-quality changes due to land-treatment practices. Reporting conveys the results to participants, funding agencies, and the general public. However, not all nonpoint source projects can afford water-quality monitoring, and few rely on local funds for such monitoring.

When little or no funding is available for monitoring the effectiveness of BMPs installed as the result of a project, visual observations of changes such as fewer algal blooms, clearer water, or increased recreational use can be helpful in assessing the effectiveness of the project. If citizens monitor a few key factors (such as dissolved oxygen, turbidity, or chlorophyll a) Monthly, they can contribute significantly to a project.

For projects that do have funds specifically earmarked for more extensive water-quality monitoring, essential tasks and elements include:

- Develop a monitoring plan based on clearly stated water quality monitoring objectives.
- Include in the monitoring plan the monitoring design, agency roles, laboratory procedures, quality assurance and quality control, data storage, reporting requirements, personnel needed, and costs.
- Collect sufficient pre-project, during-project, and post-project water-quality data to detect and document water-quality changes. In large watersheds with lakes, water-quality changes often occur gradually. As a result, monitoring for five to 10 years, or longer, may be required to confirm real, consistent changes that can be linked to land treatment. Short-term monitoring is seldom effective because climatic and hydrologic variability can mask water quality changes. However, for small watersheds affected by only a few relatively large pollutant sources, the monitoring period may be shorter.
- To detect long-term trends, collect samples at regular intervals using a predetermined time schedule. Focus on collecting samples at a relatively high frequency, and measure only pollutants that the project is trying to reduce through land treatment.

Assessing the Effectiveness of Your Project

Evaluate the data collected, keeping with project goals clearly in mind. A consistently improving trend in water quality may provide evidence needed to attribute water quality improvements to land treatment using a BMP system.
Where appropriate, interview or survey project participants as well as people who were eligible to participate but chose not to become involved in the project. This information can provide helpful feedback on the effectiveness of information and education programs, and may be of value to future projects.

It is frequently useful to assess public perceptions of water quality before and after a project. One way to evaluate the effectiveness of a project is to determine if people perceive that water quality has improved. Surveys or focus groups conducted before and after a project can document changes in public perceptions of water quality.

Report successes and failures to provide feedback to project participants and participating agencies on the results of their efforts. Making results available to the community enhances public education and provides information that can contribute to the more-effective management of water-quality problems in the future.

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**Checklist for a Successful Project**

- Choose a viable project. Identify a water resource that needs restoration or protection. Choose a water resource that is valued by members of the community.
- Identify and document the water-quality problem and its source.
- Define objectives and goals and use them to guide the project.
- Involve potential participants and community members early in the planning.
- Secure funding for all aspects of the project, including incentives for participation.
- Clarify agency roles and responsibilities and administer the project effectively. Designate a project manager. Organize a local coordinating committee.
- Define the critical area contributing the greatest amount of the primary pollutants.
- Choose a land-treatment approach that will address the water-quality problem. Encourage participants to implement systems of two or more BMPs designed to reduce a particular pollutant.
- Design a water quality and land treatment monitoring and evaluation plan program when possible, to document the effects of BMPs installed.
- Evaluate Project Effectiveness. Report project results to the public and to project participants.

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**References**


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**Information Resources for Environmental Data**

The following list provides starting points for officials and citizens searching for information about the quality of a local water resource and about factors that may affect the water quality.

**Water-Quality Data**

- North Carolina Division of Environmental Management
  - Ground Water Section: 919-733-3221
  - Water Quality Section: 919-733-5083
- EPA STORET User Assistance Group: 800-424-9067
- U. S. Geological Survey: 919-571-4000

**Soils, Climate, Hydrogeology**

- North Carolina Division of Environmental Management
  - Ground Water Section: 919-733-3221
  - U. S. Geological Survey: 919-571-4000
  - Soil and Water Conservation District (local offices)

**Land Use**

- County Planning Departments
  - Soil and Water Conservation Districts (local offices)

**Public Water Supplies**

- North Carolina Division of Environmental Health, Public Supply Section: 919-733-2321
- County Health Department

**Private Wells**

- County Health Department

**Hazardous Waste Facilities**

- North Carolina Division of Waste Management, Hazardous Waste Section: 919-733-2178

**Pollution Incident Management Data Base**

- North Carolina Division of Environmental Management, Ground Water Section: 919-733-8488

**Solid Waste Facilities**

- North Carolina Division of Waste Management, Solid Waste Section: 919-733-4996
Septic Systems
  North Carolina Division of Waste Management, Solid Waste Section: 919-733-0692

Underground Storage Tanks
  North Carolina Division of Environmental Management, Ground Water Section: 919-733-3221

Mining Operations
  North Carolina Division of Land Resources, Land Quality Section: 919-733-4574

Pesticides
  North Carolina Department of Agriculture: 919-733-3556

Animal Waste Storage and Application
  North Carolina Division of Soil and Water Conservation: 919-733-2302
  Soil and Water Conservation Districts (local offices)
  U. S. Department of Agriculture, Natural Resource Conservation Service: 919-790-2888
  (or county offices)
  U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service:
  919-790-2957 (or county offices)
  North Carolina Cooperative Extension Service (county centers)

National Pollutant Elimination System (NPDES) Permits
  North Carolina Division of Environmental Management, Water Quality Section, Permits
  and Engineering Department: 919-733-7015

Non-Discharge Permits
  North Carolina Division of Environmental Management, Water Quality Section: 919-733-5083

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AG 522

Return to: BAE Extension Publication