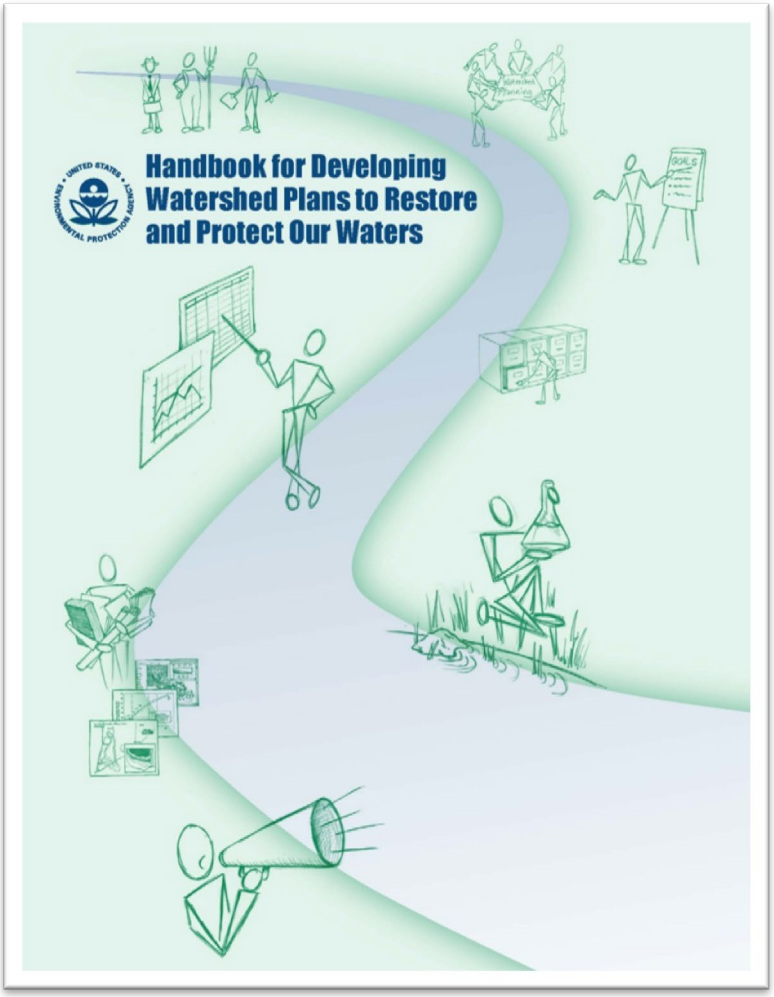
United States Environmental Protection Agency

A QUICK GUIDE to Developing Watershed Plans to Restore and Protect Our Waters



Disclaimer

This document provides guidance to states, territories, authorized tribes, local governments, watershed organizations, and the public regarding technical tools and sources of information for developing watershed-based plans to improve and protect water quality. The document refers to statutory and regulatory provisions that contain legally binding requirements. The document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, territories, authorized tribes, local governments, watershed organizations, or the public and might not apply to a particular situation based upon the circumstances. EPA, state, territory, local government, and authorized tribe decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance. The use of nonmandatory words like *should*, *could*, *would*, *may*, *might*, *recommend*, *encourage*, *expect*, and *can* in this guidance means solely that something is suggested or recommended; it does not mean that the suggestion or recommendation is legally required, that it imposes legally binding requirements, or that following the suggestion or recommendation necessarily creates an expectation of EPA approval.

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A Quick Guide to Watershed Management was prepared by Tetra Tech, Inc., under a contract with EPA. This guide was developed with input from federal, state, and local watershed practitioners and outreach experts.

United States Environmental Protection Agency
Office of Wetlands, Oceans, and Watersheds
Nonpoint Source Control Branch (4503T)
1200 Pennsylvania Ave., NW
Washington, DC 20460
EPA 841-R-13-003
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Introduction

Watershed Planning as an Overarching Management Framework

The U.S. Environmental Protection Agency (EPA) has for many years encouraged states and others to develop watershed plans to help protect and restore our waters. Due to the complex and diffuse nature of nonpoint source pollution, the substantial costs to address it, and frequent reliance on voluntary action by individual landowners, successfully addressing nonpoint source pollution to achieve water quality standards often requires years of support from a coalition of stakeholders, programs, and funding sources. Watershed planning helps address water quality problems in a holistic manner by fully assessing the potential contributing causes and sources of pollution, then prioritizing restoration and protection strategies to address these problems.

Why a Quick Guide to Watershed Management?

In 2008 EPA published the *Handbook for Developing Watershed Plans to Restore and Protect our Waters* (the Handbook) to provide users with a comprehensive resource to develop more effective watershed plans as a means to improve and protect the nation's water quality. The Handbook also provides guidance on how to incorporate the nine minimum elements from the Clean Water Act section 319 Nonpoint Source Program's funding guidelines into the watershed plan development process. Since the Handbook was issued, EPA and other entities have stepped up watershed plan implementation, introduced new initiatives, developed new tools, and provided additional funding sources.

Over the past 5 years, thousands of copies of the Handbook have been printed. The Handbook has been used by watershed practitioners, incorporated into training courses, and even adopted as part of college curricula. The purpose of this Quick Guide, developed in response to feedback on the length and complexity of the Handbook, is to provide a streamlined, easy-to-read summary of the Handbook. The guide also incorporates key watershed-related topics not included in the Handbook. The Quick Guide is not meant to replace the Handbook, but rather to provide a brief guide to watershed planning and highlight new information that can be used for more effective decision-making leading to improved management of our water resources.

Use the following icons to help locate specific information in the Quick Guide

❾ Indicates where one of the **nine minimum elements** is discussed.

🗁 Indicates a **case study** that highlights the use of the nine minimum elements in watershed plans.

🗐 Refers the reader to specific sections in **the Handbook** for more detailed information.

Organization of the Quick Guide

The Quick Guide is divided into two sections:

- **Section I: The Basics** provides a streamlined summary of the Handbook. It includes the major steps in the watershed planning process and a brief overview of the nine minimum elements to be included in watershed plans under EPA's Clean Water Act section 319 Nonpoint Source Program.
- **Section II: What's New** highlights recent EPA watershed-related initiatives and presents new tools that practitioners can access to improve water quality across the country.

If you are new to watershed management as a planning framework and the nine minimum elements, start with Section I. If you are already familiar with the Handbook, you might want to start with Section II to discover new tools and programs that you can incorporate into your watershed management activities.

Audience for the Quick Guide

The Quick Guide is intended for novice as well as experienced practitioners working on watershed-related issues at the federal, state, tribal, and local levels. The Quick Guide is also intended for managers involved in other integrated resource planning efforts, such as water and wastewater utilities, transportation departments, and local zoning offices. The Appendix includes a list of contacts from EPA's Polluted Runoff Program (http://water.epa.gov/polwaste/nps/where.cfm) website. You can follow up with them to get more information on specific watershed planning requirements in your area.

Section I

SECTION I: THE BASICS

This section presents a streamlined summary of the watershed handbook, *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, and walks you through the basic watershed planning and implementation process. In addition, this section highlights where in the planning process to incorporate the nine minimum elements (see the box to the right) required for watershed-based plans that are developed and implemented with section 319 funds.

Summary of the nine minimum elements to be included in section 319-funded watershed plans for threatened or impaired waters

a. Identify causes and sources of pollution
b. Estimate pollutant loading into the watershed and the expected load reductions
c. Describe management measures that will achieve load reductions and targeted critical areas
d. Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan
e. Develop an information/education component
f. Develop a project schedule
g. Describe the interim, measurable milestones
h. Identify indicators to measure progress
i. Develop a monitoring component

Watershed plans provide an analytic framework for managing efforts to both restore water quality in degraded areas and to protect overall watershed health. Watershed plans assist states and tribes in addressing nonpoint source pollution by providing a comprehensive assessment of nonpoint source pollution and a set of management measures to address them.

EPA recognizes that not all watersheds are threatened or impaired and that in many cases watershed stakeholders want to develop and implement watershed plans to continue protecting high-quality watersheds. The watershed planning and implementation steps are similar for healthy and impaired watersheds, but the overall watershed plan goals and management strategies will vary depending on local and regional priorities, conservation programs, and regulatory requirements or other approaches used to achieve them.

NOTE: A waterbody is **impaired** if it does not attain the water quality criteria associated with its designated use(s). **Threatened** waters are those that meet standards but exhibit a declining trend in water quality such that they will likely exceed standards in the near future.

In this section of the Quick Guide, you will learn about the framework to conduct a successful watershed planning effort. The basis for this framework is the **six steps of watershed planning,** which are discussed in detail in the Handbook (http://water.epa.gov/polwaste/nps/handbook_index.cfm). An additional goal of the Handbook (and, subsequently, of this guide) is to show both how the **nine elements** presented in the Clean Water Act section 319 grant guidelines serve as building blocks to develop watershed plans and where these elements fit within the six steps of the watershed planning process (Figure 1). The nine elements are the components of the watershed planning process that EPA believes are the most critical to preparing effective watershed plans and are generally required for watershed projects funded under section 319. EPA finalized its updated section 319 *Nonpoint Source Program and Grant Guidelines for States and Territories* in 2013, and it includes the nine elements discussed in the Handbook and this Quick Guide (see www.epa.gov/nps/319).

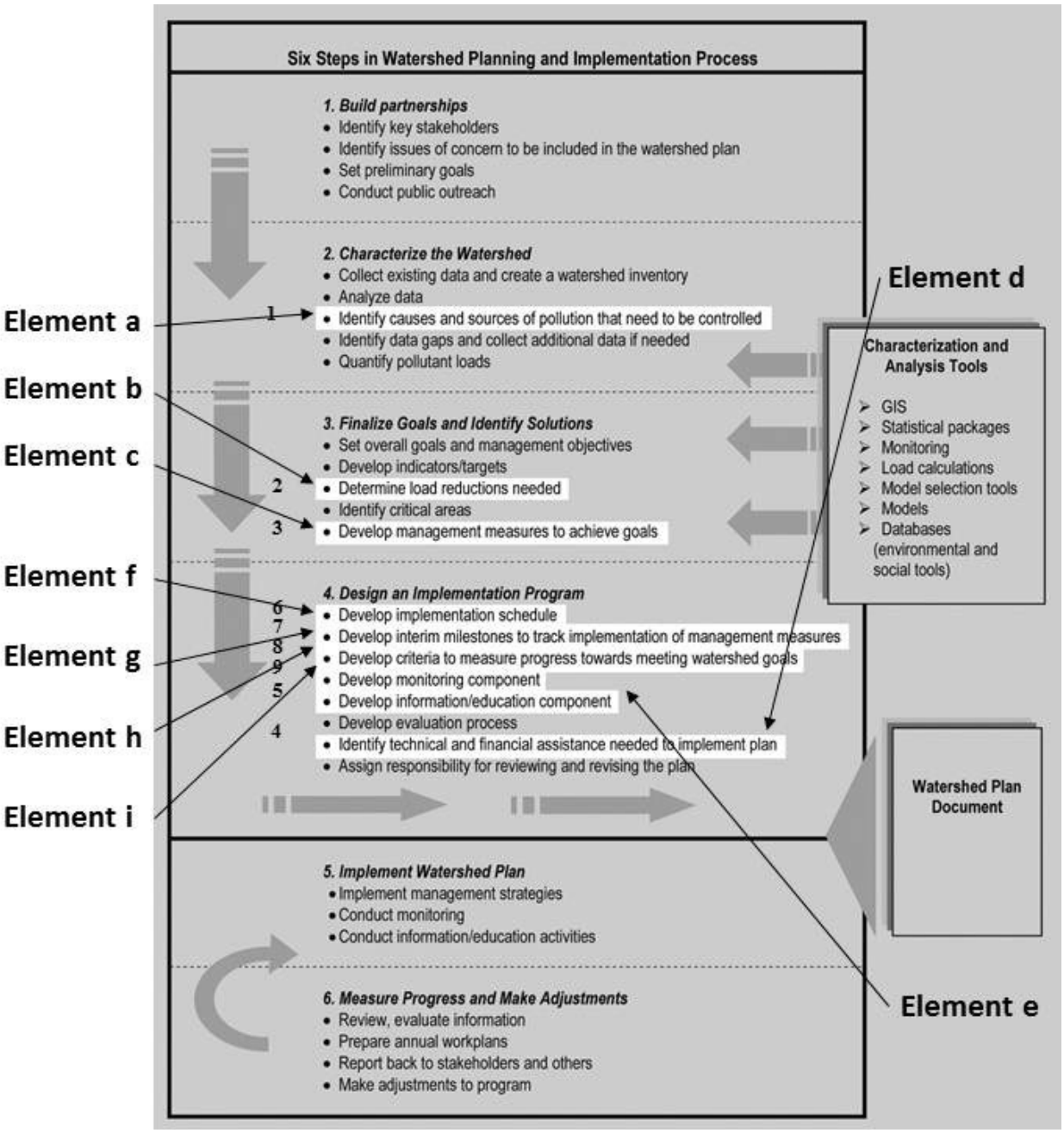


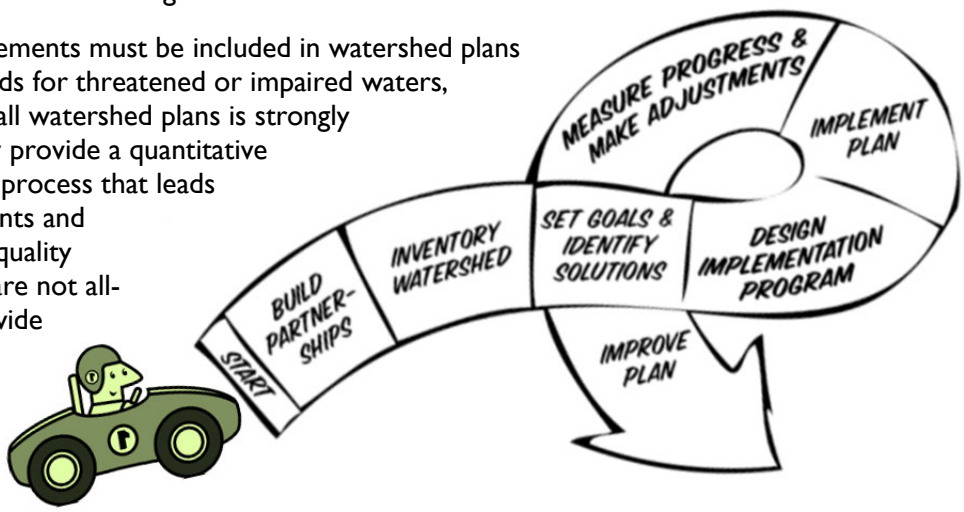
Figure 1. Crosswalk between the six steps of watershed planning and the section 319 nine minimum elements.

Understanding the Nine Minimum Elements of Watershed-Based Plans

EPA developed the nine minimum elements to help watershed managers address some of the most common pitfalls seen in watershed plans, particularly those for impaired waters. Watershed plans often lack quantified estimates of current and projected pollutant loads and the reductions needed to achieve water quality standards and other watershed goals. These loading estimates and estimates of load reductions from proposed pollution control measures provide the analytic link between actions on the ground and attainment of water quality standards. In the absence of such a framework, it is difficult to develop and implement a watershed plan that can be expected to achieve water quality standards or other environmental goals.

> **NOTE:** EPA's Watershed Central (http://water.epa.gov/type/watersheds/datait/watershedcentral/index.cfm), including its wiki, can be used to assist watershed practitioners in each of the watershed planning and implementation steps.

Although these minimum elements must be included in watershed plans funded with section 319 funds for threatened or impaired waters, including these elements in all watershed plans is strongly recommended because they provide a quantitative framework for the planning process that leads to water quality improvements and restoration to attain water quality standards. These elements are not all-encompassing, but they provide the basic components needed to produce a watershed plan that can lead to water quality improvements.



The elements are labeled *a* through *i* to reflect how they are presented in the 319 guidelines. The first three elements (*a* through *c*) are considered during the characterization and goal-setting phases to address the primary sources of pollution in the watershed and to determine the management strategies needed in specific areas to reduce the pollution to meet water quality goals. The remaining six elements (*d* through *i*) are used to develop a specific plan of action with measureable targets and milestones, as well as the necessary financial and technical resources needed to restore the waterbody.

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters—waters that are too polluted or degraded to meet their water quality standards. The law requires that these jurisdictions establish priority rankings for waters on the lists and, in most cases, develop total maximum daily loads (TMDLs) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive from both point and nonpoint sources and still meet water quality standards.

TMDLs provide an important starting point for water quality planning. Some TMDL development reports also contain an implementation strategy or plan. The point source allocations in TMDLs provide water quality targets for point sources such as wastewater treatment plants and stormwater treatment systems that go into their regulatory permits. Nonpoint source allocations are usually managed according to a TMDL implementation plan or watershed-based plan, which must include the nine elements described in this guide and in the Clean Water Act section 319 funding guidelines.

Steps to Effective Watershed Management

This section uses six basic steps to describe how to develop and implement an effective watershed plan. These steps provide a road map for you to follow to achieve your watershed goals.

Notice that in the picture on the previous page the road includes a loop. That is because watershed planning is an iterative process: As you collect new information, you should refine or modify your approach and incorporate lessons learned into your planning and implementation program. The remainder of Section I proceeds through each of the six steps and includes case studies and relevant tools and resources you can access for more information.

Step 1. Build Partnerships

Step 1: Build Partnerships

- **Identify key stakeholders**
- **Identify issues of concern**
- **Set preliminary goals**
- **Develop indicators**
- **Conduct public outreach**

The first step in the watershed planning process is to build partnerships. The very nature of working at a watershed level means you should work with local stakeholders and other partners. New ideas and input provided by partners not only provide a more solid commitment to solutions but also help to pool resources and skill sets. The stakeholders that you involve in the watershed plan development process will help you identify critical issues, set preliminary goals based on areas of mutual concern, and develop an initial set of indicators that will be crucial in monitoring progress. This step will also help you to develop an effective information/education component, which is one of the nine minimum elements (discussed in Step 4). Stakeholder involvement also increases the probability of long-term success through trust, commitment, and personal investment.

Identify Key Stakeholders

Stakeholders are those who make and implement decisions, those who are affected by the decisions made, and those who can assist or impede implementation of the decisions. Key stakeholders also include those who can contribute resources and assistance to the watershed planning effort and those who are working on similar programs that can be integrated into a larger effort. It is important to remember that stakeholders are more likely to get involved if you can show them a clear benefit to their participating.

In general, there are at least five categories of participants to consider when identifying stakeholders:

- Those who will be responsible for implementing the watershed plan
- Those who will be affected by implementation of the watershed plan
- Those who can provide information on the issues and concerns in the watershed

- Those who have knowledge of existing programs or plans that you might want to integrate into your plan (e.g., soil and water conservation districts, irrigation districts)
- Those who can provide technical and financial assistance in developing and implementing the plan (e.g., state and federal agencies, colleges and universities).

Refer to Worksheet 3 on page 3-7 of the Handbook for a checklist of skills and resources that stakeholders can contribute to the planning process.

Refer to Getting in Step: Engaging Stakeholders in your Watershed *for more information on the tools needed to effectively engage stakeholders to restore and maintain healthy environmental conditions through community support and cooperative action (http://cfpub.epa.gov/npstbx/getinstep.html).*

Identify Issues of Concern

It is important for stakeholders to assist in identifying issues of concern in the watershed. They often have a historical perspective on problems in the watershed and a sense of whether conditions are improving or deteriorating. These issues will help shape the overall goals of the watershed plan and determine what information is needed to accurately define and address the concerns. This step will also help determine the geographic scope of your watershed planning effort on the basis of where the problems are located and areas that need to be protected.

Refer to the Healthy Watersheds website for more information and resources related to watershed protection.

Set Preliminary Goals

A fundamental step in the partnership-building process is to ask stakeholders to list their long-term goals for the watershed. These goals will be refined throughout the planning process to represent shared goals among the stakeholders. Concrete objectives with measureable targets and indicators to measure progress will then be developed for each goal the stakeholder group selects.

See Figure 4-4 on page 4-9 of the Handbook; it is a conceptual diagram of how watershed goals grow and evolve during the watershed planning process.

Using Stakeholders to Identify Indicators

Case Study: Barataria-Terrebonne National Estuary Program, Louisiana

The Barataria-Terrebonne National Estuary Program (NEP) began an indicator development process by forming a planning committee with federal, state, and university participants. The planning committee decided to conduct an indicator development workshop with local stakeholders so that the stakeholders could recommend a suite of indicators. During the workshop, the stakeholders separated into breakout groups and were asked to identify indicators to address specific focus questions. Workshop participants selected the following indicators to answer Question 1: *Are our waters healthy?*

Indicator(s):

- Level of chlorophyll *a* in the estuary over time
- Size of dead zone (off coastal Louisiana) over time
- Number of petroleum spill reports in the estuary over time.

The NEP continues to use a similar process every 5 years to update its indicators. A full description of the process and indicators developed can be found at http://water.epa.gov/type/oceb/nep/indicators.cfm.

Develop Preliminary Indicators

Indicators are direct or indirect measurements of a component in a system. For example, an indirect indicator to demonstrate the improved water clarity of a lake might be the depth at which you can see your white sneakers as you wade into the lake. A direct indicator would be total suspended solids

samples taken quarterly at predetermined depths. Indicators provide a powerful means of communicating to various audiences about the watershed status, and they are used throughout the planning and implementation process. Stakeholders should be actively involved in selecting the indicators, and they should be asked to identify for each goal how progress toward that goal will be measured. Just as the preliminary goals will be refined throughout the watershed planning process, the indicators selected will be refined to ensure they are quantifiable and include environmental, social, and programmatic examples.

Conduct Public Outreach

Information/education activities should be initiated at the outset of the watershed planning effort to familiarize potential partners and stakeholders with the issues, outline the watershed planning process, and enlist their participation. Developing an information/education component is one of the nine minimum elements; it is discussed further in Step 4 of the watershed planning process (refer to page 23).

Chapter 12 (PDF, 713 KB, 38 pp.) of the Handbook provides more detail on the information/education component.

Step 2. Characterize the Watershed

Characterizing the watershed, its problems, and pollutant sources provides the basis for developing effective management strategies to meet water quality goals. The characterization and analysis process helps to focus management efforts on the most pressing needs within the watershed. During this step the first of the nine elements is addressed: The watershed plan should include ❾ a. *An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan).*

Step 2: Characterize Watershed

- **Gather existing data**
- **Create a watershed inventory**
- **Identify data gaps**
- **Collect additional data if needed**
- **Analyze data**
- **Identify causes and sources of impairments**
- **Estimate pollutant loads**

Gather Existing Data and Create a Watershed Inventory

You will first identify existing information through reports and data sets. Data needed for watershed planning include the following:

Physical and Natural Features	Land Use and Population Characteristics	Waterbody Conditions	Pollutant Sources	Waterbody Monitoring Data
Watershed boundaries, hydrology, topography, soils, etc.	Land use, land cover, existing management, etc.	305(b) reports, 303(d) reports, TMDLs, source water assessments, etc.	Permitted point sources, nonpoint sources, atmospheric deposition, etc.	Water quality and flow, biology, geomorphology, etc.

Reports and data should be obtained from local governments (city and county planning offices, environmental departments, soil and water conservation districts), state natural resource agencies, and federal agencies (EPA, USFWS, USDA, NRCS, FAS, USGS). You will then create a watershed inventory to organize the data into a common format (in a spreadsheet or database) for further analysis.

For more information on types of data typically collected for watershed characterization and the data's potential uses, see Table 5-1 (PDF, 1.42 Mb, 56 pp.) on page 5-8 of the Handbook.

Identify Data Gaps and Collect Additional Data if Necessary

There will always be more data to collect, but you need to keep the process moving forward and determine whether you can reasonably characterize watershed conditions with existing information. This process may involve:

- Conducting a data review of your watershed inventory to examine data quality and identify any significant temporal or spatial data gaps
- Examining the data to determine whether you can link the impairments seen in the watershed to the causes and sources of pollutants
- Considering whether you have gathered data of the right types and of adequate quality.

If you determine that you need to collect additional data, first develop a sampling plan. This will save you time and resources down the road, and you might be able to use portions of the sampling plan to construct the long-term monitoring program discussed in Step 4.

For more information on designing a sampling plan, see EPA's Guidance on Choosing a Sampling Design for Environmental Data Collection *(PDF, 1.02 MB, 178 pp.) and EPA's Quality Management Tools website at http://www.epa.gov/QUALITY/qa_docs.html.*

Analyze Data

Once you have gathered existing and newly collected data and consolidated the data into a database or spreadsheet, you will analyze the information to identify watershed pollutant sources and causes of any impairments, as well as important areas to protect. In this phase of the watershed planning process, you will identify the causes and sources of pollutants that need to be controlled. It is critical to have an understanding of the watershed conditions and sources of pollutants to determine the appropriate method for quantifying the pollutant loads.

Refer to Chapters 7 and 8 (PDF, 781 KB, 22 pp.) of the Handbook for details on instream data, watershed data, and an in-depth discussion of pollutant load estimation. Refer to Table 7-1 (PDF, 781 KB, 22 pp.) on page 7-3 of the Handbook for examples of data analysis activities and the tools used in various steps of the watershed planning process.

Identify Causes and Sources That Need to Be Controlled

Together with the input from stakeholders and their local knowledge of the watershed, analyzing your data should lead you to an understanding of where and when problems occur in your watershed and what could be causing the problems. Without knowing where the pollutants are coming from, you cannot effectively control them and restore and protect your watershed. Pollutant sources, along with associated pollutants, timing, and impact on the watershed, are critical to developing an effective management strategy. It is also important to identify critical areas (i.e., those that generate the most pollution) to focus on and to give priority to conservation practice implementation.

NOTE: The new EPA Recovery Potential Screening tool described in Section II can be used to assess the recovery potential of sites within a watershed based on a series of factors. This tool can be used in conjunction with other data collected to assess the impaired sites that have the highest potential to recover and meet watershed goals.

In identifying the sources, you will begin to identify the critical areas to address with targeted management strategies. The location of pollutant sources and the associated critical areas will feed into selecting the management measures needed to control the sources. This is outlined in element *c* of the nine minimum elements. ❾Element *c* states: "*A description of the nonpoint source management measures that will need to be implemented to achieve load reductions and a description of the critical areas in which those measures will be needed to implement this plan.*" The critical areas for each primary source can be indicated on a map. In the next step you will quantify the magnitude of the pollutant loads.

Estimate Pollutant Loads

A quantified estimate of pollutant loads and the related sources of those loads are often missing from watershed plans, and filling this gap is critical to effectively control sources, develop the load reductions needed to meet watershed goals, and restore watershed health.

Various approaches can be used to conduct the loading analysis. The most appropriate method depends on several factors, including water quality parameters, time scale of the analysis, source types, data needs, and user experience. First check whether a previous study that required the development of loading estimates, such as a TMDL or a Clean Lakes study, was conducted. Such studies can often be used as a basis to provide loading estimates appropriate for developing the watershed plan.

TMDLs describe the allowable point and nonpoint source load reductions or allocations that will be necessary to meet water quality standards. The TMDL sets maximum pollutant loads for the most critical conditions to ensure that the applicable water quality standards will be attained at all times and will also provide a loading scenario that addresses all seasonal conditions. The TMDL analysis also describes the pollutant load from natural or background sources and establishes a margin of safety to ensure the standards will be met. In some cases, there might be an opportunity to trade pollution allocations or develop local ordinances or other programs to achieve equitable and effective pollutant reductions from all sources. In any watershed analysis where both point and nonpoint sources are present, it is important to determine the regulatory requirements for the point sources and the feasibility of controlling the nonpoint sources using existing local, state, tribal, and federal programs. This aspect of the TMDL (referred to as reasonable assurance) provides a degree of certainty for achieving the needed pollutant reductions.

Some loading analyses are focused on determining how much load is acceptable, whereas others are focused on source loads that attribute loading to each category of sources in the watershed. There are two general types of techniques for estimating pollutant loads: (1) techniques that use actual monitoring data or literature values and (2) techniques that use models to predict the estimated pollutant loads. Monitoring data or literature values are fairly simple approaches that provide a coarse estimate of the pollutant loads entering a waterbody. These techniques are best suited to conditions where fairly detailed monitoring and flow gauging are available and the major interest is in total loads from a watershed.

Models provide another approach for estimating loads, providing source load estimates, and evaluating various management alternatives. They can be used to forecast or estimate conditions that might occur under various scenarios. In some cases, landscape and loading models are developed, and they can be supplemented with a receiving water model as well. Although you might not be the person who will run the model, you should have an understanding of what types of questions you want answered so that the most appropriate model is used. Typical questions you might want a watershed model to address include:

- Will the management actions result in meeting water quality standards?
- Which sources are the main contributors to the pollutant load targeted for reduction (e.g., land use or land cover types)?
- What are the loads associated with the individual sources (e.g., point sources versus nonpoint sources)?
- Which combination of management actions will most effectively meet the identified loading targets (e.g., stormwater management, wastewater treatment, best management practices (BMPs) for croplands)?
- When does the impairment occur? Is it seasonal or flow-dependent?
- Will the loading or impairment get worse under future land use conditions?
- How can future growth be managed to minimize adverse impacts?
- How can the watershed plan ensure that downstream water quality is also protected?

The modeling approaches developed are ultimately designed to support decision-making. Essential to decision-making is the application of the model to identify various alternatives. How you use the model to support decision-making is as important as the various steps that go into building and testing the model. Regardless of what model you use, the analysis should be field-checked before you use the results.

A summary of various approaches used to estimate pollutant loads in watersheds is included in Table 8-1 on page 8-3 of the Handbook.

Step 3. Set Goals and Identify Solutions

Now that you have characterized and quantified the problems in the watershed, you need to refine the preliminary goals and develop more detailed objectives, measurable targets, and indicators. The pollutant loads calculated in Step 2 will provide the basis for identifying the reductions needed to meet watershed goals (including meeting water quality standards) and determine which management practices will be used in the critical areas to achieve those reductions.

Step 3: Set Goals and Identify Solutions

- **Set overall goals and management objectives**
- **Develop indicators/targets**
- **Determine load reductions needed**
- **Identify critical areas**
- **Develop management measures to achieve goals**

Set Overall Goals and Management Objectives

You identified preliminary goals and associated environmental indicators with your stakeholders earlier in the characterization process, but now you will refine those goals on the basis of your data analysis. You will also establish more detailed objectives and targets that will guide the development of your management strategies.

For example, a preliminary goal developed during the scoping phase, in Step 1 of the watershed planning process, might have been to "restore aquatic habitat." Based on the information collected during data analysis, in Step 2 of the watershed planning process, you might determine that the causes contributing to poor aquatic habitat include upland sediment erosion and delivery, streambank erosion, and near-stream land disturbance (e.g., livestock, construction). Linking the preliminary goal to the source and impacts of pollution will help you define your management objectives. In this case, appropriate management objectives could include (1) reducing sediment loads from upland sources and (2) improving riparian vegetation and limiting livestock access to stabilize streambanks.

Develop Indicators/Targets

Next you will develop indicators and numeric targets to quantitatively measure whether you are meeting your objectives. You identified indicators with your stakeholders earlier to determine the current health of the watershed; now you will refine the indicators to measure implementation. When developing your indicators and targets, also work to establish interim milestones that will measure the implementation of activities in your watershed plan, including the costs associated with those activities. Refer to the Milestones section of Step 4 of this Quick Guide for more information.

NOTE: Section II provides updated information on how to develop and use social indicators to measure watershed management progress.

It is important to use different types of indicators to reflect where you are in the watershed management process and the audience with which you are communicating. You'll first select environmental indicators to measure the current conditions in the watershed and help to identify the stressors and the pollutant sources. Environmental indicators are a direct measure of the environmental conditions that plan implementation seeks to achieve. As you develop your management objectives and actually assemble your watershed plan, you will add performance indicators, such as social and programmatic indicators, to help measure progress toward meeting your goals. An example of each type of indicator is provided in Table 1.

Table 1. Examples of performance indicators

Environmental	Programmatic	Social
• Number (or percentage) of river/stream miles that fully meet all water quality standards • Reduction in pollutant loadings from nonpoint sources	• Number of public water systems with source water protection plans • Number of management measures implemented in a watershed (e.g., number of acres under nutrient management, number of riparian buffers created)	• Increase in the number of residents signing watershed stewardship pledge • Rates of participation in education programs specifically directed toward solving particular nonpoint source pollution problems

Successful Use of Aerial Photography to Track Streambank Erosion

Case Study: Bog Brook Channel Stabilization Project, New Hampshire

Past removal of woody riparian shrubs along Bog Brook made the banks of the stream susceptible to erosion. As erosion continued over time, the stream channel became wider and more unstable, exacerbating the erosion problem and sending tons of sediment into the stream. Analysis of aerial photographs showed that the stream channel had eroded laterally up to 35 feet between 1999 and 2003, consuming 4,000 square feet of land. This translated to 120 tons of sediment—approximately the amount needed to fill nine dump trucks—entering the stream each year, harming water quality and smothering fish habitat.

In an effort to halt the degradation of Bog Brook, the landowner adjacent to the eroding channel worked with the town of Stratford and a consultant to secure a section 319 grant from the New Hampshire Department of Environmental Services. The project called for a comprehensive stream morphology assessment, a design plan, and reconstruction of a 275-foot stretch of the stream to a more natural condition. Project partners returned the stream channel to a more natural state and planted vegetation at the site. As a result, the channel stabilized and erosion subsided. In 2006, New Hampshire upgraded the stream from *Impaired* by *other flow regime alterations* to *Fully Supporting Aquatic Life Use* in its 305(b) surface water quality report.

For more information see http://water.epa.gov/polwaste/nps/success319/nh_bog.cfm.

Determine Load Reductions Needed

Using the load estimates from Step 2, you must determine the extent to which the pollutant loads need to be reduced to meet watershed goals. For waters for which EPA has approved or established TMDLs, the plan should identify and incorporate the TMDLs. The estimate should account for reductions in pollutant loads from point and nonpoint sources identified in the TMDL as necessary to attain the applicable water quality standards. The load reduction estimates are based on the planned management measures to be implemented in the critical areas. Elements *b* and *c* of the nine minimum elements are directly linked: ❾Element *b* states that the watershed plan should include *"An estimate of the load reductions expected for the management measures described in element (c) below."* ❾Element *c* states that you should include *"A description of the NPS management measures that will need to be implemented to achieve the load reductions estimated in element (b) above, and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan."*

To estimate the load reductions expected once the management measures are implemented, you need to understand the cause-and-effect relationship between pollutant loads and the waterbody response. Establishing this link allows you to evaluate how much of a load reduction from watershed sources is needed to meet waterbody targets. As with your approach for quantifying pollutant loads, selecting the appropriate approach will depend on several factors, including availability, pollutants, waterbody type, types of sources, time frame, and spatial scale. Most important, the approach must be compatible with the method used to quantify loads and must be able to predict the necessary load reductions to meet targets.

Numerous models are available to determine which BMPs are more appropriate for reducing pollutant loads and to aid in selecting the locations most likely to achieve the greatest load reductions. All models have limitations that you must document to ensure decision-makers understand them before using the data.

Refer to Table 9-4 in the Watershed Handbook for a summary of many of the receiving water models available to support linkage of sources and indicators for watershed planning.

Process to Select Management Practices

1. Inventory existing management efforts in the watershed, taking into account local priorities and institutional drivers.
2. Quantify the effectiveness of current management measures.
3. Identify new management opportunities.
4. Identify critical areas in the watershed where additional management efforts are needed.
5. Identify possible management practices.
6. Identify relative pollutant reduction efficiencies.
7. Develop screening criteria to identify opportunities and constraints.
8. Rank alternatives and develop candidate management opportunities.

Identify Management Practices to Achieve Goals

In general, management practices are implemented immediately adjacent to the waterbody or upland to address the sources of pollutant loads. As part of your screening process, you will want to identify which management practices can be implemented in the critical areas that you identified as part of Step 2.

In most parts of the country, land uses are changing, and you will need to understand how these changes affect pollution loads and water quality. Some watershed pollution models allow you to factor in various development and agricultural scenarios as well as changing climate. Watershed planning is an opportunity to work with new partners to identify actions that reduce pollution, restore damaged ecosystems, and protect valuable habitat.

You can then use screening criteria to screen potential practices, narrowing the options down to those which are the most effective and acceptable. These criteria are based on factors such as pollutant reduction efficiencies, legal requirements, and physical constraints. Once you have identified and screened various management options, calculate the effectiveness of the management practices, compare the costs and benefits, and select the final management strategies that will be the most effective in achieving the load reductions needed to meet the goals for your watershed.

Step 4. Design an Implementation Program

By the end of Steps 1, 2, and 3, you should have reached out to stakeholders and identified watershed goals, characterized the sources of pollutants in the watershed (element *a*), estimated pollutant loads and the necessary reductions to meet your goals (element *b*), and identified the types and locations of management practices in the watershed that will achieve the required load reductions (element *c*). Now you must design an implementation program that shows how you will implement your watershed plan.

Step 4: Design Implementation Program

- **Develop an implementation schedule**
- **Develop interim milestones to track implementation of management measures**
- **Develop criteria to measure progress toward meeting watershed goals**
- **Develop monitoring component**
- **Develop information/education component**
- **Develop evaluation process**
- **Identify technical and financial assistance needed to implement plan**
- **Assign responsibility for reviewing and revising the plan**

Develop an Implementation Schedule

The schedule component of a watershed plan involves turning goals and objectives into specific tasks. The schedule should include a timeline of when each phase of the step will be implemented and accomplished, as well as the agency/ organization responsible for implementing the activity. In addition, your schedule should be broken down into increments that you can reasonably track and review. For example, the time frame for implementing tasks can be divided into quarters. It is important to include an estimate of when water quality standards will be achieved, even if that date extends beyond the project period. This phase will fulfill element *f* of EPA's nine minimum elements, which states that you should include a ❾ *"Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious."*

Worksheet 12-1, in Appendix B of the Handbook (PDF, 320 KB, 28 pp.)*, is an example of an implementation matrix.*

Milestones

When designing your implementation schedule, you should establish interim milestones that will help you measure the implementation of activities in your watershed plan. Developing interim measurable milestones will address element *g* of EPA's nine elements. ❾Element *g* requires *"A description of interim measureable milestones for determining whether nonpoint source management measures or other control actions are being implemented."* It usually helps to develop milestones using relevant time scales like the following: short-term (1 to 2 years), mid-term (2 to 5 years), and long-term (5 to 10 years or longer). When developing schedules and interim milestones, be sure to account for weather and seasonal factors when implementing BMPs or performing other field work.

First, outline the subtasks involved and the level of effort and funding requirements associated with each to establish a baseline for time estimates. Then provide milestones that can be reasonably accomplished within those short-term, mid-term, and long-term time frames.

See Worksheet 12-3 (PDF, 320 KB, 28 pp.) *of the Handbook for example milestones.*

Example Milestones

Short-Term (< 2 years)
Achieve 5 percent reduction in sediment load on 1,000 acres of agricultural land in the Cross Creek subwatershed by implementing rotational grazing practices.

Eliminate direct sources of organic waste, nutrients, and fecal coliform bacteria to the stream by installing 5,000 feet of fencing to exclude direct access to cattle along Cross Creek.

Mid-Term (< 5 years)
Reduce streambank erosion and sediment loading rate by 15 percent by reestablishing vegetation along 3,600 feet of Cross Creek.

Long-Term (5 years or longer)
Achieve the fecal coliform water quality standard in the upper section of Cross Creek above Highway 64.

Benchmarks to Measure Progress

As you implement your watershed plan, you will need benchmarks to track progress through monitoring. These interim targets can be direct measurements that reflect a water quality condition (e.g., fecal coliform concentrations, dissolved oxygen content, pounds of nitrogen) or indirect indicators of load reduction (e.g., number of beach closings, pounds of trash removed, length of stream corridor revegetated).

You should also indicate how you'll determine whether the watershed plan needs to be revised if interim targets are not met. These revisions need to focus on changing management practices, updating/reevaluating critical source areas/loading analyses, and reassessing the time it takes for pollution concentrations to respond to treatment; they should not focus on changing the plan's goals.

This phase of the watershed planning process will address element h of EPA's nine minimum elements. ❾Element *h* states *"A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards."*

Table 12-1 of the Handbook demonstrates how you can use a suite of indicators to measure progress in reducing pollutant loads depending on the issues of concern.

Monitoring Program

Your monitoring program will address element *i*, which states that you should include ❾ *"A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item h."*

Monitoring programs can be designed to track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring.

When developing a monitoring design to meet your objectives, it is important to understand how the monitoring data will be used. Ask yourself questions like the following:

- What questions are we trying to answer?
- What techniques will be used?
- What statistical accuracy and precision are needed?
- Can we account for the effects of weather and other sources of variation?
- Will our monitoring design allow us to attribute changes in water quality to the implementation program?

Information/Education Component

Every watershed plan should include an information/education component that involves the watershed community. Because many water quality problems result from individual actions and the solutions are often voluntary practices, effective public involvement and participation promote the adoption of management practices; help to ensure the sustainability of the watershed management plan; and, perhaps most important, encourage changes in behavior that will help you achieve your overall watershed goals. This phase of the watershed planning process will address element e, which calls for ❾*"An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented."*

The objectives of the public outreach program should directly support your watershed management goals and implementation of the watershed management plan. They should also include measurable indicators for tracking progress. The information/education component of your watershed plan should build on the outreach efforts you initiated in Step I as part of building partnerships. To develop an effective information/education plan, you should use the following steps:

- Define information/education goals.
- Identify and analyze the target audiences.
- Create the messages for each audience.
- Package the message for the various audiences.
- Distribute the messages.
- Evaluate the information/education program.

🗐 *For more information please see* Getting in Step: A Guide for Conducting Watershed Outreach Campaigns *(http://cfpub.epa.gov/npstbx/files/getnstepguide.pdf), which explains the steps needed to develop and implement an effective watershed outreach campaign and includes a set of practical worksheets to help you get on your way.*

Evaluation Process

There are two primary reasons to evaluate your watershed program. First, you want to be able to demonstrate that by implementing the management measures, you are achieving your watershed goals. Second, you want to be able to continually improve your program in terms of efficiency and quality.

In general, you will evaluate three major components of your watershed implementation program—inputs, outputs, and outcomes (Figure 2). Your evaluation framework should include indicators to measure each component. A brief description of each component is included below:

- Inputs—the elements of the process used to implement your program (i.e., resources of time and technical expertise, stakeholder participation)
- Outputs—the tasks conducted and the products developed (i.e., implementation activities such as installing management practices)
- Outcomes—the results or outcomes realized from implementation efforts (i.e., environmental improvements like water quality).

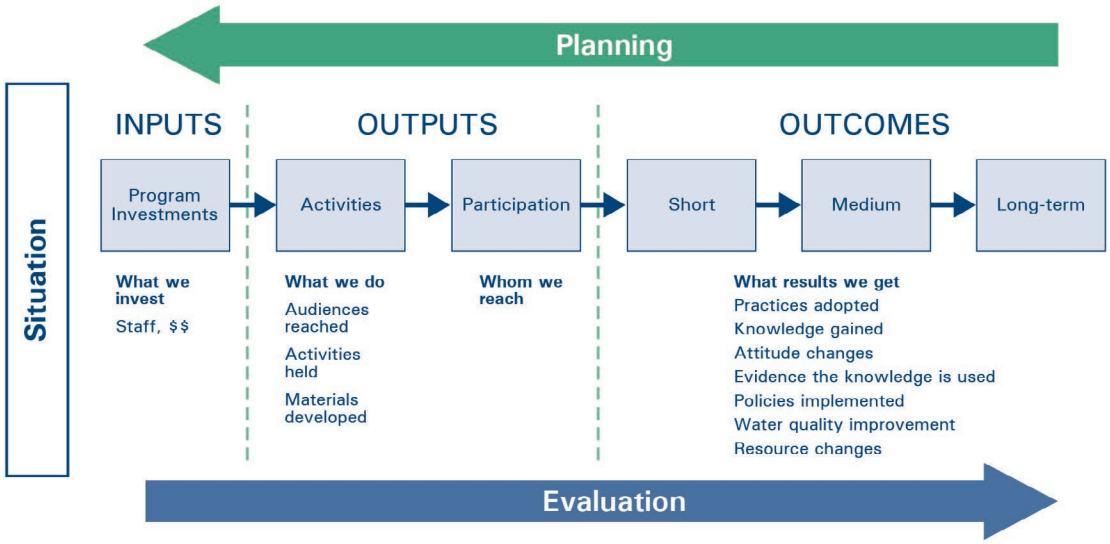


Figure 2. Using a logic model to evaluate your watershed program.

Identify Technical and Financial Assistance

A critical factor in turning your watershed plan into action is the ability to fund implementation. Funding might be needed for multiple activities, such as management practice installation, information/education activities, monitoring, and administrative support. In addition, you should document what types of technical assistance are needed to implement the plan and what resources or authorities will be relied on for implementation, in terms of both initial adoption and long-term operation and maintenance. The identification and estimation of financial and technical assistance should take into account the following:

- Administration services, including salaries, regulatory fees, supplies, and in-kind services
- information/education efforts
- Installation, operation, and maintenance of management measures
- Monitoring, data analysis, and data management activities.

Identifying the technical and financial assistance needed will address element d of EPA's nine elements: ❾*"Provide an estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan."*

Keys to Successful Implementation

Although there is no single component that defines success, several factors, if implemented, will enhance your chances of a successful watershed implementation plan:

- Measurable goals and objectives
- Dedicated staff to carry out administrative duties
- Consistent, long-term funding
- Involvement of stakeholders in planning efforts
- Dedicated individuals who are supported by local government agencies
- Local ownership of the watershed plan
- A method for monitoring and evaluating implementation strategies
- Open communication between organization members.

Highlighting Milestones for an Implementation Program

🗁Case Study: Corsica River Watershed Restoration Action Strategy, Maryland

The goal of the Corsica River strategy is to promote a voluntary best management practice to improve the water quality in the Corsica River. Section 319 funds were sought to implement a voluntary cover crop enrollment program targeted for maximum water quality benefits in the Corsica River. The table below is an excerpt of the implementation strategies and schedules to fulfill elements f, g, and h. The targets for this watershed were updated in 2012, and more information is available at http://www.townofcentreville.org/uploads/file/2012-6yr-Report-Final-Version-Corsica-River-Report_htm.pdf.

Management strategies	Party responsible for meeting management objective	Schedule	Measurable indicators/ performance measures	Monitoring and party responsible for monitoring	Public involvement, outreach, or education component	Innovations or additional leverage or benefit
1. Market and early planting incentive, commodity, small grain, cover crop. Goal: 3000 demonstration acres.	Queen Anne's County Soil Conservation District	Outreach: Fall 2004 Implementation: 2005 to 2007. Monitoring: 2005 to 2007.	Pounds of nutrients reduced. Number of farmers and number of acres enrolled. Quarterly reports and tracking of acreages enrolled.	Paired watershed study: Maryland Department of Natural Resources. Ground water test wells: University of Maryland Cooperative Extension.	QA SCD aggressive enrollment initiative. Presentation of data results to public, other watersheds, and MD DNR WRAS website.	Prorated early planting incentive: $17/acre early planting, $12/per acre later planting. Provides financial incentive to farmers to plant cover crops earlier to achieve greater nutrient uptake.
2. Agriculture nutrient and sediment reducing stream buffers. Goal: 30 Demonstration acres.	Queen Anne's County Soil Conservation District	Outreach: Fall 2004. Implementation: 2005 to 2007. 15 acres by 2005. 15 acres by 2006. Monitoring: 2005 to 2007.	Number of acres buffered. Change in concentration of nutrient and sediment levels in surface waters. Quarterly reports tracking numbers of acres enrolled.	Tracking of buffered acres: Queen Anne's County Soil Conservation District: Paired watershed study. Pre and post sampling for nutrients and sediment: Maryland Department of Natural Resources.	QA SCD aggressive enrollment initiative. Presentation of results to public, other MD/Bay watersheds, and post on MD DNR WRAS website.	A "gap" closer. Demonstrates buffer development and management techniques. Currently these unbuffered areas fall outside traditional buffer program criteria.

Source: http://www.epa.gov/owow/watershed/watershedcentral/planexamples/pdf/cr_strategy_97.pdf.

For a complete list of available federal funding for watershed-related activities, visit the *Catalog of Federal Domestic Assistance* (www.cfda.gov). Also visit www.epa.gov/watershedfunding to view the *Catalog of Federal Funding Sources for Watershed Protection.*

Step 5: Implement the Watershed Plan

Although much of the watershed planning process is focused on developing the plan, results will not happen until the plan is actually implemented. Implementation activities should follow the road map developed in your plan. This means that individual projects should be coordinated by a plan-designated project manager or implementation team to ensure that BMPs are not just implemented but also fit the schedules, achieve specific milestones, and are integrated with various monitoring and outreach efforts.

Step 5: Implement the Watershed Plan

- **Prepare work plans**
- **Implement management strategies**
- **Conduct monitoring**
- **Conduct information/education activities**
- **Share results**

Prepare Work Plans

You will use your overall watershed plan as the foundation for preparing work plans, which will outline the activities in 2- to 3-year time frames. Think of your watershed plan as a strategic plan for long-term success and annual work plans as the specific to-do lists to achieve that vision. Work plans can also be useful templates for preparing grant applications to fund implementation activities. Depending on the time frame associated with your funding source, your work plans might need to be prepared annually with quarterly reporting.

Implement Management Strategies

Implementing the watershed management plan involves a variety of expertise and skills, including project management, technical expertise, group facilitation, data analysis, communication, and public relations. The management practices you identified in your plan will probably include a combination of structural and nonstructural controls. Be sure to set and track the milestones to measure the rate of progress in implementing the management strategies. Your tracking should include the progress made in BMP implementation, maintenance activities, and (if applicable) point source treatment improvements and monitoring of social indicators.

Conduct Monitoring

As part of the development of your watershed plan, you should have developed a monitoring component to track and evaluate the effectiveness of your implementation efforts. There are many ways to monitor water conditions. To monitor the constituents in water, sediments, and fish tissue—such as levels of dissolved oxygen, suspended sediments, nutrients, metals, oils, and pesticides—monitoring specialists perform chemical measurements. Physical measurements of general conditions such as temperature, flow, water color, and the condition of streambanks and lakeshores are also important. Biological measurements of the abundance and variety of aquatic plant and animal life and the ability of test organisms to survive in sample water are also widely used to monitor water conditions. In addition to government monitoring programs, trained volunteers have been able to provide important data for watershed management.

Project Effectiveness Monitoring

Case Study: Otter Creek Watershed, Wisconsin

Section 319 funding was sought to improve water quality conditions in the Otter Creek watershed. Modeling and field inventories identified critical areas needing treatment to achieve the project goals of improving dissolved oxygen levels and reducing bacterial levels. Best management practices (BMPs) were implemented on area dairy farms; they include rainwater diversions, concrete loading areas, filter screens to trap large solids in runoff, and grassed filter strips for treating runoff. The following monitoring activities are conducted to track project effectiveness:

- Paired watershed and upstream/downstream monitoring studies covering eight monitoring sites are used to evaluate the benefits of the BMPs. The monitoring sites are above and below a dairy with barnyard and streambank stabilization BMPs.
- Habitat, fish, and macroinvertebrates are sampled each year during the summer.
- Water chemistry is tracked through analysis of 30 weekly samples collected each year from April to October at the paired watershed and upstream/downstream sites.
- Runoff events are also sampled at the upstream/downstream sites and at the single downstream station site at the outlet of Otter Creek.

Read more about this project at http://www.epa.gov/owow/NPS/Section319III/pdf/319_all.pdf.

Analyze Your Data

Two types of analyses should be considered during the implementation phase: (1) routine summary analysis that tracks progress, assesses the quality of data relative to measurement quality objectives (i.e., whether the data are of adequate quality to answer the monitoring questions), and provides early feedback on trends, changes, and problems in the watershed and (2) intensive analysis to determine status, changes, trends, or other issues that measure the response to watershed plan implementation.

In general, intensive data analysis should be conducted at least annually in a multiyear watershed plan. The types of data analyses you perform on the monitoring data depend on the overall goals and objectives, the management approach, and the nature of the monitoring program; several types of analyses might be appropriate depending on the monitoring questions. Where analysis and evaluation of management practices are the focus of monitoring, it might be feasible to use relatively simpler analyses, such as t-tests comparing indicator levels before and after implementation, levels above and below implementation sites, or pollutant levels in areas where management options were implemented and areas where they were not. Where adequate pre-implementation data are not available, trend analysis can be used to look for gradual changes in response to your implementation program. In some cases, more sophisticated statistical techniques such as analysis of covariance might be required to control for the effects of variations in weather, streamflow, or other factors.

Conduct Information/Education Activities

Although it is important to let people know about the water quality problems in the watershed, sometimes simply informing and educating people on the issues is not enough to encourage adoption of practices over time. First, audiences should be made aware of the issue. Then they should be educated on the problems facing the watershed. Finally, they should learn what actions they can take to help address those problems.

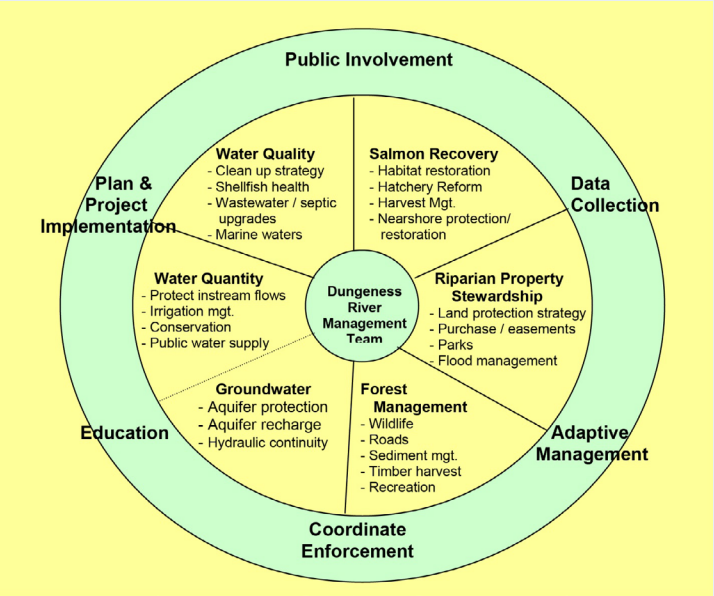
Share Results

Continuous communication is essential to building the credibility of and support for the watershed implementation process. As part of your information/education activities, you should be highlighting key activities and results to the stakeholders and the larger community. This helps to keep them engaged and to show them how their participation is making a difference.

Importance of Adaptive Management and the Dungeness River Management Team

Case Study: Protecting and Restoring the Waters of the Dungeness Watershed, Jamestown S'Klallam Tribe

Monitoring in the Dungeness watershed consists of an integrated strategy of "implementation monitoring" of progress and "effectiveness monitoring" of whether quantitative goals have been achieved. Monitoring and adaptive management are coordinated through the Dungeness River Management Team (DRMT), which has members that are governments with decision-making and implementing authorities. Regular reports and communications occur between the DRMT, governmental entities, and the public at large. The DRMT has three standing committees to oversee implementation and effectiveness monitoring and to develop adaptive strategies. They are the Executive Committee (to prepare agendas and the annual work plan) and two technical oversight committees—the Clean Water Work Group and the Dungeness River Restoration Work Group. In addition, the DRMT appoints project committees as needed. The importance of adaptive management as a key activity of the DRMT is illustrated below.



Read more about this project at http://www.jamestowntribe.org/programs/nrs/319cplan.pdf.

Step 6. Measure Progress and Make Adjustments

Step 6: Measure Progress and Make Adjustments

- **Track progress**
- **Make adjustments**

You will periodically review the implementation activities outlined in your work plan, compare the results with your interim milestones, provide feedback to stakeholders, and determine whether you want to make any corrections. The adaptive management approach is not linear but circular, to allow you to integrate results back into your program. You need to create decision points at which you will review information and then decide whether to make changes in your program or stay the course.

Track Progress

As part of your plan implementation, you will track progress in several areas, such as meeting the milestones you set for management practice implementation. You will also analyze monitoring data to determine water quality improvements. It is helpful to set time frames for the review and assessment of your watershed plan. Simple basic data analysis should be done routinely as part of the review process. Your review should also address several key areas:

- The process being used to implement your program
- Progress on your work plan
- Implementation results
- Feedback from landowners and other stakeholders.

Make Adjustments

If you have determined that you are not meeting the implementation milestones or interim targets that you set for load reductions and other goals, you need to make adjustments. Perhaps you have determined that you need additional management measures or you need to apply the management measures in another location. Be sure to ask the right questions before making any changes. In some cases you might not have met your milestones because of weather conditions, or perhaps you lacked the funding to implement some of the measures.

Adaptive Management: Pollution Reductions versus Implementation Progress

Case Study: Lower Monocacy River Watershed Restoration Action Strategy (WRAS), Frederick, Maryland

The Lower Monocacy River Watershed Restoration Action Strategy (WRAS) stressed the importance of achieving both implementation progress and monitoring results. In the instance that the pollution reductions are inadequate, based on the monitoring data, but the implementation progress is adequate, based on project tracking and modeling, adaptive management is required. Alliance members reanalyze existing watershed conditions, monitoring methods, and modeling methods to investigate possible explanations. Questions to be considered include:

- Is it possible that conditions in the watershed have changed to counteract the nutrient reductions of the installed restoration projects?
- Is it possible that the installed restoration projects are not performing as expected or have failed since the last time they were monitored?
- Is it possible that the nutrient reductions for the project, as cited in literature, could be incorrect for the area where the project was installed?
- Are other BMPs more effective at reducing nutrients and sediment than those implemented?
- If so, should those BMPs be prioritized for implementation or should their level of implementation be increased?

Read more about this project at http://www.watershed-alliance.com/mcwa_pubsWRASsupplement.html.

Sections 13.7.1 and 13.7.2 of the Handbook include questions that you should ask yourself before modifying your watershed plan.

SECTION II: WHAT'S NEW?

The watershed planning approach is increasingly being applied as an overarching framework for integrated resource planning to address emerging issues such as climate change and coastal resource development pressures. The values of ecosystem services and green infrastructure practices are becoming important drivers in targeting watershed work. EPA is continually developing new watershed management tools and initiatives for managers to help them make more effective decisions with limited resources through better access to data that can help produce more robust results. Section II highlights many of these new tools and describes how they support a watershed management framework.

This section highlights recent watershed-related initiatives and presents new tools that practitioners can access to strengthen the management of water quality across the country. These tools have been organized into the following categories:

- Data Access Tools
- Prioritizing Sites for Watershed Restoration and Protection
- Lessons Learned
- Funding Sources
- Climate Change
- Emerging Issues
- Training and Social Media Tools.

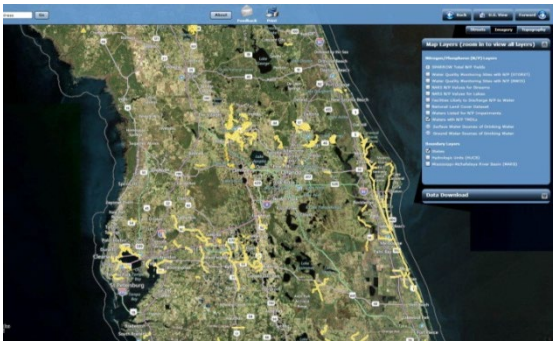
Data Access Tools

The Water Quality Portal

The Water Quality Portal (WQP, http://www.waterqualitydata.us/) is a cooperative project sponsored by the United States Geological Survey (USGS), EPA, and the National Water Quality Monitoring Council (NWQMC). It integrates publicly available water quality data from the USGS National Water Information System (NWIS) and the EPA STORET (STOrage and RETrieval) Data Warehouse. The EPA water quality data originate from the STORET Data Warehouse, which is EPA's repository of water quality monitoring data collected by water resource management groups across the country. Organizations, including states, tribes, watershed groups, other federal agencies, volunteer groups, and universities, submit data to the STORET Data Warehouse to make their data publicly accessible. For more information about STORET, see http://www.epa.gov/storet. The USGS water quality data originate from the NWIS Web Database, which contains current and historical water data from more than 1.5 million sites across the nation. It is used by state and local governments, public and private utilities, private citizens, and other federal agencies involved with managing our water resources.

Nitrogen and Phosphorus Pollution Data Access Tool

The Nitrogen and Phosphorus Pollution Data Access Tool (NPDAT, http://gispub2.epa.gov/npdat/) enables users to view and download nitrogen and phosphorus pollution data from a variety of databases. The NPDAT consists of an introductory website, geospatial viewer, data downloads, and data sets. The tool aggregates data at a single location and uses shared Web services, including the STORET and NWIS Mini-Portal services and numerous mapping services. It also leverages the common code base used by EPA's Recovery Mapper, MyWATERS Mapper, and Beaches Mapper Web mapping applications.



Nitrogen and Phosphorus Pollution Data Access Tool

The NPDAT can help support states in analyzing nitrogen and phosphorus pollution by providing, in a readily accessible and easy-to-use format, key data on the following:

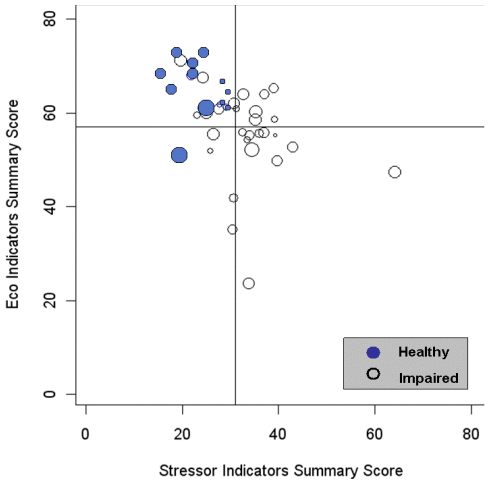
- The extent and magnitude of nitrogen and phosphorus pollution
- Water quality problems related to this pollution
- Potential pollution sources.

Prioritizing Sites for Watershed Restoration and Protection

The Recovery Potential Screening Tool

EPA has developed Recovery Potential Screening (RPS; see www.epa.gov/recoverypotential) to assist watershed managers in making strategic decisions. Based on a combination of ecological, stressor, and social context indicators, RPS provides a systematic approach for comparing how well watersheds may respond to restoration or protection. Users apply this decision support tool to prioritize the better prospects for successful restoration, reveal key factors underlying the difficulty of improving watersheds, and compare how healthy watersheds may be vulnerable to different degrees or types of threat.

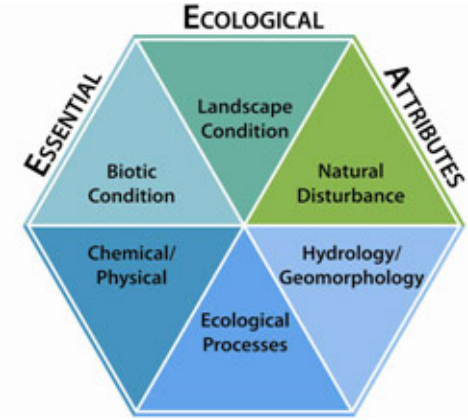
The RPS website features step-by-step instructions in recovery potential screening that link to several online tools and resources. A library of recovery potential indicators offers technical information on specific recovery-related factors (ecological, stressor, and social), how they influence restorability, and how to measure them. Use of RPS could lead to better restoration investments that restore valuable waters earlier, more consistently, more cost-effectively, and in more places.



An RPS plot displays how watersheds (dots) differ in ecological (Y axis), stressor (X axis), and social (dot size) indicator scores. Impaired watersheds in the upper left most resemble healthy watersheds and are good prospects for restoration; small blue dots are healthy watersheds that may be at risk due to low social score and higher stressor score.

Promoting Healthy Watersheds

Of growing importance is the need to protect healthy, functioning watersheds and natural areas. EPA launched the Healthy Watersheds Initiative (http://water.epa.gov/polwaste/nps/watershed/index.cfm) to encourage states, local governments, watershed organizations, and others to protect and maintain healthy waterbodies. Developing and implementing comprehensive watershed management plans in these situations will result in considerable savings over time if the need for costly restoration can be avoided in watersheds that would otherwise become impaired by the cumulative impacts of multiple stressors.

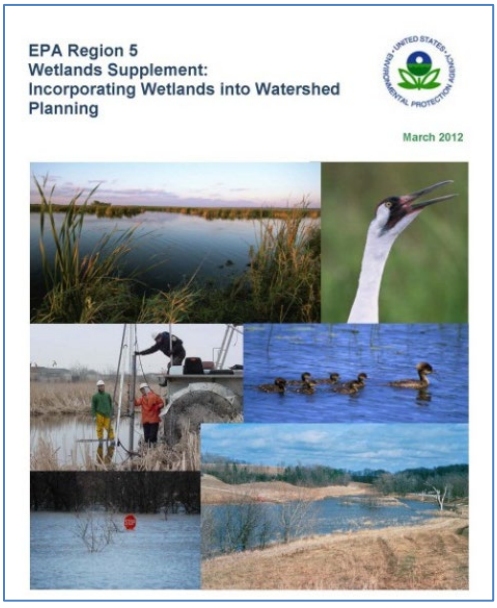


Healthy watersheds possess essential ecological attributes that contribute to a well-functioning, integrated system.

Although many of EPA's programs focus on watersheds that have been degraded, these same programs can be used to protect high-quality water through watershed planning. The Healthy Watersheds Initiative uses a holistic framework that considers essential ecological attributes and has developed tools to identify and conserve these watersheds. Many environmental organizations consider the green spaces found in healthy watersheds as *green infrastructure*, defined as "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations" (Benedict and McMahon 2001). EPA's 2013 section 319 guidelines continue the focus on restoration of impaired waters, but the guidelines also allow the use of 319 funds for watershed protection when protection is cited as a priority in the state's updated Nonpoint Source Management Program.

EPA Region 5 Wetlands Supplement

EPA Region 5 Wetlands Supplement is an addition to the Handbook. It conveys information on recently developed approaches and tools for assessing wetland functions and conditions, the results of which assist decision-makers in determining where in a watershed existing and former wetlands can best be restored or enhanced, or where wetlands can be created to optimize their functions in support of water quality and other watershed management plan goals. The supplement also discusses wetland restoration, enhancement, and creation techniques and reviews the considerations involved in deciding how best to undertake a wetland project.



The purpose of the supplement is to encourage the inclusion of proactive wetland management in watershed plans because wetlands play an integral role in the healthy functioning of the watershed. It promotes using a watershed approach that not only protects existing freshwater wetlands but also maximizes opportunities to use restored, enhanced, and created freshwater wetlands to address watershed problems like habitat loss, hydrological alteration, and water quality impairments. The primary audiences are members and staff of watershed organizations and local/state agencies.

Lessons Learned

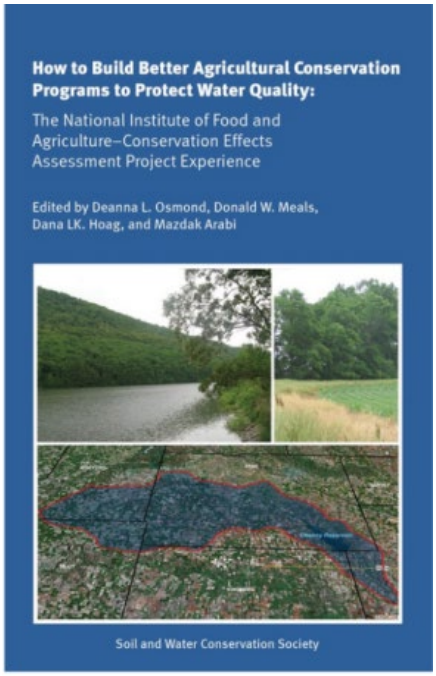
Nonpoint Source Pollution Success Stories

The Section 319 Nonpoint Source Success Stories Website (www.epa.gov/nps/success) features stories about primarily nonpoint source-impaired waterbodies where watershed-level restoration efforts have led to documented water quality improvements. Projects highlighted on the site have received Clean Water Act section 319 funding or other nonpoint source-focused funding. The waterbodies featured in the stories are separated into three categories, depending on the type of water quality improvement achieved: (1) partially or fully restored waterbodies, (2) waterbodies that show progress toward achieving water quality goals, and (3) waterbodies for which ecological restoration has been the main focus of improvement efforts. This website houses approximately 450 success stories.

The section 319 program was created to provide critical support for state and local nonpoint source efforts. Under section 319, states, territories, and tribes receive grant money that supports a wide variety of activities, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects.

Lessons Learned from Agricultural Conservation Projects

From 2004 to 2006, the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) and Natural Resources Conservation Service (NRCS) jointly funded 13 watershed projects across the nation. The overall goal of these projects, which were conducted under the name Conservation Effects Assessment Project (CEAP, www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/), was to determine the measurable effects of agricultural conservation practices on spatial patterns and trends in water quality at the watershed scale. A recent publication by the Soil and Water Conservation Society titled *How to Build Better Agricultural Conservation Programs to Protect Water Quality: The National Institute of Food and Agriculture–Conservation Effects Assessment Project Experience* synthesizes the results, lessons learned, and recommendations from the 13 CEAP projects. The publication presents overarching lessons learned and provides detailed information about each CEAP project, including watershed setting, water quality problem(s), land treatment, water quality results, modeling, socioeconomics, and outreach/education.



The lessons learned from this synthesis strengthen the knowledge base for evaluating the impacts of conservation practices on water quality, improving management of agricultural landscapes for improved water resource outcomes, and informing conservation policy. The publication is available on the Soil and Water Conservation Society's website (www.swcs.org/en/publications/building_better_agricultural_conservation_programs).

Funding Sources

Financial Assistance for Conservation Practices

Overseen by USDA NRCS, the Environmental Quality Incentives Program (EQIP, www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/) is a voluntary program that provides financial and technical assistance to agricultural producers through funding contracts up to a maximum term of 10 years in length. These contracts provide assistance to help plan and implement conservation practices that address natural resource concerns, and they offer opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and nonindustrial private forestland. In addition, EQIP helps producers meet federal, state, tribal, and local environmental regulations. In fiscal years 2012 and 2013, some EQIP funds are being focused on the National Water Quality Initiative (NWQI) to implement conservation practices in selected watersheds. Check with your state USDA-NRCS office for the latest information regarding eligibility, the application process, and schedules.

The NWQI funds projects in priority watersheds to help farmers, ranchers, and forest landowners improve water quality and aquatic habitats in impaired streams. NRCS will help producers implement conservation and management practices through a systems approach to control and trap nutrient and manure runoff. Qualified producers will receive assistance for installing conservation practices such as cover crops, filter strips, and terraces.

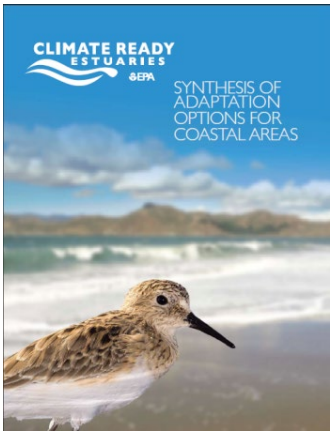
The basic structure of the NWQI is that NRCS devotes a percentage of EQIP financial assistance funds to agricultural conservation practices in watersheds identified as priorities by state water quality agencies, and state agencies help track progress in NWQI watersheds through water quality monitoring. This is an NRCS initiative, on which NRCS is collaborating with EPA.

For this initiative NRCS is currently investing about 5 percent of its EQIP funds in one to three HUC-12 (12 digit hydrological unit) watersheds per state. NRCS is also supporting field-scale monitoring, and states are monitoring selected streams and rivers. Watershed managers interested in this initiative should contact their local or state NRCS offices regarding application requirements for these funds.

Climate Change

Adapting to Climate Change

Changes in our climate are expected to increase the variability and quantities of water resources, as well as to create physical impacts from sea-level rise and more intense storms. In *Synthesis of Adaptation Options for Coastal Areas* (http://www.epa.gov/oppeoee1/cre/downloads/CRE_Synthesis_1.09.pdf) from EPA's Climate Ready Estuaries Program, EPA has recommended an integrated planning framework as a mechanism to manage many of these uncertainties, particularly in coastal and estuarine environments. Sound coastal zone management and wetland practices can help to reduce the impact of storms, maintain water quality, and preserve habitat for vulnerable species.



Evaluating Climate Risks and Adaptation Options for Water and Wastewater Utilities

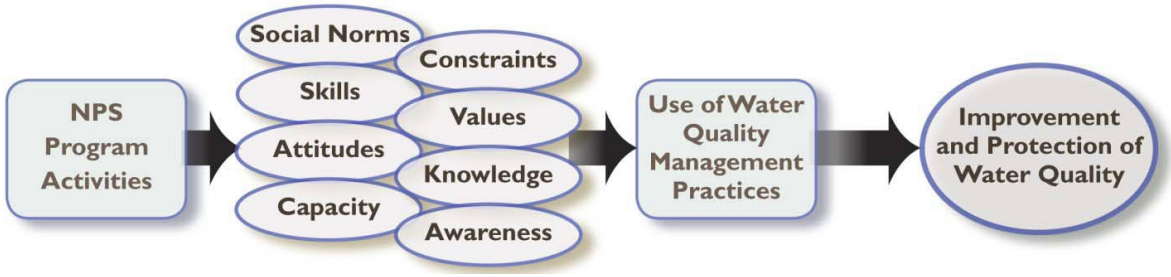
EPA has developed the *Climate Resilience Evaluation and Awareness Tool* (CREAT, www.epa.gov/climatereadyutilities), a PC-based tool to assist drinking water and wastewater utility owners and operators in understanding potential climate change threats and in assessing the related risks at their individual utilities. CREAT provides users with access to the most recent national assessment of climate change impacts, as well as local historical climate data for use in considering how those changes will affect utility operations and missions.

This tool will also allow utilities to evaluate adaptation options to address the impacts using both traditional risk assessment and scenario-based decision-making. CREAT provides references of drinking water and wastewater utility assets (e.g., water resources, treatment plants, pump stations) that could be impacted by climate change; possible climate change-related threats (e.g., flooding, drought, water quality); and adaptive measures that can be implemented to reduce the impacts of climate change. The tool guides users through identifying threats based on regional differences in climate change projections and designing adaptation plans based on the types of threats being considered. Following assessment, CREAT provides a series of risk reduction and cost reports that allow the user to evaluate various adaptation options as part of long-term planning.

Emerging Issues

Incorporating Social Indicators into Watershed Plans

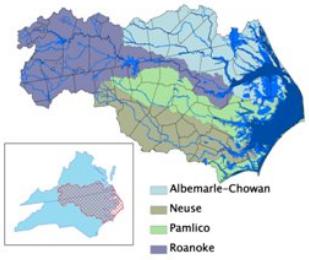
EPA Region 5, the Great Lakes Region of the National Institute of Food and Agriculture's (NIFA) National Water Quality Program, the EPA Region 5 state nonpoint source programs, and land grant universities released an updated version of the Social Indicator Planning and Evaluation System for Nonpoint Source Planning (SIPES, http://greatlakeswater.uwex.edu/sites/default/files/library/outreach-and-education/sipeshandbook-medium-res.pdf) in 2011. It provides a step-by-step approach for using social indicators to help plan, implement, and evaluate nonpoint source management projects. SIPES is intended to be used by resource managers working in state or regional nonpoint source management programs. Social indicators provide consistent measures of social change within a watershed, and managers can use them to estimate the impacts of their efforts on adopting practices and to provide a link to the eventual improvement of water quality. SIPES is designed to complement the Handbook, and it is specifically focused on evaluating water quality projects. In addition, the social information collected can help address several of the nine minimum elements.



Conceptual model of social indicators and water quality.

Assessing the Value of Ecosystems

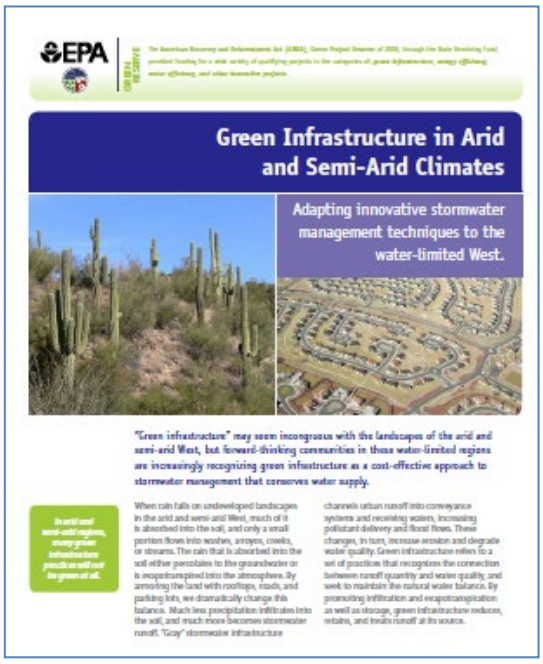
In the past several years, the ecosystem services concept has emerged as a way to evaluate the economic and environmental benefits of ecosystems, which should be factored into management decisions. The challenge is how to quantify the economic benefits of functioning ecosystems, clean water, and clean air, as well as corresponding markets. EPA's Office of Research and Development (ORD) is conducting research to provide the data, methods, models, and tools that states, communities, and tribes need to understand the cost and benefits of maintaining ecosystem services.



Albemarle-Pamlico watershed with primary river basins.

ORD's Ecosystem Services Research Program (in progress) is using a watershed approach in the Albemarle-Pamlico Watershed Study (http://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=500514) to provide the information and tools needed to understand how watershed regulation of reactive nitrogen upstream (and the associated land use decisions) influence the nature and quantity of ecosystem services that estuaries and coastal wetlands provide.

Using Green Infrastructure Practices to Achieve Sustainability



The watershed planning framework provides an excellent platform to develop and implement innovative practices to achieve multiple goals within a community. EPA uses the term *green infrastructure* to describe various practices used at a wide range of landscape scales in place of, or in addition to, more traditional stormwater control practices to support the principles of low-impact development (LID). LID is an approach to land development that works with nature to manage stormwater as close to its source as possible.

Green infrastructure approaches are being used in urban and suburban areas to provide environmental, economic, and human health benefits. In *Green Infrastructure in Arid and Semi-Arid Climates*, EPA demonstrates how increasing the amount of pervious surface area close to the source of the runoff reduces the overall volume of stormwater and related pollutants (USEPA 2010a, www.epa.gov/npdes/pubs/arid_climates_casestudy.pdf). The increased infiltration also recharges the groundwater. In addition, tree-planting programs, green roofs, and other green infrastructure have an overall cooling effect that lowers the demand for air-conditioning energy and thereby decreases emissions from power plants (USEPA 2010a). For example, through Chicago's green roof program, a green roof was installed at Chicago's city hall; it reduces stormwater runoff by 50 percent and saves the city approximately $5,500 annually on heating and cooling expenses (USEPA 2010b). LID practices also provide economic benefits such as increased property values where trees have been planted, as shown in the cities of Philadelphia, Pennsylvania, and Buffalo, New York (USEPA 2010b). Analysis tools and case studies related to green infrastructure projects are available on EPA's Green Infrastructure website (http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm).

Training and Social Media Tools

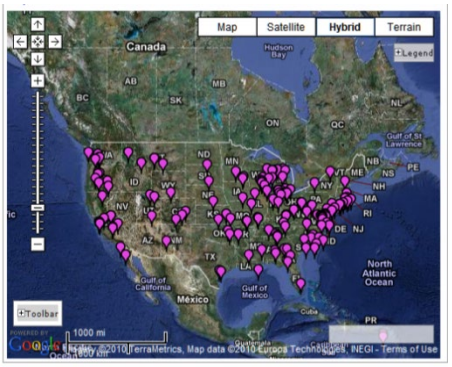
Watershed Academy Webcasts and Online Training Modules

The Watershed Academy is a focal point in EPA's Office of Water for providing training and information on implementing watershed approaches. EPA offers Watershed Academy Webcasts (see www.epa.gov/watershedwebcasts) throughout the year featuring national experts across a broad range of watershed topics. All webcasts are archived and available online at the above website after each webcast. EPA's Watershed Academy Web (www.epa.gov/watertrain) offers more than 50 self-paced training modules that provide a broad introduction to the watershed management field. The modules include "Introduction to Watershed Planning" (www.epa.gov/watertrain), which serves as a companion to the Handbook and this guide. This resource also offers a Watershed Management Training Certificate for trainees who complete 15 modules and pass the module self-tests. More than 4,000 trainees have received certificates to date.

Watershed Central

Watershed Central (www.epa.gov/watershedcentral/) is a web-based platform designed to assist users in developing and implementing effective watershed management programs. The site includes guidance, tools, case studies, and data sets to help users share information, analyze data, and identify opportunities to initiate or strengthen their watershed efforts. A key feature of Watershed Central is its wiki.

Anyone can access the Watershed Central Wiki (https://wiki.epa.gov/watershed2/) on the Internet, and anyone can view user-supplied information without registering or logging in. Users are prompted to log in only if they want to add or modify wiki content (similar to Wikipedia). Another chief benefit of this open-access tool is that the information is accessible to search engines like Google.



Users can review and share information from hundreds of watersheds across the country.

EPA developed the Watershed Central Wiki in response to comments from watershed practitioners who had expressed a need for peer-to-peer exchange on watershed management issues. The Watershed Central Wiki is a powerful tool that allows users to do the following:

- Share best practices, case studies, and lessons learned
- See what other watershed organizations are up to and learn from them
- Identify potential partners in a particular watershed area
- Evaluate and comment on watershed management tools or report on new tools
- View a map with water monitoring stations, high-resolution aerial photography, and more for a watershed
- Provide a link to a watershed management plan for others to learn from
- Create a page about an organization, add a map, and share it among other group members.

Thank you for reading this guide and taking the time to learn more about watershed planning. For more detailed information, please refer to the Handbook (http://water.epa.gov/polwaste/nps/handbook) and the "Introduction to Watershed Planning" online module (www.epa.gov/watertrain).

We wish you the best of luck as you move forward with your watershed planning effort!

APPENDIX

Regional, Tribal, and State Nonpoint Source Program Contacts

For a list of EPA regional and tribal NPS coordinators, as well as a list of state NPS coordinators, visit http://water.epa.gov/polwaste/nps/where.cfm.

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