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III. Techniques and Procedures for Assessing Implementation, Operation and Maintenance of Management Measures

A. Overview

As discussed in the introduction to this chapter, States will not be able to fully interpret their water quality monitoring data without information regarding the adequacy of management measure implementation, operation, and maintenance. Section II of this chapter provides an overview of techniques for assessing water quality and estimating pollution loads. The information presented in this section is intended to complement that provided in Section II to give State and local field personnel the basic information they need to develop sound programs for assessing over time the success of management measures in reducing pollution loads and improving water quality.

Successful management measures designed to control nonpoint source pollutants require proper planning, design and implementation, and operation and maintenance. This section presents a general discussion of the procedures involved in ensuring the successful design and implementation of various management measures, but is not intended to provide recommendations regarding the operation and maintenance requirements for any given management measure. Instead, this section is intended to provide "inspectors" with ideas regarding the types of evidence to seek when determining whether implementation or operation and maintenance are being performed adequately.

B. Techniques

1. Implementation

Proper planning is an essential step in implementing management measures effectively and developing procedures that ensure that the measures are achieved. During the planning stage, the optimal selection of management practices for a specific discipline, such as forestry, is made following an evaluation of several factors. Some of these factors include site conditions, the water quality goals to be achieved, and the need to meet additional objectives established by the user. In some cases, local and state measures may directly require the use of certain practices or effectively dictate the use of certain practices through the establishment of limits (e.g., application rates for fertilizers and pesticides, annual erosion rates, land use controls, or setback distances from environmentally sensitive areas). The key components of the planning stage include:

- Site investigations by qualified personnel such as soil scientists, biologists, wetlands scientists, hydrologists, and engineers;
- Collection of pertinent data relative to the source category;
- Identification of water quality goals;
- Identification of land user objectives;
- Identification of relevant State and local regulations;
- Coordination with regulatory (and at times funding) agencies as necessary; and
- Identification of an appropriate series of practices that achieve both the stated objectives and the applicable management measures.

Once the appropriate series of practices has been identified for use, it is essential that each practice be properly designed and implemented for the measures to be successful. This requires that design and installation be conducted by qualified and experienced personnel. Design of the management practices should be done in accordance with existing design guidelines and standards outlined in technical guides, including those developed by States and the Soil Conservation Service of the U.S. Department of Agriculture. These standards include specific design criteria and specifications that, when followed, will ensure the proper design of a practice. The technical guides also include construction and implementation specifications that provide detailed guidance to the installer. It is always desirable to have a qualified person such as the designer present at certain stages during installation to ensure that the designs are being interpreted correctly and installed as specified.

2. Operation and Maintenance

A critical step in ensuring success of a management measure is proper operation and maintenance (O&M) of each practice. Once a series of practices has been designed and installed, it is crucial that the individual practices be operated and maintained to ensure that they function as intended. During the design process, an operation and maintenance plan that

identifies continual procedures, schedules, and responsibility for operating and maintaining the practices should be drafted.

Examples of procedures and techniques to ensure the successful achievement of operation and maintenance are identified in the following subsections. These procedures are generally applied by the landowner or operator responsible for implementing the management measures. The examples provided below are not mandatory but rather are presented as illustrations of effective operation and maintenance practices. States may wish to develop programs that ensure that O&M is performed by the responsible individuals or entities.

a. Agriculture

Chapter 2 of this guidance identifies six major categories of agricultural nonpoint pollution sources that affect coastal waters: erosion from cropland, confined animal facilities, application of nutrients to cropland, application of pesticides to cropland, land used for grazing, and irrigation of cropland. Table 8-3 *(35k)* presents examples of general O&M procedures to ensure the performance of these measures.

b. Forestry

Forestry-related activities such as road construction, timber harvesting, mechanical site preparation, prescribed burning, and fertilizer and pesticide application contribute to nonpoint source pollution. These operations can change water quality characteristics in waterbodies receiving drainage from forest lands. Activities such as timber harvesting, mechanical site preparation, and prescribed burning can accelerate erosion, resulting in increased sediment concentrations.

There are O&M techniques that minimize hydrological impacts, temperature elevations, the amount of sediment production, and the transport of sediment, nutrients, pesticides, and other pollutants from forest lands into waterbodies. These procedures typically involve periodic inspection and repair of the roadways, streamside management areas, and drainage structures (particularly after storm events); containment and proper use of chemicals used during forestry activities; and revegetation of the disturbed areas. A more detailed description of typical O&M procedures to ensure adequate performance of forestry management measures is presented in Table 8-4 *(37k)*.

c. Urban Sources

Pollutants from urban sources include suspended solids, nutrients, pathogens, metals, petroleum products, and various toxics. Generally, urban nonpoint source control measures consist of nonstructural, and vegetative practices, all of which must be properly maintained to ensure pollutant removal. All of these practices should be periodically inspected. In the case of structural practices and vegetative practices, inspections are conducted to locate any structural defects and to perform cleaning operations. Nonstructural practices should be reviewed periodically as guidelines are updated or to determine the level of compliance with the guidelines. These issues are summarized in Table 8-5 *(45k)*.

d. Marinas and Recreational Boating

Potential adverse effects of recreational boating include degradation of water quality, degradation of sediment quality, destruction of habitat, increased turbidity, and shoreline and shallow area erosion. Proper design and operation of marinas can result in reductions in these adverse impacts to the environment. However, poorly designed or managed marinas can pose additional environmental hazards including dissolved oxygen deficiencies; concentration of pollutants from boat maintenance, operation, and repair; transport of runoff from impervious surfaces into coastal waters; and destruction of coastal habitat areas.

Management practices typically used to ensure proper operation and maintenance of marinas and boats include both the development of regular schedules for inspecting, cleaning, and repairing facilities and the implementation of education programs for boaters and marina owners and operators. Examples of O&M procedures and techniques for marinas and recreational boating management measures are presented in Table 8-6 *(20k)*.

e. Hydromodification

Operation and maintenance procedures for hydromodification management measures typically involve periodic inspection of structures and features (particularly after storm events), clearing of debris not needed for habitat, and repair or replacement of structures and features as required. Examples of procedures to ensure adequate operation and maintenance of management measures during hydromodification are presented in Table 8-7 *(11k)*.

f. Dams

Examples of typical O&M procedures for ensuring adequate performance of management measures for dams are presented in Table 8-8 *(15k)*.

g. Shoreline Erosion

In shoreline and streambank areas requiring erosion protection from water flow and wave action, shoreline structures such as breakwaters, jetties, groins, bulkheads, and revetments are often constructed. In addition, nonstructural measures (e.g., marsh creation and vegetative bank stabilization) are often used in protecting shorelines and streambanks from erosive forces. Typical O&M procedures for ensuring adequate performance of these measures against erosion include monitoring for erosion, making structural or nonstructural modifications as needed, performing periodic inspection of the erosion control systems, and performing repair and replacement as required. Table 8-9 presents examples of typical O&M procedures for shoreline erosion management measures.

h. Protection of Existing Wetlands and Riparian Zones

Wetlands provide many beneficial uses including habitat, flood attenuation, water quality improvement, shoreline stabilization, and ground-water recharge. Wetlands can play a critical role in reducing nonpoint source pollution problems in open bodies of water by trapping or transforming pollutants before releasing them to adjacent waters. Their role in water quality includes processing, removing, transforming, and storing such pollutants as sediment, nitrogen, phosphorus, pesticides, and certain heavy metals.

The loss of wetland and riparian areas as buffers between uplands and the parent waterbody allows for more direct contribution of nonpoint source pollutants to the aquatic ecosystem. Often, loss of these areas occurs at the same time as the alteration of land features, which increases the amount of surface water runoff. As a result, excessive fresh water, nutrients, sediments, pesticides, oils, greases, and heavy metals from nearby land use activities may be carried in runoff from storm events and discharged to surface and ground water. Without wetlands these nonpoint source pollutants travel downstream to coastal waters without the benefits of filtration and attenuation that would normally occur in the wetland or riparian area.

Wetland and riparian areas also provide important habitat functions. Protection of wetlands and riparian zones provides both nonpoint source control and other corollary benefits of these natural aquatic systems although adverse impacts on wetlands from nonpoint source pollutants can occur. Such impacts can be minimized through pretreatment with stormwater management practices. Land managers should, therefore, use proper management techniques to protect and restore the multiple benefits of these systems. Examples of typical O&M procedures for ensuring adequate performance of measures to protect existing wetlands and riparian areas are provided in Table 8-10.

i. Restoration of Wetland and Riparian Areas

Restoration of wetlands refers to reestablishing a wetland and its range of functions where one previously existed by reestablishing the hydrology, vegetation, and other habitat characteristics. Restoration of wetlands and riparian areas in the watershed have been shown to result in nonpoint source control benefits.

A combination of practices may be implemented to restore preexisting functions in damaged and destroyed wetlands and riparian systems in areas where they could serve a nonpoint source control function. Examples of typical O&M procedures for ensuring adequate performance of measures to restore wetlands and riparian areas are provided in Table 8-11.

j. Vegetated Treatment Systems

Runoff water quality management methods, referred to as biofiltration methods, have been shown to provide significant reductions in pollutant delivery. These include vegetated filter strips, grassed swales or vegetated channels, and created wetlands. When properly installed and maintained, biofiltration methods have been shown to effectively prevent the entry of sediment and sediment-bound pollutants, nutrients, and oxygen-consuming substances into waterbodies.

A combination of practices can be used to manage vegetated treatment systems. Examples of typical O&M procedures for ensuring adequate performance of these systems are provided in Table 8-12.

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