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Handbook for Developing Watershed Plans to Restore and Protect Our Waters

Chapter 12. Design Implementation Program and Assemble Watershed Plan

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Handbook Road Map

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12. Design Implementation Program and Assemble Watershed Plan

Chapter Highlights

- Information/education component
- Schedule for implementation
- Milestones
- Criteria to measure progress
- Monitoring component
- Financial and technical resources needed
- Evaluation framework
- Assembling watershed plan

→ Read this chapter if...

- You want to integrate information and education components into your watershed plan
- You want to know how to develop the implementation component of your watershed plan
- You want to develop a schedule, milestones, criteria for measuring progress, and a monitoring plan
- You would like information on finding sources to help you implement your plan
- You want to know how to set up an evaluation framework for your watershed plan

12.1 What Do I Need to Design My Implementation Program?

Now that you've identified watershed management measures that when implemented should meet your objectives, it's time to develop the remaining elements of your implementation program. Designing the implementation program generates several of the basic elements needed for effective watershed plans:

- An information/education (I/E) component to support public participation and build management capacity related to adopted management measures
- A schedule for implementing management measures
- Interim milestones to determine whether management measures are being implemented
- Criteria by which to measure progress toward reducing pollutant loads and meeting watershed goals
- A monitoring component to evaluate the effectiveness of implementation efforts
- An estimate of the technical and financial resources and authorities needed to implement the plan
- An evaluation framework

12.2 Develop Information/Education Component

Every watershed plan should include an I/E 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 to achieve your overall watershed goals.

9 This phase of the watershed planning process should result in element *e* of the nine elements for awarding section 319 grants. Element *e* is “*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.*”

12.2.1 Integrate I/E Activities into the Overall Watershed Implementation Program

Where to Go for More Help on I/E Activities

For more information on planning and implementing outreach campaigns, refer to EPA's Getting in Step: A Guide for Conducting Watershed Outreach Campaigns. This comprehensive guide will walk you through the six critical steps of outreach—defining your goals and objectives, identifying your target audience, developing appropriate messages, selecting materials and activities, distributing the messages, and conducting evaluation at each step of the way. You can download the guide at www.epa.gov/owow/watershed/outreach/documents/getnstep.pdf or order it by calling 1-800-490-9198. Ask for publication number EPA 841-B-03-002.

The objectives of the public outreach program should directly support your watershed management goals and implementation of the watershed management plan. For example, the overall goal for your watershed plan might be to restore water quality to Brooker Creek, which has been badly degraded due to nutrient inputs from fertilizers. To help meet that goal, you might develop a public participation program that will “*make residents aware of proper fertilizer use to reduce application rates.*” The I/E

components identified should include measurable objectives and indicators for measuring progress. The objectives will also be shaped by the size of the community and the resources available to support efforts.

You can develop a separate public outreach component in your watershed plan that provides the foundation of your I/E activities, but be sure to include the specific tasks, costs of implementation, and responsible parties in the overall implementation matrix.

12.2.2 Develop an I/E Program

Although it's 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 initiate behavior change. Behavior change occurs over time. First, audiences should be made aware of the issue or problem. Then they should be educated on the problems facing the watershed. Finally, they should know what actions they can take to help address those problems.

To develop an effective I/E program, you should follow these six steps:

1. Define I/E goals and objectives.
2. Identify and analyze the target audiences.
3. Create the messages for each audience.
4. Package the messages for various audiences.
5. Distribute the messages.
6. Evaluate the I/E program.

The activities that occur in each of these steps are briefly summarized below.

Step 1: Define I/E Goals and Objectives

In developing an I/E component, you should identify I/E goals for the watershed plan implementation program.

👉 Start with the driving forces that you outlined at the beginning of the watershed planning effort in chapter 4.

🎯 This will help set the foundation for, and focus, your I/E activities.

The outreach goals and objectives will reinforce the overall watershed goals and objectives and should be specific, measurable, action-oriented, and time-focused. Keep the desired outcome in mind when developing your objectives. Do you want to create awareness, provide information, or encourage action among your target audience? It's very important to make your objectives as specific as possible and to include a time element as well as a result. This approach will make it easier to identify specific tasks and will enable you to evaluate whether you've achieved the objectives.

Don't Reinvent the Wheel

EPA has developed a "Nonpoint Source Outreach Digital Toolbox," which provides information, tools, and a catalog of more than 700 outreach materials that state and local agencies and organizations can use to launch their own nonpoint source pollution outreach campaign. The toolbox focuses on six nonpoint source categories: stormwater, household hazardous waste, septic systems, lawn care, pet care, and automotive care, with messages geared to urban and suburban residents. Outreach products include mass-media materials, such as print ads, radio and television public service announcements, and a variety of materials for billboards, signage, kiosks, posters, movie theater slides, brochures, factsheets, and everyday object giveaways that help to raise awareness and promote non-polluting behaviors. Permission-to-use information is included for outreach products, which makes it easy to tailor them to local priorities. Evaluations of several outreach campaigns also offer real-world examples of what works best in terms of messages, communication styles, formats, and delivery methods.

👉 The toolbox is available online and as a CD at www.epa.gov/nps/toolbox/.

Objectives Will Change

As you progress through implementation, your outreach objectives and activities will evolve. For example, during the early stages it might be necessary to generate basic awareness of watershed issues, but as problems are identified during watershed characterization your objectives will focus on educating your target audiences on the causes of the problems. Next, your objectives will focus on actions your target audience can take to reduce or prevent adverse water quality impacts. Finally, your objectives will focus on reporting progress.

Step 2: Identify and Analyze the Target Audience

Next, you should identify the audiences you need to reach to meet your objectives. The target audience is the group of people you want to reach with your message. You should break down your target audience into smaller segments using demographics, location, occupation, watershed role, and other factors. If your target audience is too broad, chances are you won't be able to develop a message that engages and resonates with the entire audience. Be creative in defining and developing perspectives on your target audiences and in finding out what makes them tick.

Step 3: Create the Message

After gathering information on members of the target audience, you're ready to craft a message that will engage them and help achieve your watershed planning objectives. To be effective, the message must be understood by the target audience and appeal to people on their own terms. The message should articulate what actions the audience should take. These actions might include letting vegetation grow taller along a stream, pumping septic tanks, or conducting soil tests before fertilizing lawns. The actions should tie directly back to the goals of the watershed plan because one of the goals of your I/E program will be to help implement the watershed plan. In addition, your message should be clear, specific, and tied directly to something the target audience values, such as

- Money savings
- Time savings
- Convenience
- Health improvements
- Efficiency
- Enhancing public values
- Improving ecosystem function
- Enhancing quality of life and environmental amenities
- Economic development benefits

Step 4: Package the Message

Now it's time to determine the best package or format for the message for eventual delivery to the target audience. The information you collected in Step 2 while researching the audi-

ence will help to determine the most appropriate format.

When selecting your message format, think about where the target audience gets its information. A farming community might respond more positively to door-to-door visits or articles in farm publications than to an Internet and e-mail campaign.

Work with the Media

If your message needs to be understood and embraced by the public, it should be covered by the mass media. The media can be a very cost-effective and efficient way to get your message delivered. Formats using the mass media can be broken down into two major categories—news coverage and advertising. News coverage includes interviews, news stories, letters

Lake Champlain Wins Award for TV Spots

In the Lake Champlain Basin, a cooperative venture between the Lake Champlain Basin Program and a local TV station produced weekly spots on the evening news between May 1999 and September 2004 that provided an in-depth look at many of the important environmental issues surrounding the lake, its basin, and restoration efforts. Periodic half-hour special reports showed compilations of these spots and provided videos as a resource for teachers and communities. The series won many awards, including awards from EPA and the North American Lake Management Society.

 www.lcbp.org/

to the editor, and event coverage. Advertising includes the development of public service announcements (PSAs). Publicity generated from news coverage is dependent on the news organization, whereas you create radio, TV, and newspaper advertising yourself. In many cases the advertising you do can be leveraged later into news coverage. For example, one state bought informational ads on agriculture-related water quality issues from a radio station and received as a benefit some free news coverage of the issues during the year.

Develop Effective Print Materials

By far the most popular format for outreach campaigns is print. Printed materials include fact sheets, brochures, flyers, booklets, posters, bus placards, billboards, and doorknob hangers. These materials can be created easily, and the target audience can refer to them again and again. The Texas Commission on Environmental Quality (TCEQ) launched a nonpoint source outreach campaign in 2001 that targeted watersheds with water quality problems where the causes were known. In watersheds where pet waste was identified as contributing to these problems, TCEQ developed a full-color billboard display of a dog with the message, “Please pick up my poop.” The billboards served as prompts to encourage behavior change. 🐾 For more information, visit www.tceq.state.tx.us/assistance/education/nps.html.

Hold Events

Also consider using activities to spread your message. A watershed event can be one of the most energizing formats for distributing messages targeted at awareness, education, or direct action. A community event plays into the desire of audience members to belong to a group and have shared goals and visions for the community. In urban areas, where knowing your neighbors and other members of your community is the exception rather than the rule, community events can help to strengthen the fabric of the community by creating and enhancing community relationships, building trust, and improving the relationships between government agencies and the public. And if such events are done well, they’re just plain fun.

Leverage Resources

If resources are limited and the message is fairly focused, try to piggyback onto an existing event that involves the target audience. Trade shows and other events for farmers, developers, boaters, fishers, the automobile industry, and other groups can often be accessed with a little research and a few phone calls. As in all outreach, you can’t deliver a message to the target audience if you don’t have access to it. Approaches for generating interest and attention are limited only by your creativity. Watershed groups have used bands, balloons, face-painting, mascots, interactive displays, video games, giveaways, clowns, jugglers, and celebrities to draw crowds. You can also increase the exposure of your event by inviting local TV and radio stations to cover it.

Step 5: Distribute the Message

Once the message has been packaged in the desired format, you can proceed with distribution. Fortunately, you’ve already considered distribution mechanisms somewhat while researching the target audience and selecting a format. Common means of distribution are by direct mail, door-to-door, by phone, through targeted businesses, during presentations,

Neighbors Help Spread the Word on Water Stewardship

The Livable Neighborhood Water Stewardship Program in Falls Church, Virginia, fulfilled community members’ desire to take part in watershed protection activities at the neighborhood level. Volunteer leaders recruited their neighbors to form household EcoTeams to help each other become better water stewards. The teams adopted behaviors such as creating a rain garden and reducing the use of household chemicals. The team aspect provided the motivation to carry out the actions while establishing relationships that helped create a more livable neighborhood. Studies show that such community activities are successful in sustaining significant behavior change. 🐾 Go to www.empowermentinstitute.net/files/WSP.html for more information on this program.

as hand-outs at events, through media outlets, and by posting your message in public places. Consider which distribution method(s) is best for your community. Local governments, for example, might choose to add inserts to utility bills, whereas local community groups might prefer door-to-door visits. One of the ways the City of Fresno, California, distributed its stormwater pollution prevention message was through placemats at area fast food restaurants. Be creative in your distribution mechanisms.

In addition to *how* you're going to deliver the message, you should decide *who* will deliver the message. Analyzing the target audience can help you to identify the most trusted members of the community. An organization trusted by the public can use a staff representative of its own. If the organization is a government agency, having a member of the target audience deliver the message might be more effective.

Example I/E Indicators

Programmatic

- Number of newspaper stories printed
- Number of people educated/trained
- Number of public meetings held
- Number of volunteers attending activities
- Number of storm drains stenciled

Social

- Number of calls to hotline
- Number of people surveyed with increased knowledge of watershed issues
- Number of people surveyed with changes in behavior
- Participation at watershed events
- Number of trained volunteer monitors

Environmental

- Number of gallons of used paint collected
- Number of people who purchased rain barrels
- Pounds of trash collected on stream cleanup days
- Number of pet waste bags taken at kiosks
- Pounds of yard waste collected

In Grapevine, Texas, the “Conservation Cowboy” conducts numerous visits throughout the year within the community to promote environmental responsibility and nonpoint source pollution prevention. The Conservation Cowboy has been a huge hit with children and has become an effective environmental education messenger.

Remember to use your watershed stakeholder group to help distribute the message. The group already has a vested interest in the success of the watershed plan and will help you distribute educational materials to the watershed community—perhaps through in-kind support like helping to erect watershed road signs, or through financial or technical support to cover printing costs or conduct presentations at community meetings. Members of your stakeholder group will be trusted, respected members of the watershed community and will make it easy to spread the word.

Step 6: Evaluate the I/E Program

Evaluation provides a feedback mechanism for ongoing improvement of your outreach effort. Many people don't think about how they'll evaluate the success of their I/E program until after the program has been implemented. Building an evaluation component into the plan from the beginning, however, will ensure that at least some accurate feedback on outreach program impact is generated. Ideally, feedback generated during the early stages of the project will be used immediately in making preliminary determinations

about program effectiveness. Adapting elements of the I/E effort continually as new information is received ensures that ineffective components are adjusted or scrapped while components that are working are supported and enhanced. 🐾 Go back to chapter 4 (section 4.6) to review the suite of potential indicators you can use to measure the effectiveness of your I/E program. 🐾 Appendix A provides additional information on developing outreach programs.

12.3 Establish an Implementation Schedule

9 This phase of the watershed planning process should result in element *f* of the nine elements for awarding section 319 grants. Element *f* is a “*Schedule for implementing the nonpoint source management measures identified in the plan that is reasonably expeditious.*”

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. You will prepare more detailed schedules as part of your annual work plans (see section 13.4).



In developing schedules, it helps to obtain the input of those who have had previous experience in applying the recommended actions. Locate experienced resource agency staff and previous management practice project managers where possible to identify the key steps. Be sure to note sequence or timing issues that need to be coordinated to keep tasks on track.

12.4 Develop Interim Measurable Milestones

One means of supporting detailed scheduling and task tracking is to identify interim, measurable milestones for determining whether management practices or other control actions are being implemented. What do you want to accomplish by when? It usually helps to think of milestones in terms of relevant time scales. For example,

- Short-term (1 to 2 years)
- Mid-term (2 to 5 years)
- Long-term (5 to 10 years or longer)

9 This phase of the watershed planning process should result in element *g* of the nine elements for awarding section 319 grants. Element *g* is “*A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.*”

It’s also helpful to think of the milestones as subtasks, or what needs to be accomplished over time to fully implement the practice or management measure. When determining time scales and subtasks for actions, place the milestones in the context of the implementation strategy. Given the selected practices and the available funds or time frame for obtaining grants, estimate what can be accomplished by when. First, outline the subtasks involved and the level of effort associated with each to establish a baseline for time estimates. Next, identify the responsible parties associated with the steps so that you can collectively discuss milestones and identify those which are feasible and supported by the people that will do the work.

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.

It's important to consider economic, social, and environmental factors. When selecting a milestone, make sure that it is specific, measurable, achievable, relevant to a nonpoint source management measure, and time-sensitive.

You should also consider staff availability and funding resources and how the milestones will be evaluated. For example, will progress toward a milestone be determined through monitoring, spot-checking, participation, adoption of management practices, or some other methods? Answering this question will enable you to allocate and plan for resources and easily determine whether a milestone has been met. It would be difficult to set a milestone at "installing 30 miles of buffer strips within 2 years" if no staff were available to measure the miles of buffer strips installed. Resources should be targeted toward the highest-priority milestones.

Finally, your plan should also provide a description of what will be done if the milestones are not being achieved or how your program will take advantage of milestones being achieved in a significantly shorter time frame than expected.

12.5 Establish a Set of Criteria to Measure Progress toward Meeting Water Quality Standards and Other Goals

As part of your implementation program, you should set some criteria by which to determine whether you are achieving load reductions over time and making progress toward meeting your overall watershed goals. These criteria can also support an adaptive management approach by providing mechanisms by which to reevaluate implementation plans if you're not making substantial progress toward meeting your watershed goals.

9 This phase of the watershed planning process should result in element *h* of the nine elements for awarding section 319 grants. Element *h* is "*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.*"

These criteria can be expressed as indicators and associated interim target values. You can use various indicators to help measure progress (↪ chapter 4). You'll want to select indicators that will provide quantitative measurements of progress toward meeting the goals and can be easily communicated to various audiences. It's important to remember that these indicators and associated interim targets will serve as a trigger, in that if the criteria indicate that you are not making substantial progress, you should consider changing your implementation approach.

The indicators might reflect a water quality condition that can be measured (dissolved oxygen, nitrogen, total suspended solids) or an action-related achievement that can be measured (pounds of trash removed, number of volunteers at the stream cleanup, length of stream corridor revegetated). In other words, the criteria are interim targets in the watershed plan, such as completing certain subtasks that would result in overall pollutant reduction targets. Be careful to distinguish between programmatic indicators that are related to the implementation of your work plan, such as workshops held or brochures mailed, and environmental indicators used to measure progress toward water quality goals, such as phosphorus concentrations or sediment loadings.

The indicators and interim target values you select should reflect the performance of the management measures being implemented, the concerns identified early in the process by

stakeholders, and the refined goals that were outlined (chapter 9). Because of the confounding, dynamic conditions that occur in a watershed, you should be careful how you interpret these indicators once implementation begins. For example, if you've selected turbidity as an indicator for measuring sediment load reductions and the turbidity value actually increases after installation of management practices, does this mean you're not making improvements in the watershed? You should determine whether additional activities, such as new development activities, are contributing additional loads that you didn't consider. You also should realize that the land disturbance that installing management practice sometimes generates initially could create a short-term increase in sediment loadings. In addition, you might actually see a decrease in sediment loads while turbidity remains the same or increases due to increased biological production. Therefore, you also want to include long-term progress measurements such as reduced frequency of dredging as an indication of reduced sediment loads, or improved aquatic habitat as a result of reduced sediment loads. Table 12-1 demonstrates how you can use a suite of indicators to measure progress in reducing pollutant loads depending on the issues of concern.

Table 12-1. Example Indicators to Measure Progress in Reducing Pollutant

Issue	Suite of Indicators
Eutrophication	<ul style="list-style-type: none"> • Phosphorus load • Number of nuisance algae blooms • Transparency of waterbody or Secchi depth • Frequency of taste and odor problems in water supply • Hypolimnetic dissolved oxygen in a lake or reservoir • Soil test phosphorus in agricultural fields
Pathogens (related to recreational use)	<ul style="list-style-type: none"> • Bacteria counts • Compliance with water quality standards (single sample or geometric mean) • Number and duration of beach closings • Number of shellfish bed reopenings • Incidence of illness reported during recreation season
Sediment	<ul style="list-style-type: none"> • Total suspended solids concentration and load • Raw water quality at drinking water intake • Frequency and degree of dredging of agricultural ditches, impoundments, and water supply intake structures

There are various factors to consider before setting criteria, such as the implementation schedule of the management measures, the nature of the pollutants, and the time frame for applying the criteria.

12.5.1 Schedule for Implementation of Management Measures

Before developing any criteria to measure progress in reducing loads, you should review the schedule you've developed for implementing the proposed management measures. Obviously, you won't see any load reductions until the measures are installed. Check to see if the management measures are to be installed evenly over the duration of the plan or whether most practices are to be installed in the first few years of implementation. Often, long and uncertain lag times occur between implementation and response at the watershed level.

12.5.2 Nature of Pollutants to Be Controlled

The speed with which loads can be reduced also depends on the nature of the pollutants. Pathogens in animal waste, for example, tend to die off quickly in the environment, so response to a decrease in pathogen delivery to a waterbody might be noticed quickly. If direct deposition of waste in a stream by grazing livestock is the problem, fencing the animals away from the stream might cause nearly immediate reductions in pathogen levels in the water. Implementation of erosion controls, however, might show results more slowly as sediments already in the drainage network move through the system even as soil loss from cropland or construction sites is controlled. If runoff of soluble phosphorus due to excessive soil phosphorus levels is the problem, it might take years or even decades to demonstrate a measurable change in response to nutrient management as accumulated phosphorus is slowly depleted by crop harvests.

12.6 Develop a Monitoring Component

As part of developing your watershed plan, you should develop a monitoring component to track and evaluate the effectiveness of your implementation efforts using the criteria developed in the previous section.

9 This phase of the watershed planning process should result in element *i* of the nine elements for awarding section 319 grants. Element *i* is “*A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.*”

Monitoring programs can be designed to track progress in meeting load reduction goals and attaining water quality standards, but there are significant challenges to overcome. Clear communication between program and monitoring managers is important to specify monitoring objectives that, if achieved, will provide the data necessary to satisfy all relevant management objectives. The selection of monitoring designs, sites, parameters, and sampling frequencies should be driven by the agreed-upon monitoring objectives, although some compromises are usually necessary because of factors like site accessibility, sample preservation concerns, staffing, logistics, and costs. If compromises are made because of constraints, it’s important to determine whether the monitoring objectives will still be met with the modified plan. There is always some uncertainty in monitoring efforts, but to knowingly implement a monitoring plan that is fairly certain to fail is a complete waste of time, effort, and resources. Because statistical analysis is usually critical to the interpretation of monitoring results, it’s usually wise to consult a statistician during the design of a monitoring program.

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. All too frequently watershed managers rely on modeling projections or other indirect measures of success (e.g., implementation of management measures) to document achievement, and in some cases this approach can result in a backlash later when monitoring data show that actual progress does not match the projections based on surrogate information.

There is no doubt that good monitoring can be complex and expensive. Monitoring can be done at numerous levels; the most important criterion is that the monitoring component should be designed in concert with your objectives. If documenting the performance of

particular management practices under seasonal conditions is important, a detailed and intensive water quality monitoring regime might be included. If your objective is to restore swimming at a beach previously closed, you might monitor progress by keeping track of the number of days the beach is open or the number of swimmers visiting the beach. If restoration of life in a stream is the objective, annual sampling of benthic invertebrates and fish might be included, or a count of anglers and a creel census could be useful. If another agency is already conducting monitoring (e.g., making annual measurements of phosphorus load or regulating shellfish beds based on bacteria counts), you might be able to use such ongoing monitoring to track your project's progress. In North Carolina, the Long Creek Watershed Project used the frequency of dredging at a water supply intake as a measure of the progress in controlling erosion in the watershed (Lombardo et al. 2004). Regardless of the specific objective, keep in mind that documental measures of progress toward your water quality goals are important.

Because of natural variability, one of the challenges in water quality monitoring is to be able to demonstrate a link between the implementation of management measures and water quality improvements. To facilitate being able to make this connection, the following elements should be considered when developing a monitoring program.

12.6.1 Directly Relate Monitoring Efforts to the Management Objectives

The data you collect should be directly related to the management objectives outlined in your watershed plan. Often data are collected for historical purposes, but the information is not used to help determine whether watershed plan objectives are being met. The monitoring component, which will be used to assess the effectiveness of implementation strategies, can also be used to address other important information needs in the watershed with minimal changes or additional resources. Consider a range of objectives like the following when developing your monitoring program:

- Analyze long-term trends.
- Document changes in management and pollutant source activities in the watershed.
- Measure performance of specific management practices or implementation sites.
- Calibrate or validate models.
- Fill data gaps in watershed characterization.
- Track compliance and enforcement in point sources.
- Provide data for educating and informing stakeholders.

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

- What questions are we trying to answer?
- What assessment techniques will be used?
- What statistical power and precision are needed?
- Can we control 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?



The answers to these questions will help to determine the data quality objectives (DQOs) (section 6.4.2), that are critical to ensuring that the right data are collected. These DQOs also take into consideration practical constraints like budget, time, personnel, and reporting requirements and capabilities. Parameters measured, sampling locations, sampling and analysis methods, and sample frequency are determined accordingly. It's helpful to know the degree of measurement variability you might encounter for a given parameter method and watershed. If variability in a parameter concentration or value is relatively high because of natural or methodological causes, it will be difficult to identify actual improvements over time. You might need to collect more samples, consider different methods, make more careful site selections, select different parameters or indicators, or use a combination of approaches.

12.6.2 Incorporate Previous Sampling Designs

If you already developed a sampling plan as part of additional data collection efforts (↪ chapter 6), start with that plan to develop the implementation monitoring component. The plan, which was focused on immediate data needs, should have followed the key steps in the monitoring process (study design, field sampling, laboratory analysis, and data management). Most important, that additional data collection plan should have been developed with an eye toward supporting your long-term monitoring program. The data collected in that effort, along with other historical data, can be analyzed to evaluate the locations of hot-spots, the sampling frequencies necessary to adequately capture variability, and other parameters of a monitoring program. The sampling and analysis done during that phase can provide an evaluation of baseline conditions; continued monitoring under a similar program during and after implementation can be used to track trends in response to plan implementation.

Many of the specific elements developed as part of that effort, including DQOs, measurement quality objectives (MQOs), and a quality assurance project plan (QAPP), can be modified or expanded for this final monitoring component. ↪ Go back to section 6.4 to review the information and resources on the selection of sample design, field and lab protocols, and standard operating procedures.

12.6.3 Monitor Land Use Changes in Conjunction with Water Quality Monitoring

The monitoring component of your watershed plan should include not only water quality monitoring but also monitoring on the land, including the land treatments being implemented and the land use activities that contribute to nonpoint source loads. Land treatment tracking is important to determine whether the plan is being implemented appropriately and in a timely manner. At a minimum, you should track where and when practices were installed and became operational. But you should look beyond dollars spent or points on a map and consider how the measures are working. Structural practices like waste storage lagoons or sediment basins might be easy to see and count, but their associated management activities are more difficult to monitor. How have nitrogen and phosphorus applications changed under nutrient management? Are riparian buffers filtering sheet flow or is runoff channelized through the buffer area? Are contractors following erosion and sediment control plans?

Sometimes such questions can be answered only by asking the landowners. Some agricultural watershed projects have had success in asking farmers to keep records of tillage, manure and fertilizer application, harvest, and other management activities. Several Vermont projects, for example, used log books and regular interviews by local crop management consultants to gather such information (Meals 1990, 1992, 2001). In urban settings, public works

staff can be valuable sources of information. Aerial photography and windshield or foot surveys are also useful (section 6.5.1). Remember to monitor not just where implementation is occurring but in all areas in the watershed that might contribute to nonpoint source loads.

A good land treatment/land use monitoring program will help you to

- Know when and where measures are implemented and operational
- Determine whether measures are working as planned and how much they have accomplished
- Get a handle on contributions of non-implementation areas to watershed nonpoint loads
- Prevent surprises

Surprises can derail the best watershed plan. An accidental release from a waste storage facility, a truck spill, land use changes, technology adoption, or the isolated actions of a single bad actor can have serious water quality consequences and, if the source is not documented, can cause you to question the effectiveness of your plan.

The result of a good land use/land treatment monitoring program is a database of independent variables that will help you explain changes in water quality down the road. The ability to attribute water quality changes to your implementation program or to other factors will be critical as you evaluate the effectiveness of the implementation effort and make midcourse plan corrections.

12.6.4 Use an Appropriate Experimental Design

You can choose from many different monitoring designs, such as paired watersheds, upstream-downstream monitored before, during, and after land treatment, and multiple-watershed monitoring (Clausen and Spooner 1993; Grabow et al. 1999a, 1999b). Your decision should be based on the pollutants of concern, the length of the monitoring program, the size of the study area, and the objectives of the monitoring program.

Loads can be measured at many levels of resolution; tributaries and watersheds commonly serve as the geographic unit for load estimation. Loads can also be measured for specific subwatersheds or sources, providing watershed managers with opportunities to track priority areas and determine whether funding is being directed efficiently to solve the water quality problems. The time frame for estimating loads should be selected to fit the watershed plan and the watershed of interest. For example, seasonal loads might be most relevant for nonpoint sources, whereas annual loads might be more appropriate in watersheds with fairly consistent wastewater treatment plant discharges. Because nonpoint source loads are subject to considerable variability due primarily to weather but also to source management, it is highly advantageous to use controlled studies (e.g., paired watersheds, upstream-downstream pairs before and after implementation) and covariates (e.g., flow) to aid in interpreting load patterns. ↪ See appendix A for resources on developing an effective monitoring program.

A **covariate** is a measurement of those variables that are not controllable by the researcher.

12.6.5 Conduct Monitoring for Several Years Before and After Implementation

To increase your chances of documenting water quality changes, you should conduct multiple years of monitoring both before and after implementing management measures. Year-to-year variability is often so large that at least 2 to 3 years each of pre- and post-management

practice implementation monitoring might be necessary to document a significant water quality change following management practice implementation. Also, longer-duration monitoring might be necessary where water quality changes are likely to occur gradually. Sampling frequency and collection should be consistent across years.

12.6.6 Build In an Evaluation Process

When developing your monitoring program implementation strategy, plan for evaluation and reporting processes that will record change and provide the basis for appropriate modifications to the watershed plan. Link assessments and reporting formats back to the objectives by comparing monitoring results for the indicators to the criteria for judging progress toward milestones. ↪ For more information on developing monitoring programs, see results and recommendations of National NPS Monitoring Program projects at www.bae.ncsu.edu/programs/extension/wqg/319index.htm.

Often, monitoring programs should be modified as they are implemented. Flexibility is important in the implementation strategy so that staff can make minor refinements “on the fly.” Significant adaptations also might need to be considered periodically by sponsors and decisionmakers (e.g., following review of an annual progress report). This applies to revisions to the QAPP as well.

12.7 Estimate Financial and Technical Assistance Needed and the Sources/Authorities that Will Be Relied on for Implementation

9 This phase of the monitoring process should result in element *d* of the nine elements for awarding section 319 grants. Element *d* is “*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.*”

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, I/E 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 (O&M). For example, if you have identified adoption of local ordinances as a management tool to meet your water quality goals, you should involve the local authorities that are responsible for developing these ordinances.

The estimate of financial and technical assistance should take into account the following:

- Administration and management services, including salaries, regulatory fees, and supplies, as well as in-kind services efforts, such as the work of volunteers and the donation of facility use
- I/E efforts
- The installation, operation, and maintenance of management measures
- Monitoring, data analysis, and data management activities

Don't Forget the O&M Costs

Improper maintenance is one of the most common reasons for failure of water quality controls to function as designed. It's important to consider who will be responsible for maintaining permanent management practices, what equipment is required to perform the maintenance properly, and the long-term cost involved in maintaining structural controls.

12.7.1 Identify Funding Sources

You can access hundreds of funding sources to help fund the implementation of your watershed plan. These sources include federal, state, local, and private sources. Try to access several different funding sources so you don't put all of your eggs into one basket.

The greatest challenge is identifying funding opportunities in an efficient manner. Several online tools can help narrow the places you need to look. ↪ For example, EPA has developed *Guidebook of Financial Tools: Paying for Sustainable Environmental Systems*, which is available for download at www.epa.gov/efinpage/guidbkpdf.htm. The guide was designed to enable watershed practitioners in the public and private sectors to find appropriate methods to pay for environmental protection efforts. It was developed by EPA's Environmental Financial Advisory Board and the Agency's network of university-based Environmental Finance Centers. ↪ More information on funding sources for watershed programs is posted at EPA's Sustainable Finance Web site at www.epa.gov/owow/funding.html.

Locating Federal Funding

↪ For a complete list of federal funding, visit the *Catalog of Federal Domestic Assistance* (www.cfda.gov). This Web site provides access to a database of all federal programs available.

↪ Also visit www.epa.gov/watershedfunding to view the *Catalog of Federal Funding Sources for Watershed Protection*. This interactive Web site helps match watershed project needs with funding sources.

12.7.2 Leverage Existing Resources

Some of the costs of implementing your watershed plan can be defrayed by leveraging existing efforts and seeking in-kind services. Some examples follow.

Use existing data sources. Most geographic areas have some associated background spatial data in the public domain, such as digital elevation models, stream coverages, water quality monitoring data, and land cover data in the form of imagery like orthophoto quads or raster satellite image files. Note that the EPA Quality System (↪ www.epa.gov/quality) (EPAQA/G-5) recommends that a QAPP be prepared for the use of existing data, as well as for the collection of new data.

Use existing studies. Many agencies have reports of previous analyses, providing useful baseline information and data, such as delineated subwatersheds or a historical stream monitoring record. The analyses might have been done for another purpose, such as a study on fish health in a particular stream, but they can contribute to understanding the background of the current concerns.

Use partnerships. State, county, or federal agencies working as technical assistance providers and implementing natural resource program initiatives can offer computer services and expertise, such as performing GIS analysis or weaving together elements of different programs that might apply to the local area. They might be in a position to write part of the overall watershed plan if they have existing generalized watershed characterization studies.

Cover incidental/miscellaneous costs through contributions. For example, staff time to assemble needed elements, supplies, and meeting rooms for a stakeholder or scoping meeting can all be donated. As a start, ↪ refer back to the checklist you compiled from your stakeholder group in section 3.3.4 to determine what resources are available within the group.

Locating Private Funding

↪ Visit www.rivernetwork.org for the *Directory of Funding Sources for Grassroots River and Watershed Conservation Groups*. It lists private and corporate sources, as well as federal sources. Note: This resource is for River Network members only.

12.7.3 Estimating Costs

Many factors affect the cost of implementing management measures as part of a watershed plan, including the following:

- Type of management practice/restoration activity
- Installation costs
- Operation and maintenance costs
- Method of cost calculation
- Annual tasks and milestones that you establish (see the next sections)

Plan2Fund

Plan2Fund was developed by the Environmental Finance Center (EFC) at Boise State University to help organizations determine the amount of outside funding necessary to achieve the goals and objectives of their watershed management plan. The Plan2Fund tool leads organizations through the process of estimating implementation costs for their goals and objectives, evaluating local funding options, and finally identifying gaps in funding. With the output from Plan2Fund, users can then search EFC's Directory of Watershed Resources database for federal, state, and private funding sources based on identified funding needs. http://sspa.boisestate.edu/efc/Tools_Services/Plan2Fund/plan2fund.htm

↪ Go back to section 11.5, where you researched cost considerations related to the proposed management measures. Some management measures might be more diffusely implemented across the watershed, and therefore the costs might be difficult to quantify. For example, developers across the watershed are encouraged to use fencing to prevent sediment runoff on their construction sites, and homeowners are encouraged through educational outreach to keep their neighborhood storm drains free of debris. These actions are voluntary, and therefore no specific operational costs are associated with them. However, costs would be associated with the I/E activities.

In refining the implementation plan to establish your overall financial and technical assistance needs, you should develop a more detailed estimate of the annualized cost of your actions. Table 12-2 provides annualized cost estimates for selected management practices from Chesapeake Bay installations.

Monitoring Program Costs

The cost of your monitoring program will depend on many factors, including the program design, the number and locations of sampling stations, the types and number of samples collected, the variables measured, staff and equipment required, local conditions, and others. Because these factors vary so much from watershed to watershed, it is impossible to establish general unit costs for monitoring activities. In building a monitoring budget for your program (or in putting together a grant application to support monitoring), you should consider costs in several common categories, which are described below.

Staffing

Consider how much staff time you'll need to carry out the activities necessary to conduct monitoring, including

1. Researching and selecting sampling sites
2. Installing and maintaining structures or instruments
3. Collecting samples and other field data
4. Delivering samples to the laboratory
5. Maintaining field data and other records

Table 12-2. Annualized Cost Estimates for Selected Management Practices from Chesapeake Bay^a

Practice	Practice Life Span (Years)	Median Annual Cost ^b (EAC ^c) (\$/ac/yr) (1990 dollars)	Median Annual Cost (EAC ^c) (\$/ac/yr) (2002 dollars)
Terraces	10	84.53	116.35
Diversions	10	52.09	71.70
Sediment retention water control structures	10	89.22	122.81
Grassed filter strips	5	7.31	10.06
Cover crops	1	10.00	13.76
Permanent vegetative cover on critical areas	5	70.70	97.31
Reforestation of crop and pasture ^d	10	46.66	64.22
Grassed waterways ^e	10	1.00/lin ft/yr	1.38
Animal waste system ^f	10	3.76/ton/yr	5.18

^a Median costs (1990 dollars) obtained from the Chesapeake Bay Program Office management practice tracking database and Chesapeake Bay Agreement Jurisdictions' unit data cost. Costs per acre are for acres benefited by the practice.

^b Annualized management practice total cost, including operation and maintenance, planning, and technical assistance costs.

^c EAC = equivalent annual cost: annualized total costs for the life span. Interest rate = 10%.

^d Government incentive costs.

^e Annualized unit cost per linear foot of constructed waterway.

^f Units for animal waste are given as dollars per ton of manure treated.

Source: Camancho 1991.

Note that the relationship between the number of stations or samples and the staff requirement is not always linear; operating 20 stations might cost only 25 percent more in staff time than operating 10 stations. This is especially true if you are hiring full-time staff dedicated to a single project. Consider sharing staff with other activities if possible. Monitoring programs associated with a college or university can take advantage of graduate student efforts to provide some staff support.

Equipment

Sophisticated monitoring instrumentation like autosamplers, electronic flow recorders, and dataloggers can automate much of the monitoring program and offset some staffing resources. This might be a desirable approach in long-term, relatively intensive monitoring programs. However, such equipment is often expensive, has a steep learning curve, and sometimes has a greater risk of failure than manual sampling and measurement. The balance between high-tech, high-initial-expense equipment and more manual, labor-intensive approaches will depend on your available budget and monitoring design. Remember to consider power, shelter, and security requirements for expensive electronic equipment in your budget. If you decide to use electronic equipment, consider renting or purchasing used equipment rather than purchasing new equipment outright, especially for short-term projects.

Combine Forces to Share Costs

Twelve state and local Vermont entities facing Stormwater Phase II requirements formed the Chittenden County Regional Stormwater Education Program (RSEP). The RSEP focused on increasing awareness and changing behaviors through social marketing by hiring a local marketing firm to craft a communications and marketing strategy based on the results of a public stormwater awareness survey. Each entity provided \$5,000 toward the development and implementation of the strategy. This approach was cost-effective for each entity and allowed for the development of a consistent message across the state. The RSEP paid \$20,500 in message distribution through the media (newspaper, cable TV, and radio broadcasts) in the first year.

For more information, visit the RSEP Web site, www.smartwaterways.org.

Supplies

In estimating your monitoring costs, remember to account for sampling supplies like bottles, batteries, chemicals, labels, ice, shipping, and so forth, as well as supplies needed to tabulate and report data collected.

Logistics

Operating and maintaining a sampling network requires logistical support. The cost of travel between the project base and remote sampling locations must be considered. Be sure to include routine maintenance and field checks in mileage estimates, in addition to actual sampling runs. You might also need to factor in some additional costs to deal with difficult weather conditions like harsh winters or major storms.

Consider the sample handling and holding requirements for the variables you're monitoring. The cost of collecting, preserving, and transporting a sample for analysis of a variable with a 24-hour holding time might far exceed the costs associated with a variable with a 7-day holding time. Factor this into your decision on whether it's really necessary to measure soluble reactive phosphorus or whether total phosphorus analysis will meet your needs. Travel distance and time to deliver samples, as well as the lab's ability to accept certain kinds of samples on certain days, will affect costs, as well as your decisions on where to collect samples and what lab to choose. The lowest quoted per sample price might not adequately represent the total cost to your monitoring budget.

Laboratory

Analytical costs are relatively straightforward to estimate using direct price quotes from one or more laboratories. Be sure to discuss sample numbers and schedules at the start so that the lab can give you its best price. Remember to include your own field quality control samples in your estimates of total sample numbers for the lab.

Training

Your monitoring staff might need training in specialized monitoring techniques such as stream morphologic assessment or collection and identification of stream biota. Determine the costs (both tuition and travel) for any such training your staff will require in carrying out your monitoring program. Remember to budget for training for staff turnover that is likely to occur over the course of the monitoring program.

Data management

Hardware, software, or programming costs might be associated with storing and manipulating monitoring data. Budget for anticipated costs for statistical analysis or other data reporting that might be contracted out.

I/E Program Costs

Just as for other parts of the watershed plan implementation, you should determine roughly how much funding you'll need to implement your I/E program. I/E program costs are almost always higher than you expect, especially if you plan to use mass media formats like TV or radio PSAs. When planning your I/E budget, don't forget to include travel expenses, supplies (e.g., display booths, paper, storm drain stencil kits), giveaways, and vendor services such as printing and Web site registration. Also consider costs related to obtaining technical information to include in any educational materials developed. You might also incur costs associated with researching ways that your audience can protect water quality or consulting with professionals to obtain this information. You can keep costs down by teaming with universities, local civic organizations, or area businesses. You might also team with other localities or watershed organizations that face the same issues.

12.7.4 Identify Technical Assistance Needs

Technical assistance can take many forms. At the beginning stages of your watershed planning process, it might be collecting or compiling data on the watershed. Later it might involve the work of selecting an appropriate model to work on your watershed's particular issues (e.g., lake-based pollution, sediments) and then actually running the model. After specific practices have been selected, technical assistance in siting chosen practices or selecting among several different management practices for cost-effectiveness might be necessary. Technical assistance can also include advice on the best combination of practices and tools to apply to a particular site based on previous similar work and experience.

The process of delivering technical assistance can include working one-on-one with a landowner to share technical design specifications and similar site experiences; developing engineering plans for a property; showing a demonstration site; presenting drawings, plans, and documents that can be used as a technical record to go along with a watershed plan; or simply providing oversight.

Technical assistance is offered by many agencies and organizations, including local conservation districts, state natural resources agencies, universities, and federal agencies.

12.7.5 Identify the Relevant Authorities Needed for Implementation

In addition to the required technical assistance you might need, it's critical to identify any relevant authorities or legislation that specifically allows, prohibits, or requires an activity. For example, if you're planning a streambank restoration project that involves working in the stream channel, a section 404 dredge and fill permit might be required. You should also identify the available authorities that can help you to implement your plan. For example, you might identify stream buffer ordinances, nutrient management plans, or animal feeding operation (AFO) regulations. In chapter 3 you identified other local, state, tribal, and federal planning efforts that you wanted to coordinate with, and these same programs can help you identify any relevant authorities that you might have missed. Close communication with the local agency staff and state agency personnel can help ensure that you have considered the relevant statutes and authorities needed for implementation.

12.8 Develop the Implementation Plan Basics

The implementation plan is a guide for turning your management strategies from paper into reality and for determining how you're going to measure progress toward meeting your goals. Putting the implementation pieces together involves laying out the detailed tasks that need to be done, identifying who will do them, identifying the funding and technical assistance

Common Sources of Technical Assistance for Agricultural Activities

Federal

In addition to the in-house technical support that USDA provides through Natural Resources Conservation Service, Farm Service Agency, and conservation districts, the Department has expanded the availability of technical assistance to landowners by encouraging the use of technical service providers (TSPs). TSPs are independent of USDA but are certified in delivering conservation technical services to landowners. Keep in mind that TSPs are private professional consultants that provide services to landowners at a cost, unlike the extension agents, Soil and Water Conservation District technicians, and NRCS field staff, whose services are free to the landowner. USDA has developed a registry of TSPs to enable landowners to locate and choose TSPs in their service area. Go to <http://techreg.usda.gov>.

State

USDA's Cooperative State Research, Education, and Extension Service partially sponsors its state partners through Extension Service programs based in land-grant universities. Frequently, state Cooperative Extension Services have a research and education focus that results in their being able to provide cutting-edge technical expertise at a regional scale.

Go to www.csrees.usda.gov/qlinks/partners/state_partners.html.



needed, and setting up a process to measure the effectiveness of the program. The implementation plan, or action plan, is a subset of the overall watershed plan.





If you've followed the approach of this handbook, you've already defined the scope of your plan (chapter 4); estimated pollutant loads and set goals for load reductions (chapters 8 and 9); and identified, evaluated, and selected a management strategy (chapters 10 and 11). From information developed in those steps, you should have a reasonable idea of what, where, and when practices need to be implemented in the watershed to achieve your goals. Although the level and source of resources necessary to complete implementation might not be completely known at this point in time, the procedures recommended in this section will help identify responsible parties, costs, sources of funds, and ways to track progress that will improve the likelihood of assembling the pieces necessary to successfully implement your plan. A good implementation plan that is part of a good overall watershed plan can be very helpful in securing funds for implementation.

To provide a clear guide for stakeholders implementing the watershed plan, it is recommended that you compile basic information into several matrices. For each selected management option or related management options, work with your stakeholders to outline the following:

- Actions that need to be taken (including any special coordination, education, or public outreach needed to improve the chances of implementation)
- The responsible party(ies) for the action/education
- Time frame for implementing the actions
- Time frame for operation and maintenance requirements
- Estimated total cost and annual cost for each action
- Funding mechanism(s) for each action
- Measures or tracking indicators

Your implementation plan should include all activities, including I/E activities and monitoring requirements. Once all the elements of the plan are laid out in matrices, you'll be able to identify gaps or areas that you did not address.

Developing implementation plan matrices can also help to increase the likelihood of completing actions on time and within budget, as well as facilitating the development of annual work plans. The challenge, however, is to generate implementation information that is accurate and acceptable to the stakeholders responsible for carrying out the recommended actions. Meeting that challenge requires research by each responsible party (and consensus-building discussions where multiple parties are involved) regarding feasibility, constraints, possible funding sources, and timeline confirmation for each primary action to be taken. It's important to identify areas of uncertainty and constraints so they can be addressed or planned for where possible. Where funding resources among stakeholders appear to be falling short of projected needs, place emphasis on identifying other potential sources of funding or technical assistance from outside watershed partners.  Worksheet 12-1 is an example of an implementation matrix, based on the  blank worksheet provided in appendix B.

 **Worksheet 12-1** *Sample Implementation Plan Matrix*

Watershed Goals

Goal 1: Restore water quality to meet designated uses for fishing



Objective 1: Reduce sedimentation by 20 percent

Tasks for G1/O1	Respon. Party	Total Costs	Funding Mechanism	Indicators	Milestones			
					Short < 1 yr	Med < 3 yr	Long < 7 yr	Remaining
Task 1								
Seek donation of conservation easements from property owners along Baron Creek	Local land trust	\$0		# acres donated	2	7	10	10
I/E Activities Task 1								
Hold informational workshop with property owners	Local land trust	\$3,000	Section 319 funding	# workshops held	3	3		0
				# participants	40	45		
Develop brochures on how to donate easements				# requests for assistance	2	4		
Task 2								
Purchase greenway alongside Baron Creek	County park district	\$2,000/mile	County general funds	# miles purchased	2	4	7	5
I/E Activities Task 2								
None								
Task 3								
Develop ordinance requiring a 150-ft easement for new construction in floodplain of Baron Creek	Local municipalities	\$0		# ordinances adopted	1	2	4	0
I/E Activities Task 3								
Run articles in local newspapers on benefits of ordinances	Watershed Committee	\$0		# articles	2	5	8	0
Task 4								
Install 300 ft of riparian buffer along Baron Creek	County dept. of natural resources	\$2,500	EQIP, CREP	# ft of buffers	100			
Monitoring Activities for Task 1/2/3								
Monitor sediment load before and after implementation	State DEP	\$5,000/yr	Section 319 funding, state funds	Annual TSS load (kg/yr)	2,500	2,250	2,000	
Evaluate substrate habitat	State DEP & Watershed Committee	\$3,000/yr	Section 319 funding, local volunteers	% embeddedness	12	6	3	
				% sand	10	5	2	

 **Worksheet 12-2** *Developing Criteria to Measure Progress in Meeting Water Quality Goals*

[Note: Complete one worksheet for each management objective identified.]

Management Objective: Reduce nutrient inputs into Cane Creek by 20 percent				
Indicators to Measure Progress	Target Value or Goal	Interim Targets		
		Short-term	Medium-term	Long-term
P load	44 t/yr	52 t/yr	49 t/yr	44 t/yr
# of nuisance algae blooms	0	2	1	0
transparency	5.5 m	4.1 m	4.9 m	5.5 m
frequency of taste and odor problems in water supply	0	1	1	0
hypolimnetic DO	5.0 mg/L	2.5 mg/L	4.0 mg/L	5.0 mg/L

As a companion matrix to the implementation of your management practices, I/E activities, and monitoring program, you should document how you will measure progress toward reducing pollutant loads and meeting your goals. The criteria you select should correspond to the management objectives in the previous table.  A blank  Worksheet 12-2 is provided in appendix B.

12.9 Develop an Evaluation Framework

There are two primary reasons to evaluate your watershed program. First, you want to be able to prove, or demonstrate, that by implementing the management measures, you are achieving your water quality and other environmental goals. Second, you want to be able to continually improve your program in terms of efficiency and quality. This adaptive management process should be built into your program before implementation so that you ask the right questions and use the answers to strengthen your program. Collecting information does no good if you don't use the information to improve your watershed program.

You should develop an evaluation framework to use once you begin to implement your watershed plan. The framework should be developed before implementation so that you can effectively identify what measures you want to evaluate and determine how you will obtain the information. You should recognize that you'll continue to build on the initial characterization, filling information gaps and refining the connections between sources, pollutants, and load reductions. You'll adapt your implementation efforts on the basis of new information collected, changes in the operational structure of your partnership, emerging technologies, and monitoring results.


12.9.1 What Parts of Your Program Should You Evaluate?

In general, you'll evaluate three major parts of your watershed implementation program to be able to demonstrate progress and make improvements in your program. You need to structure your evaluation framework to consider all three components and develop indicators that

will measure each. The components are inputs, outputs, and outcomes. When filling in these components, you'll work backward, starting with your desired outcomes (goals) and working toward identifying the specific inputs needed to achieve those outcomes.

1. **Inputs:** *the process used to implement your program.* Inputs to your program include resources of time and technical expertise, organizational structure and management, and stakeholder participation.

Sample evaluation questions:

- Are the human and monetary resources allocated sufficient to carry out the tasks?
- Did stakeholders feel they were well represented in the process? (👉 appendix B,  Worksheet 13-1)

2. **Outputs:** *the tasks conducted and the products developed.* These include the implementation activities, such as installing management practices, developing brochures, holding workshops, and preparing fact sheets.

Sample evaluation questions:

- Are we meeting our implementation schedule?
- Are we meeting our milestones?
- Did we meet our milestones sooner than expected?
- Did we reach the appropriate target audiences with our I/E materials?

3. **Outcomes:** *the results or outcomes seen from implementation efforts.* These include increased awareness and behavior changes among the watershed community, as well as environmental improvements like water quality, habitat, and physical changes. Outcomes can be further broken down into short-term outcomes and long-term outcomes.

Sample evaluation questions:

- Did the target audience increase its awareness of watershed issues?
- Did the behaviors of the target audience change as a result of implementing the watershed plan?
- Are we meeting our interim targets for pollutant load reductions?
- Are pollutant loads being reduced?

Once you've determined the questions you want to answer, you can set up the framework to collect the necessary information. One approach to setting up an evaluation framework is to use a logic model.

12.9.2 Using a Logic Model to Develop an Evaluation Framework

Many programs use a logic model (figure 12-1) to set up and evaluate their programs. The model is an important tool in the adaptive management process because it allows you to better document the results you find and helps you determine what worked and why. Logic models have been used for years in social programs and are now being used in the context of watershed management.

Basically, a logic model is a picture or visual representation of your program, showing the inputs needed to implement your program, the expected outputs to be performed, and the

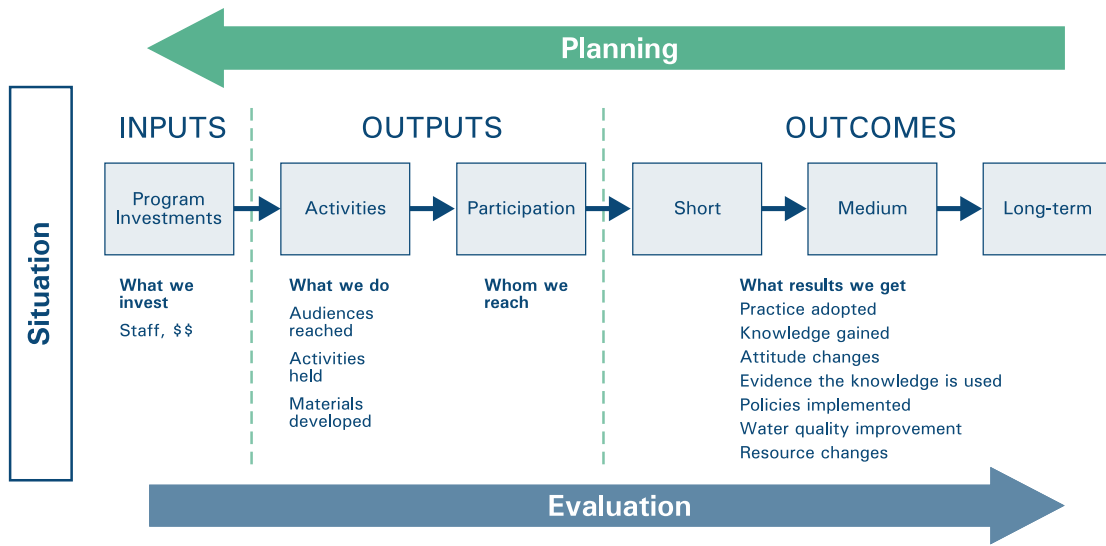


Figure 12-1. Logic Model Components

anticipated outcomes from implementing those activities. Using a logic model can help you to better document the outcomes, discover what works and why, and continually make changes to your program based on your evaluation results.

Using a logic model has several benefits. First, the model puts all the information about your program in one place and can summarize a complex program in a simple picture. This is particularly helpful when communicating key activities to stakeholders. A logic model also shows the connections that link the inputs to results so that you can readily identify any gaps in the sequence. Finally, a logic model provides a “to do” list for evaluation, signaling what needs to be evaluated and when.

The basic structure of a logic model includes stating your situation or problem, recording the inputs or resources needed, listing anticipated outputs, and ultimately outlining the expected outcomes from the program. As you move from the inputs through the outputs and to the outcomes, there should be a direct link between the steps. These links are called “if...then” relationships. For example, if you invest the required staff time and resources (inputs), you’ll be able to conduct the outlined activities (outputs). If you conduct those activities, you’ll see the expected results (outcomes). Setting up a logic model this way can help you to identify gaps and revise some of the parameters. See figure 12-2 for an example logic model for water quality improvements.

🔗 The resources listed in appendix A provide more information on how to develop and use logic models to evaluate your program.

12.9.3 Evaluation Methods

To evaluate your watershed program, you’ll use various methods and tools, such as baseline surveys, focus groups, direct measurements, and stakeholder interviews. The important point is to determine what methods you will use *before* you implement your program. Identifying these methods will help make sure you are collecting information that will directly relate to your program. For example, if you wish to do any before-and-after comparisons, you should have baseline information with which you can compare the final results. The methods

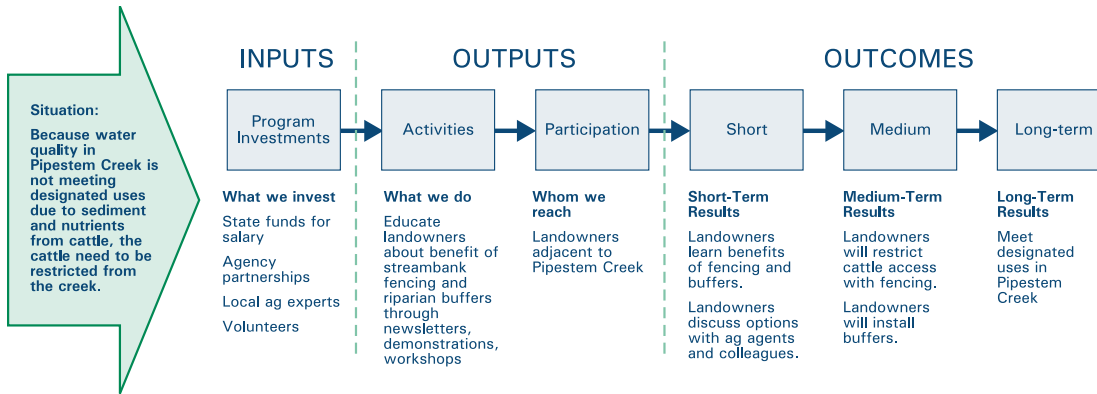


Figure 12-2. Logic Model Example

will be used to measure the indicators you have selected. For each indicator selected, you will identify the method for measuring the indicator. ↪ See appendix A for resources for evaluation approaches.

12.9.4 Timing of Evaluation

Once you know what you want to evaluate and how you'll collect the information, you'll develop a timeline for evaluation. Typically, you'll evaluate your watershed management program four times. The first is once you've completed the plan but have not yet begun to implement it. The second is during the implementation of project activities; the purpose of this evaluation is to provide feedback on the activities so that changes can be made if needed to increase their effectiveness. The third time is after the project activities have been completed; the purpose of this evaluation is to provide some measures of project effectiveness. Finally, you will continue to evaluate after the project has been completed to observe its effects. This is the most difficult aspect of the evaluation to complete because of lack of long-term funding. You have the greatest chance of following through on this if you have built your partnership into a sustaining organization to maintain continuity and stability through the years. ↪ Chapter 13 provides more information on conducting evaluations during the implementation phase and shows how to use the information collected to make changes in your program.

12.10 Devise a Method for Tracking Progress

Whether you track your implementation program by using index cards or create a computer database tracking system, you should identify how you'll track your program before you begin to implement it. Specifically, you want to set up a system that makes it as easy as possible to perform subsequent evaluations of your watershed plan's effectiveness.

First, examine the types of data that you'll collect to perform the evaluations and match them to the appropriate formats. For example, if you want to perform periodic statistical analysis to answer one or more types of evaluation questions, store data in a spreadsheet (or a more powerful database program if you have large amounts of data for numerous indicators) that can be linked to the analysis. If you plan to conduct spatial analysis and present results in map form, storing information in a GIS database will be appropriate. You might also be using a complex simulation model from your assessment on an ongoing basis and will need to update and maintain it with new information. Whatever your plans for evaluation of

Illinois Conservation Practices Tracking System

The Illinois Department of Natural Resources and the University of Illinois Extension, in cooperation with the USDA's Farm Service Agency, initiated a pilot program to develop a GIS-based information system to track conservation practices being implemented in Illinois and, in particular, the Illinois River Basin.

The project goals are (1) to provide baseline data to assess the efficacy of conservation practices and management techniques in improving water quality and habitat in the Illinois River Basin and (2) to create a tool that will aid state and federal partner agencies in planning and implementing watershed management activities within the Illinois River Basin, as well as visualizing the individual and cumulative impact of programs.

To date, conservation easement data for approximately 123,000 acres have been entered and mapped for all active Illinois Conservation Reserve Enhancement Program (CREP), Conservation Reserve Program (CRP), and Environmental Quality Incentives Program (EQIP) contracts in a six-county area of the Middle Illinois River Basin.

The initiative will continue to expand programmatically and geographically, with the eventual goal of creating a statewide system that tracks all conservation management activities of agencies in Illinois.

the implementation program, be sure you consider the types and uses of the data when setting up the tracking system.

You should also consider how you plan to communicate results to stakeholders and other parties and determine your needs for that process. Examine the format of the results—are you communicating progress in improvement of your indicators, costs of management measures, a schedule of progress? Also consider your method of communication—are you sending e-mails and do you need to maintain an e-mail list, or do you need a list server (a program for distributing e-mail to a large number of recipients)? Are you sending newsletters through the Postal Service and do you need to maintain a database of names and addresses? If you are planning to maintain a Web site, have you arranged for access to a Web server, and do you know the Web site address? Be sure to plan for all of your data management needs as they pertain to stakeholder communication.

Next, think about staff experience, training, and ease of use. For instance, if you need to input and track a large amount of water quality monitoring data and are using a database, you might need to train others to use the database system. Alternatively, you could have a database administrator develop data input forms that are easy to use and require little training. Web site design and maintenance require a certain level of expertise, depending on your expectations about the quality and complexity of the Web site. A number of boxed programs that make Web site design and maintenance relatively easy are available for purchase.


There are several administrative issues to consider as well. Be sure to plan for the following:

1. **Process and ownership.** *Process* refers to the procedures you set up to ensure that tasks are performed and completed. *Ownership* refers to the specific person responsible for carrying out each process. It's helpful to have processes written out in detail and easily accessible by staff. This helps staff reference how to perform procedures that occur infrequently, and it facilitates transferring responsibilities when someone is out of the office or leaves a position. Ownership is critical to ensuring that tasks are completed on time.
2. **Maintenance schedule.** This is an important component of defining processes. You should determine a set timetable for various activities, such as data entry, Web site updates, and database maintenance.
3. **Quality assurance/quality control.** Be sure to have procedures for QA/QC. For example, you might want to have a manager responsible for examining data before they are entered into a database to make sure the data are reasonable. You might want to have a third party look over data that have just been entered. For correspondence or reports, you should have someone else do proofreading.






4. **Version history.** In some cases it's important to maintain a file history. This is important in tracking down errors and preventing important information from being overwritten. You might also want to refer back to previous versions to detect changes or report on long-term progress. For files, you might find it helpful to insert the date and version number into the filename itself (e.g., "Progress Report 3-25-05 V2.wpd"). For simulation models, you might want to create a new directory each time you do a model run. GIS files might also need a version history.
5. **Metadata.** Metadata means "data about data," and it communicates the *who, what, when, where, why, and how* about data. You might want to maintain metadata about certain aspects of project areas. For instance, a database could have metadata describing its contents, who maintains it, the period it covers, sources of information, and so forth. You should give special consideration to metadata for GIS files that you generate. In fact, some state or federal agencies might require that you maintain GIS metadata in a specific format if you're working under contract for them. You should document sources of data, processing steps, definitions of database fields and their values, projection information, and the like. Several scripts and plug-ins for ArcView help with metadata generation and tracking, and ArcGIS has built-in functionality for this.

Remember that the high-quality work is key to maintaining credibility with your stakeholders and with regulators. Through careful planning, attention to detail, and high standards for accuracy, you will retain the respect of those that benefit from your work.

12.11 Putting It All Together

There is more than one way to assemble your watershed plan, but most plans follow a similar sequence of organization. An example table of contents from the White Oak Creek, Ohio, watershed plan is provided (figure 12-3).  To download a complete copy of this watershed plan, go to http://brownswcd.org/action_plan.htm.

12.11.1 The Final Review

 Once you've assembled your watershed plan, take a few minutes to review the sections. Ensure that you have included the recommended elements for a watershed plan, which will help to ensure that you have identified measurable goals that will lead to measurable results. Use the following checklist ( Worksheet 12-3) as a guide.  A blank worksheet is provided in appendix B. In addition, some states have developed checklists to help groups submit watershed plans that meet the nine elements.  Worksheets from Michigan and Missouri are included in appendix B ( Worksheets 12-4 and 12-5).



12.11.2 Make the Plan Accessible to Various Audiences

Your plan provides an exceptional opportunity to educate the watershed community about the key watershed issues, goals, and planned implementation activities. Consider developing a reader-friendly summary version of the watershed plan, a short executive summary, or a list of frequently asked questions that you can distribute to various audiences. Distribution mechanisms could include mass mailings, handouts at community events, or articles in local papers. A press release could also be used to communicate the availability of your watershed plan for public comment or review. Press releases should be clear, straightforward, and free

White Oak Creek Watershed Plan	
Plan Endorsement	
Table of Contents	
Acronyms	
General Watershed Facts	
Executive Summary	
Project Partners	
Section I: Introduction	
Mission Statement	
Water Quality Goals	
Comprehensive White Oak Creek Watershed Goals	
Purpose of Action Plan	
Updates and Revisions	
Previous Water Quality Efforts	
White Oak Creek Watershed Group	
Development of the Action Plan	
Education/Marketing Strategies and Outreach Goals	
Education and Community Outreach	
Section II: Inventory of the Watershed	
Fact Sheet	
Map of Watershed	
Introduction	
Physical Description	
Administrative Boundaries	
Districts	
Demographics	
Economics	
Agriculture and Economy	
Geology and Topography	
Land Form and Slope	
Soils	
Land Uses	
Livestock in Streams	
Forested Areas and Riparian Corridors	
Floodplains	
Agriculture	
Chemical Use Patterns	
Precipitation and Climate	
Surface Water Resources	
Wetlands	
Tributary	
Groundwater Resources	
Climate and Precipitation	
Flow and Depth	
Threatened and Endangered Species	
Wildlife	
Recreation	
Historical Information	
Historical Sites	
Dams	
Physical Attributes of the Stream and Floodplain Area	
Section III: Water Quality Data	
Point and Nonpoint Source Pollution	
Designated Uses and Subcategories for Surface Water Resources	
Aquatic Life Habitat	
Water Supply	
Recreation	
State Water Resources	
Aquatic Life Use Designations	
Potential Contamination Sources	
Overview of Water Quality Impairments	
Section IV: Water Quality Issues	
Critical Area Table	
Major Water Quality Issues	
Sedimentation and Loss of Riparian Area	
Improperly Treated Wastewater	
Excessive Nutrient and Pesticide Runoff	
Section V: Load Reductions	
STEPL Program	
Section VI: Subwatershed Inventory	
Subwatershed Introduction and Goals	
1997 Use Attainment Status Summary	
Individual Subwatersheds	
Physical Description	
Tributaries, Reservoirs, Dams, Special Features	
Land Use	
Point and Nonpoint Causes and Sources	
Water Quality Results	
Subwatershed Map	
Impairments	
Background	
Problem Statement	
Goals	
Implementation Strategies/Task Table	
Causes/Sources by Tributary	
Inventory Spreadsheet	
Section VII: Watershed Programs	
Previous and active programs	
Section VIII: Water Quality Monitoring	
Introduction	
Program	
High School Volunteer Monitoring Sites	
Monitoring Parameters	
Macroinvertebrate Testing	
Future Water Quality Monitoring Activities	
Section IX: Funding and Evaluation	
Funding Guideline	
Evaluation Activity Table	
Appendices	


Figure 12-3. Table of Contents from White Oak Creek, Ohio, Watershed Plan

 **Worksheet 12-3** *Basic Components of a Watershed Plan*

Key watershed planning components	Chapter	Done?	Comments
Include the geographic extent of the watershed covered by the plan.	4		
Identify the measurable water quality goals, including the appropriate water quality standards and designated uses.	4, 5, 8, 9		
Identify the causes and sources or groups of similar sources that need to be controlled to achieve the water quality standards.	4, 5, 6		
Break down the sources to the subcategory level.	7		
Estimate the pollutant loads entering the waterbody.	8		
Determine the pollutant load reductions needed to meet the water quality goals.	9		
Identify critical areas in which management measures are needed.	7, 9, 10		
Identify the management measures that need to be implemented to achieve the load reductions.	10, 11		
Prepare an I/E component that identifies the education and outreach activities needed for implementing the watershed management plan.	12		
Develop a schedule for implementing the plan.	12		
Develop interim, measurable milestones for determining whether management measures are being implemented.	12		
Develop a set of criteria to determine whether loading reductions are being achieved and progress is being made toward attaining (or maintaining) water quality standards, and specify what measures will be taken if progress has not been demonstrated.	12		
Develop a monitoring component to determine whether the plan is being implemented appropriately and whether progress toward attainment or maintenance of applicable water quality standards is being achieved.	6, 12		
Estimate the costs to implement the plan, including management measures, I/E activities, and monitoring.	12		
Identify the sources and amounts of financial and technical assistance and associated authorities available to implement the management measures.	12 Appx C		
Develop an evaluation framework.	12		

of unnecessary words or details. The goal of a press release is to arouse the curiosity of reporters and furnish information they can use in developing new stories to publicize your plan.

You should also consider posting the watershed plan on the Internet. With a Web-based format, readers can view the document at their leisure and you can easily update the plan as necessary. In addition, you should provide background information on the Web site that describes how the plan was developed, who was involved in developing it, and how citizens can get in involved in implementing it. Keep in mind that the downloading capabilities and processing speeds of computers vary widely, so you should allow readers to choose which format they would like to view or download, depending on their computer capabilities. The Upper Neuse River Basin Association posted the Upper Neuse Watershed Management Plan

on its Web site ( www.unrba.org/project.htm#mgmtplan) in May 2003. Since the plan was posted, it has been downloaded more than 850 times.

When it comes to publicizing your watershed plan, be creative. Team with local schools to build watershed lessons into science curricula. Develop a slide presentation on the watershed plan and present it at Master Gardeners or Kiwanis Club meetings. Try to piggyback on the efforts of other organizations to help spread the word about the watershed plan. Finally, be inclusive in your efforts to get the plan out. Be sure to develop written communication in all languages relevant to your community and across various education levels.

General Outline of a Watershed Plan

- 1. Executive Summary**
 - 2. Introduction**
 - 2.1. Document Overview
 - 2.2. Planning Purpose and Process
 - 2.2.1. Watershed Management Team
 - 2.2.2. Public Participation Approach
 - 3. Watershed Description**
 - 3.1. Physical and Natural Features
 - 3.1.1. Watershed Boundaries
 - 3.1.2. General Hydrology
 - 3.1.3. Climate/Precipitation
 - 3.1.4. Wetlands (NWI) Data
 - 3.1.5. Surface Water
 - 3.1.6. Ground Water Resources
 - 3.1.7. Floodplain Information
 - 3.1.8. Dams in the Watershed
 - 3.1.9. Navigation Channels/Ports/Harbors
 - 3.1.10. Topography/Elevation Data
 - 3.1.11. Geology and Soils
 - 3.1.12. Vegetation
 - 3.1.13. Exotic/Invasive Species
 - 3.1.14. Wildlife
 - 3.1.15. Endangered Species
 - 3.1.16. Sensitive Areas
 - 3.1.17. Cultural Resources
 - 3.2. Land Use and Land Cover
 - 3.2.1. Open Space
 - 3.2.2. Forested Areas
 - 3.2.3. Agricultural Practices
 - 3.2.4. Mining Activities
 - 3.2.5. Fisheries
 - 3.2.6. Developed Areas
 - 3.2.7. Political Boundaries
 - 3.2.8. Relevant Authorities
 - 3.2.9. Future Land Use Expectations
 - 3.3. Demographic Characteristics
 - 3.3.1. Population
 - 3.3.2. Economics
 - 3.3.3. Languages
 - 4. Watershed Conditions**
 - 4.1. Water Quality Standards
 - 4.1.1. Designated and Desired Uses
 - 4.1.2. Numeric Criteria/ State Standards
 - 4.1.3. Antidegradation Policies/Procedures
 - 4.2. Available Monitoring / Resource Data
 - 4.2.1. Water Quality Data (Impairments/Threats)
 - 4.2.2. Flow Data
 - 4.2.3. Biological Data
 - 4.2.4. Stream Corridor Data
 - 4.2.5. Sediment and Other Data
 - 5. Pollutant Source Assessment**
 - 5.1. Nonpoint Sources
 - 5.1.1. Agriculture
 - 5.1.2. Wildlife
 - 5.1.3. Septic Systems
 - 5.1.4. Silviculture
 - 5.1.5. Urban/ Suburban Runoff
 - 5.1.6. Streambank Erosion
 - 5.1.7. Atmospheric Deposition
 - 5.2. Point Sources
 - 5.2.1. NPDES Permitted Facilities
 - 5.2.2. Wastewater Treatment Plants
 - 5.2.3. Phase I and II Stormwater Permits
 - 5.2.4. CAFO Permits
 - 5.3. Hazardous Waste Sites
 - 5.3.1. CERCLA Sites
 - 5.3.2. RCRA Sites
 - 5.3.3. Brownfields
 - 5.3.4. Underground Storage Tanks
 - 5.4. Mines and Other Pollutant Sources
 - 6. Pollutant Loads and Water Quality**
 - 6.1. Estimate of Existing Pollutant Loads
 - 6.2. Future/Buildout Pollutant Load Estimates
 - 6.3. Identification of Critical Areas
 - 7. Watershed Goals**
 - 7.1. Management Objectives and Indicators
 - 7.2. Key Pollutant Load Reduction Targets
 - 8. Identification of Management Strategies**
 - 8.1. Existing Management Strategies
 - 8.1.1. Structural Controls
 - 8.1.2. Nonstructural Controls
 - 8.2. Other Strategies Needed to Achieve Goals
 - 8.2.1. Structural Controls
 - 8.2.2. Nonstructural Controls
 - 9. Implementation Program Design**
 - 9.1. Management Strategies Overview
 - 9.2. Schedule of Activities
 - 9.3. Interim Milestones
 - 9.4. Indicators to Measure Progress
 - 9.5. Costs and Technical Assistance Needed
 - 9.6. Information/Education Activities
 - 9.7. Monitoring Approach
 - 9.8. Evaluation Framework
 - 10. Watershed Plan Implementation Updates**
- Appendices**