United States
Environmental Protection
Agency

Office of Water
(4503F)
Washington DC 20460

EPA 841-D-99-001
August 1999

Draft Guidance for Water Quality-based Decisions: The TMDL Process (Second Edition)

Disclaimer

This document provides guidance to States, Territories and authorized Tribes exercising responsibility under section 303(d) of the Clean Water Act concerning the development of lists of waterbodies not meeting water quality standards and TMDLs for such waterbodies. It also provides guidance to the public and the regulated community on how EPA intends to exercise its discretion in implementing section 303(d) and its regulations regarding lists of impaired waterbodies and TMDLs. The guidance is designed to implement national policy on these issues. The document does not, however, substitute for section 303(d) of the Clean Water Act or EPA's regulations; nor is it a regulation itself. Thus, it does not impose legally-binding requirements on EPA, States, Territories, authorized Tribes or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA and State, Territorial and authorized Tribal decisionmakers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

Address/Email for Comments:

EPA solicits comments on the "Draft Guidance for Water Quality-based Decisions: The TMDL Process (Second Edition)." Send written comments on the proposed TMDL Guidance to: TMDL Guidance, U.S. Environmental Protection Agency, Mail Code 4503F, 401 M Street, S.W., Washington, DC 20460. As of August 23, 1999, EPA will also accept comments electronically. Comments should be sent to the following email address at: tmdlgud@epa.gov. Electronic comments must be submitted as an ASCII or WordPerfect file avoiding the use of special characters and any form of encryption. No confidential business information (CBI) should be sent via email. EPA requests that commenters submit any references cited in their comments. All comments must be postmarked by October 22, 1999, which ends the 60 day comment period. No facsimiles (faxes) will be accepted.

Please note: In order to provide the public and all stakeholders an adequate period of time to fully analyze the issues and prepare comprehensive comments, we are extending the comment period an additional 60 days for a total comment period of 120 days. The extended comment period deadline is December 22, 1999. Please send your written comments to the Comment Clerk for the TMDL Program Rule, Water Docket (W-98-31), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460 by December 22, 1999.

Contents

List of Tables

List of Figures

Chapter 1. Introduction and General Overview

An Overview of the TMDL Guidance Document

Chapter 1 provides an overview of § 303(d) program activities, the process for identifying impaired or threatened waters, and the procedures for establishing total maximum daily loads (TMDLs). The regulatory framework and essential definitions are reviewed. Issues associated with interpreting the regulation and the implications for States, Territories, and authorized Tribes in carrying out the requirements of the § 303(d) program are described.

- ✓ **Definitions**
- ✓ **The TMDL process**
- ✓ **Answers to frequently asked questions**

Chapter 2 discusses the process by which impaired or threatened waters are identified and listed under § 303(d) of the Clean Water Act (CWA). Included in this chapter are the scope of the listing process (waters that must be included); the contents of the § 303(d) list; the process by which States, Territories, and authorized Tribes can add or remove waters from the list; documentation of methodologies used in the listing process; and priority ranking of impaired or threatened waters and scheduling of TMDL establishment.

- ✓ **Statutory and regulatory requirements**
- ✓ **The listing process**
- ✓ **The four parts of the § 303(d) list submittal**
- ✓ **How monitoring supports the § 303(d) listing process**
- ✓ **Public participation**
- ✓ **EPA actions**

Chapter 3 discusses the establishment and implementation of the TMDL. Included in this chapter are factors that must be considered when establishing a TMDL, the components of a TMDL analysis, planning for implementation and monitoring, the required elements of an approvable TMDL submittal, and the implementation process.

- ✓ **Statutory and regulatory requirements**
- ✓ **The required elements of the TMDL submittal**
- ✓ **The components of the TMDL establishment process**
- ✓ **How monitoring supports the TMDL establishment process**
- ✓ **Public participation**
- ✓ **EPA actions**

Appendices include additional information on the § 303(d) list submittal, related federal programs, and illustrations of TMDLs.

1.1 The § 303(d) Listing and TMDL Establishment Process

The objective of the TMDL process is to systematically identify impaired or threatened waterbodies and the pollutant(s) causing the impairment and ultimately establish a scientifically-based strategy—a TMDL—for correcting the impairment or eliminating the threat and restoring the waterbody. A schematic of the listing and TMDL establishment process is shown in Figure 1-1. States, Territories, and

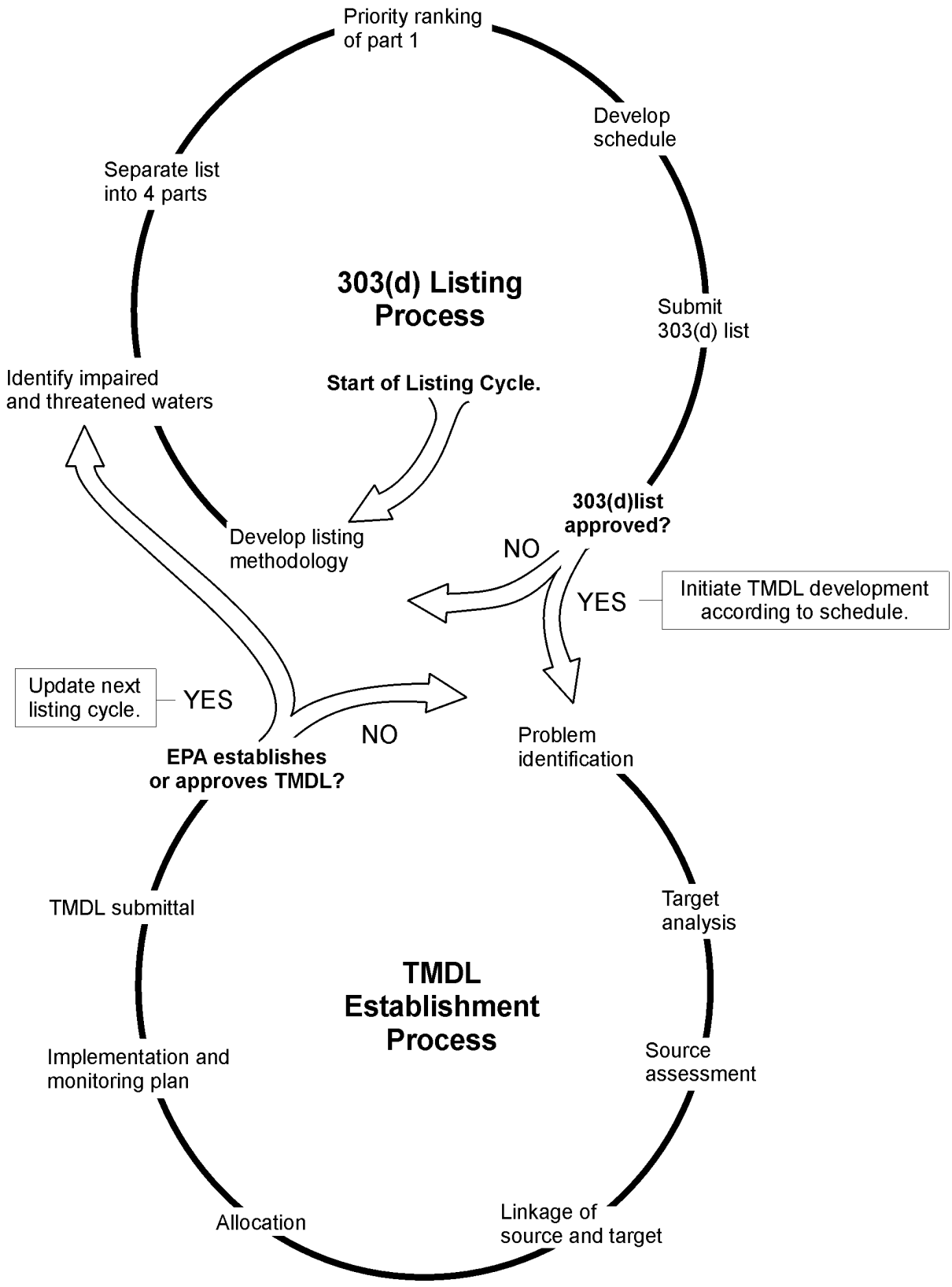


Figure 1-1. Components of the § 303(d) listing and TMDL establishment process.

authorized Tribes are required to identify and establish a priority ranking for waterbodies not meeting water quality standards. They must then establish a TMDL for each of these waterbodies. The U.S. Environmental Protection Agency (EPA) reviews the list and TMDLs. If the EPA disapproves the list or TMDLs or if the State, Territory, or authorized Tribe fails to establish the list or TMDLs, EPA will list waterbodies and establish TMDLs for them. The TMDL process allows for alternative point and nonpoint source control strategies that provide decision makers with an opportunity to compare the cost-effectiveness and efficiency of different pollutant reduction activities or controls and the social and economic benefits of alternative allocation approaches.

Successful use of the TMDL process to develop an effective strategy to improve water quality requires accurately defining the problem, characterizing the impaired waterbody and all pollutants contributing to the impairment, and understanding the political and economic constraints that affect implementation and acceptance of the TMDL. Establishment of TMDLs rests on the following premises:

- The total pollutant load to a waterbody is derived from point, nonpoint, and background sources.

- Pollutant loads can be transported into a waterbody directly through effluent discharge, bank and bar erosion (in streams, rivers, estuaries, and lakes), recirculation (e.g., nutrients in lakes, estuaries, and wetlands), solar heating, atmospheric deposition, and groundwater flows or indirectly by overland flow caused by snowmelt or precipitation.

- The technical approach used to develop the TMDL will vary according to the nature of the problem, pollutant of concern, type of waterbody, types and number of pollutant sources, and political and economic constraints that affect a specific watershed.

TMDLs are required to consider the effect of processes that contribute pollutants to a waterbody. These processes may relate to thermal changes, critical flow conditions, sedimentation, and riparian and channel processes. Control measures to implement TMDLs, therefore, are not limited to National Pollutant Discharge Elimination System (NPDES) permits, but may also include State, Territorial, Tribal, and local authorities and actions to reduce nonpoint source pollution.

1.2 Definitions

It is necessary to become familiar with several terms used throughout this guidance. These definitions will be discussed in greater detail in later chapters.

Critical conditions. The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.

Impaired waterbody. Any waterbody of the United States that does not attain water quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131), due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a thermal discharge from one or more point sources, “impaired” means that the waterbody does not have or maintain a balanced indigenous population of shellfish, fish, and wildlife.

Load allocation. The portions of a TMDL's maximum allowable pollutant load allocated to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources.

Margin of safety (MOS). A required element of a TMDL that accounts for uncertainty and lack of knowledge. An MOS may be expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL and its maximum allowable pollutant load (e.g., derivation of numeric loads, modeling assumptions, or effectiveness of proposed management actions).

Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. This term does not mean (A) "sewage from vessels" within the meaning of § 312 of the Clean Water Act or (B) water, gas, or other material that is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, if the well used either to facilitate production or for disposal purpose is approved by authority of the State in which the well is located, and if that the State determines that such injection or disposal will not result in the degradation of ground or surface water resources. (See CWA § 502(6).) EPA believes this definition encompasses drinking water contaminants regulated under § 1412 of the Safe Drinking Water Act and may be discharged to waters of the United States that are source waters of one or more public water systems. Source water is any water reaching the intake of a public water system.

Pollution. The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

Reasonable assurance. Reasonable assurance means that you demonstrate that each wasteload allocation and load allocation in a TMDL will be implemented. For point sources regulated under section 402 of the Clean Water Act, you must demonstrate reasonable assurance by procedures that ensure that enforceable NPDES permits (including coverage to individual sources under a general NPDES permit) will be issued expeditiously to implement applicable wasteload allocations for point sources. For nonpoint sources you must demonstrate reasonable assurance by specific procedures and mechanisms that ensure load allocations for nonpoint sources will be implemented for that waterbody. Specific procedures and mechanisms for nonpoint sources must apply to the pollutant for which the TMDL is being established, must be implemented expeditiously, and must be supported by adequate funding. Examples of specific procedures and mechanisms which may provide reasonable assurances for nonpoint sources include State, Territorial, and authorized Tribal regulations, local ordinances, performance bonds, contracts, cost share agreements, memoranda of understanding, site specific voluntary actions, and compliance audits of best management practices.

Thermal discharge. The discharge of the pollutant heat from a point source.

Threatened waterbody. Any waterbody of the United States that currently attains water quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131), but for which existing and readily available data and information on adverse declining trends or anticipated load measures indicate that water quality standards will likely be exceeded by the time the next list is required to be submitted to EPA. Where a waterbody is threatened by a thermal discharge, threatened means that the waterbody has a balanced indigenous population of shellfish, fish, and wildlife, but adverse declining trends indicate that a balanced indigenous population of shellfish, fish, and wildlife will not be maintained.

Total maximum daily load (TMDL). TMDLs are written plans and analyses established to ensure that the waterbody will attain and maintain water quality standards (existing uses, designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131) including consideration of reasonably foreseeable increases in pollutant loads. TMDLs must be established for waterbodies on Part 1 of your list of impaired and threatened waterbodies and must contain the following ten elements: (1) the name and geographic location of the impaired or threatened waterbody for which the TMDL is being established; (2) identification of the pollutant and quantification of the pollutant load that may be present in the waterbody and still allow attainment and maintenance of water quality standards; (3) identification of the amount or degree by which the pollutant load in the waterbody deviates from the target representing attainment or maintenance of water quality standards; (4) identification of source categories, source subcategories or individual sources of the pollutant for which wasteload and load allocations are being established; (5) wasteload allocations for pollutants from point sources; (6) load allocations for pollutants from nonpoint sources; (7) a margin of safety; (8) consideration of seasonal variation; (9) an allowance for future growth which accounts for reasonably foreseeable increases in pollutant loads; and (10) an implementation plan.

Wasteload allocation. The portions of a TMDL's pollutant load allocated to a point source of a pollutant.

Waterbody. A geographically defined portion of navigable waters, waters of the contiguous zone, and ocean waters under the jurisdiction of the United States, including segments of rivers, streams, lakes, wetlands, coastal waters, and ocean waters.

1.3 Frequently Asked Questions Regarding the § 303(d) Program

What is the § 303(d) list?

The § 303(d) list is a list of all impaired or threatened waters within the jurisdiction of a State, Territory, or authorized Tribe. EPA believes that the list required under § 303(d)(1) of the Clean Water Act provides a comprehensive public accounting of all impaired or threatened waterbodies, regardless of the cause or source of the impairment or threat. An impaired waterbody is one that does not attain water quality standards (including designated uses, narrative and numeric criteria, and antidegradation requirements defined at 40 CFR 131), due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a thermal discharge from one or more point sources, impaired means that the waterbody does not have or maintain a balanced indigenous population of shellfish, fish, and wildlife. A threatened waterbody is one that currently attains water quality standards but existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time the next list is required to be submitted to EPA.

States, Territories, and authorized Tribes must list impaired or threatened waterbodies regardless of the source of the impairment. The source of the impairment might be from point sources, nonpoint sources, atmospheric deposition, or a combination of these. Impaired or threatened waterbodies must be listed regardless of whether the pollutant or source of pollution is known.

What is the format of the list?

- *Part 1:* Waterbodies impaired or threatened by a pollutant as defined in 40 CFR 130.2(d).
- *Part 2:* Waterbodies impaired or threatened by pollution as defined by CFR § 130.2(c), but not impaired or threatened by one or more pollutants.
- *Part 3:* Waterbodies for which EPA has approved or established a TMDL for one or more pollutants, but where water quality standards have not yet been attained.
- *Part 4:* Waterbodies that are impaired, but for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works are expected to result in attainment of water quality standards by the next listing cycle.

The § 303(d) list has four parts. Waterbodies impaired or threatened by pollutants are placed on Part 1 of the list, and a TMDL is required for each waterbody and pollutant combination. Once a TMDL has been established, the waterbody and pollutant combination is moved to Part 3 of the list until water quality standards are attained. Waterbodies impaired or threatened due to pollution are listed on Part 2 of the list. No TMDL is required for these waterbody and pollution combinations. Part 4 of the list consists of waterbody and pollutant combinations for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works are expected to result in attainment of water quality standards by the next listing cycle. No TMDL is required for these waterbody and pollutant combinations as long as water quality standards are attained before the next listing cycle. Otherwise, the waterbody and pollutant combination must be included on Part 1 unless there is documentation that failing to attain standards is due to failure to comply with applicable technology-based requirements.

How long do waterbodies stay on the list?

Once a waterbody has been identified as impaired or threatened by a specific pollutant and placed on the § 303(d)(1) list, that waterbody and pollutant combination must remain on the list until water quality standards are attained. It does not matter whether a waterbody has been assigned to Part 1, 2, 3, or 4 of the list. All impaired or threatened waterbodies on the list must remain on the list until new data and information indicate that the waterbody has attained water quality standards and is no longer impaired or is no longer threatened.

What type of information is used to generate the list of impaired or threatened waters?

EPA regulations require that States, Territories, and authorized Tribes assemble all existing and readily available data and information to develop a list of impaired or threatened waterbodies (40 CFR 130.22). EPA regulations also explain that existing and readily available data must include, but is not limited to the data and information included in the following:

- Most recent EPA-approved § 303(d) list.
- Most recent § 305(b) report.
- CWA § 319 nonpoint source assessments.
- Drinking water source water assessments under § 1453 of the Safe Drinking Water Act, where the assessment results demonstrate for one or more pollutants regulated as drinking water contaminants under § 1412 that either a water quality standard has been exceeded, or is at risk of

being exceeded, or the concentration of a pollutant has increased since use of the waterbody as a public water supply began.

- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical, or biological integrity of streams, rivers, lakes, and estuaries.

- Data, information, and water quality problems reported by local, State, Territorial, or Federal agencies, Tribal governments, members of the public, and academic institutions.

Existing and readily available data and information includes both monitored data and evaluated data and information. Although it is usually preferable to base listing decisions on monitored data, there are situations where the decision may be based solely or primarily on evaluated data and information. In these cases, there must be assurances that the evaluated data and information are reliable and are in accordance with applicable data collection and/or quality assurance/quality control (QA/QC) program requirements.

What is a TMDL?

TMDLs are written plans and analyses established to ensure that the waterbody will attain and maintain water quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131) including consideration of reasonably foreseeable increases in pollutant loads. TMDLs must be established for waterbodies on Part 1 of the list of impaired or threatened waterbodies.

The total maximum daily load (TMDL) process is an essential element of the water quality-based approach to watershed management. It links the development and implementation of control measures to attainment of water quality standards. Through the establishment and implementation of a TMDL, pollutant loadings from all sources are estimated; links are established between pollutants, sources, and impacts on water quality; allowable pollutant loads can be allocated to each source; and appropriate control mechanisms can be established or modified so that water quality standards can be achieved.

Within each TMDL is a carefully identified allowable pollutant load. This pollutant load is the amount of a pollutant that may be contributed to a waterbody and still allow that waterbody to attain and maintain water quality standards. The allowable pollutant load is equivalent to the sum of wasteload allocations for point sources, load allocations for nonpoint sources, a margin of safety sufficient to account for uncertainty and lack of knowledge, and allowances for future growth.

What are the required elements of a TMDL submittal?

Ten discrete elements are required as part of a TMDL submittal:

- The name and geographic location of the impaired or threatened waterbody for which the TMDL is being established, as well as the geographic location of upstream waterbodies that contribute the pollutant for which the TMDL is being established (40 CFR 130.33(b)(1)).

- Identification of the pollutant for which the TMDL is being established and quantification of the target load of the pollutant that may be present in the waterbody and still ensure attainment and maintenance of water quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131) (40 CFR 130.33(b)(2)).

- Identification of the amount or degree by which the current pollutant load in the waterbody deviates from the target representing attainment or maintenance of water quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131) (40 CFR 130.33(b)(3)).

- Identification of the source categories, source subcategories, or individual sources of the pollutant for which the wasteload allocations and load allocations are being established consistent with 40 CFR 130.2(f) and 130.2(g) (40 CFR 130.33(b)(4)).

- Wasteload allocations to each industrial and municipal point source permitted under §402 of the Clean Water Act discharging the pollutant for which the TMDL is being established ; wasteload allocations for storm water, combined sewer overflows, abandoned mines, combined animal feeding operations, or any other discharges subject to a general permit may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated to attain or maintain water quality standards (minor or remotely located) may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that wasteload allocations when implemented, will attain and maintain water quality standards (40 CFR 130.33(b)(5)).

- Load allocations, ranging from reasonably accurate estimates to gross allotments, to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources; if possible, a separate load allocation should be allocated to each source of a pollutant, where this is not possible, load allocations may be allocated to categories of sources, subcategories of sources; pollutant loads that do not need to be allocated (minor or remotely located) may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that load allocations, when implemented, will attain and maintain water quality standards (40 CFR 130.33(b)(6))

- A margin of safety expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL; e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions which ensures attainment and maintenance of water quality standards for the allocated pollutant (40 CFR 130.32(b)(7)).

- Consideration of seasonal variation such that water quality standards will be met for the allocated pollutant during all seasons of the year (40 CFR 130.33(b)(8)).

- An allowance for future growth which accounts for reasonably foreseeable increases in pollutant loads (40 CFR 130.33(b)(9)).

- An implementation plan, which may be developed for one or a group of TMDLs (40 CFR 130.33(b)(10)).

As part of each TMDL, States, Territories, and authorized Tribes are also required to submit a summary of all public comments on the TMDL and responses to those comments. Responses must indicate whether the agency agreed or disagreed with each comment and why, as well as how comments were considered in the final decision (40 CFR 130.37(b)). States, Territories, and authorized Tribes should include a cover/submittal letter when submitting a TMDL to EPA for approval.

For what types of impairments are TMDLs established?

TMDLs are established for impairments or threats to a waterbody caused by identifiable pollutants, as defined by the CWA. TMDLs are not established for impairments or threats to a waterbody that are caused by pollution only (no identifiable pollutant). If it is unknown whether the cause of impairment is a pollutant or some type of pollution, EPA expects the waterbody to be included on Part 1 of the § 303(d) list and the pollutant(s) to be identified when TMDL establishment is initiated.

Are TMDLs established for specific pollutants?

TMDLs are established for the specific waterbody and pollutant combinations that States, Territories, and authorized Tribes identify on Part 1 of their § 303(d) lists. Separate TMDLs are required for each waterbody and pollutant combination, although States, Territories, and authorized Tribes are encouraged to establish TMDLs for multiple waterbodies within the same watershed in a coordinated manner.

TMDLs can also be established by using an appropriate surrogate for a broader type of impairment on a specific waterbody. The key is to frame the problem in a way that ties all aspects of TMDL establishment back to the pollutant and waterbody of concern. For example, acceptable surrogate targets for a TMDL that is developed to address violation of temperature criteria might be increasing the percent of stream cover or improving the channel morphology (e.g., establishing a smaller width-depth ratio and a more stable meander pattern). However, to be an acceptable surrogate indicator for the TMDL, a quantitative relationship between the surrogate indicator and the pollutant (in this case heat) must be established. This might require a detailed explanation about how stream cover or width-depth ratio is related to temperature. For example, streams that have a larger width-depth ratio tend to be shallow and wide, exposing more water volume to solar heating than streams that are deeper and narrower, supporting analysis and documentation justifying this approach is required..

At what geographic scale are TMDLs established?

There are no fixed rules regarding the appropriate size or scale of a TMDL. The geographic scale will vary considerably with the scope of the problem to be addressed and the location of sources that contribute to the problem. TMDLs may vary in scale from the entire basin to the watershed of small headwater streams to individual stream segments contaminated by a particular pollutant discharged by a limited number of sources. A TMDL might be too large if its size and complexity preclude meaningful monitoring, evaluation, and implementation. By contrast, a TMDL might be too small if its geographic scale is defined so narrowly that the entire problem area is not included in the analysis, and in particular if all sources contributing to the problem are not identified and addressed.

TMDLs can be developed for waterbodies of various sizes ranging from single stream reaches to whole basins well over 1,000 square miles in size. The geographic scale of the TMDL is primarily a function of

- Specific impairment or threat to designated use(s)
- Type of waterbody that is impaired
- Spatial distribution of use impairments
- Pollutant source locations
- Scale of similar assessment and planning efforts under way for the waterbody

Where impairments occur throughout a watershed, it is recommended that the analysis be conducted for smaller, more homogenous analytical units (subwatersheds). For example, specific impaired river

reaches might require detailed TMDLs to address individual sources. If this subwatershed approach is chosen, care should be taken to apply consistent methodologies within a basin from one subwatershed to the next so that an additive approach can eventually be applied to the larger basin.

How long do you have to establish all required TMDLs?

TMDLs for high-priority waterbody and pollutant combinations should be completed prior to completion of medium- and low-priority waterbody and pollutant combinations on Part 1 of the § 303(d) list (40 CFR 130.31(1)). TMDLs for all waterbody and pollutant combinations must be completed no later than 15 years after their initial placement on Part 1 of the § 303(d) list (40 CFR 130.31(2)). EPA expects States, Territories, and authorized Tribes to schedule establishment of TMDLs in a manner that will ensure the workload is reasonably distributed over the entire duration of the schedule (40 CFR 130.31(3)).

How can stakeholders and the interested public be involved and contribute to the § 303(d) listing and TMDL establishment process?

Public participation is a required component of the TMDL process and is often vital to a TMDL's success. Stakeholders can contribute credible, useful data and information about impaired or threatened waterbodies. They can also contribute more than their approval or disapproval for a specific TMDL. They might be able to raise funds for monitoring or to implement a specific control measure. More importantly, stakeholders can offer insights about their community that might ensure the success of one TMDL allocation strategy where an alternative strategy might fail, as well as the success of follow-up monitoring and evaluation activities.

Why is implementation essential to the successful TMDL?

To be effective in improving water quality, a TMDL must be more than an estimation of necessary pollutant reductions; it must be implemented. Therefore, every approved TMDL must include an implementation plan that explains the techniques that will be used to meet the load reductions identified. The plan also provides the mechanism for tracking the implementation of management measures and point source controls and monitoring the various relevant indicators of water quality conditions. Evaluation of the milestones identified in the implementation plan can be used to determine whether progress is being made toward meeting water quality standards.

Chapter 2. Identifying Impaired and Threatened Waterbodies and Setting Priorities for Establishing TMDLs

This chapter defines and clarifies the listing requirements of § 303(d) of the Clean Water Act (CWA). Its purpose is to help State, Territorial, or authorized Tribal water quality program managers better understand existing statutory and regulatory language so that lists are submitted to and approved by EPA in an efficient and timely manner. The chapter summarizes the necessary components of an approvable list and provides recommendations for the data elements to be reported for each impaired waterbody and pollutant or pollution combination. The relationship between the four parts of the list are discussed, and additional guidance is provided regarding EPA's expectation of the scope of the State's, Territory's, or authorized Tribe's listing methodology. Information is also provided on the meaning of the term "readily available data and information" and on interpreting narrative criteria and designated use impairments. The chapter also provides guidance regarding the role of monitoring and how data are interpreted to support listing decisions. Identifying minimum data requirements for making listing decisions and assessing the level of information quality are also discussed.

2.1 What is the § 303(d) List?

The § 303(d) list is a comprehensive public accounting of all impaired or threatened waterbodies, regardless of the cause or source of the impairment or threat. An impaired waterbody is one that does not attain water quality standards (designated uses, numeric and narrative criteria and anti-degradation requirements defined at 40 CFR 131). The standards violation might be due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a thermal discharge from one or more point sources, impairment means that the waterbody is not meeting the applicable State temperature criterion or does not have or maintain a balanced, indigenous population of shellfish, fish, and wildlife. A threatened waterbody is one that currently attains water quality standards but for which existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time the next list is required to be submitted to EPA.

A State's, Territory's, or authorized Tribe's list of impaired or threatened waterbodies must be submitted to EPA by October 1 of every [reserved] year, beginning in the year 2000 (40 CFR 130.30). State, Territorial, and authorized Tribal § 303(d) lists must include waterbodies impaired or threatened by pollutants, such as nitrogen, copper, and clean sediment, and by pollution, such as hydromodification and loss of habitat. Separate listings are required for each waterbody and pollutant or pollution combination. The source of impairment might be from point sources, nonpoint sources, atmospheric deposition, or a combination of these. Impaired or threatened waterbodies must be listed regardless of whether the pollutant or source of pollution is known and whether the pollutant/pollution source(s) can be controlled.

Federal agencies have an important role to play in helping to meet the goals of the CWA. Federal agencies should work cooperatively with States, Territories, and authorized Tribes to ensure that Federal lands comply with Federal, State, and local water quality requirements and to ensure that impaired and threatened waterbodies located on Federal lands are identified during the listing process. During its review of State, Territory, and authorized Tribe lists, EPA will verify that impaired or threatened waterbodies on Federal lands are identified and listed.

Summary of Statutory and Regulatory Requirements for Identifying Impaired or Threatened Waterbodies and Setting Priorities for Establishing TMDLs

All existing and readily available data and information must be assembled and considered to identify impaired or threatened waterbodies (§ 130.22(a)). Existing and readily available data and information includes, but is not limited to, the data and information in (§ 130.22(a))

- Your most recent EPA approved § 303(d) list;
- Your most recent Clean Water Act § 305(b) report;
- Clean Water Act § 319 nonpoint source assessments;
- Drinking water source water assessments under §1453 of the Safe Drinking Water Act where the assessment results demonstrate for one or more pollutants regulated as drinking water contaminants under § 1412 that (i) a water quality standard has been exceeded, or is at risk of being exceeded, or (ii) the concentration of a pollutant has increased since use of the waterbody as a public water supply began;
- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical or biological integrity of streams, rivers, lakes, and estuaries; and
- Data, information, and water quality problems reported from local, State, Territorial, or Federal agencies, Tribal governments, members of the public, and academic institutions.

States, Territories, and authorized Tribes are required to develop a methodology that explains how existing and readily available data and information were assembled and considered to make listing and priority decisions regarding the § 303(d) list (§ 130.23 and § 130.24). The methodology must (§ 130.23 (b), (c) and (d)):

- Specify the factors used to consider and evaluate the following types of data and information when making listing decisions:
  - Physical/chemical data and information
  - Biological data and information
  - Aquatic and riparian habitat data and information
  - Waterbody impairment and drinking water susceptibility analyses required under §130.22 (b)
- Identify the type of data and information considered to be "existing and readily available" and explain how the following are considered in making listing and priority ranking decisions:
  - Data quality and age
  - Degree of confidence in the information used to determine whether waterbodies are impaired or threatened
  - Number and degree of exceedances of numeric or narrative criteria and designated uses used to determine whether waterbodies are impaired or threatened
- Describe the selection factors used to include waterbodies on the list;
- Detail the process for resolving disagreements with other jurisdictions involving waterbodies crossed by State or authorized Tribal or international boundaries; and
- Describe the method and factors used to assign a priority ranking to waterbodies on Part 1 of the list.
- Describe how and for what reasons previously listed waterbodies will be removed from the list.
- Be made available for the public to make comments for at least 60 days (§ 130.23(a)).
- Be submitted to EPA by January 31 of every [reserved] year for review and comment, along with a summary of all comments received and the response of the State, Territory, or authorized Tribe to each comment (§ 130.24(a)).

States, Territories, and authorized Tribes are required to develop a comprehensive list of impaired or threatened waters (§ 130.25 through § 130.27). The list must

- Include all waterbodies that, based on all existing and readily available data and information, are impaired or threatened by individual pollutants, multiple pollutants, or pollution from any source regardless of whether the waterbodies are impaired or threatened by
  - a pollutant which is unknown at the time of the listing;
  - atmospheric deposition; or
  - point sources, only by nonpoint sources, or by a combination of point and nonpoint sources.
- Be divided into four parts:
  - Part 1 - Waterbodies impaired or threatened by one or more pollutants. TMDL required.
  - Part 2 - Waterbodies impaired or threatened by pollution, but not impaired or threatened by one or more pollutants. No TMDL required.
  - Part 3 - Waterbodies for which EPA has approved or established a TMDL and water quality standards have not yet been attained.
  - Part 4 - Waterbodies that are impaired, for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works are expected to result in attainment of water quality standards by the next listing cycle. No TMDL required.
- Identify the pollutant or pollutants causing the impairment or threat of impairment for each waterbody on Parts 1, 3, and 4 of the list.
- Identify the class of pollutants (e.g., metals, pesticides, industrial chemicals, or nutrient), if the specific pollutant is unknown at the time of listing.
- Identify the type of pollution causing the impairment or threat of impairment for each waterbody on Part 2.
- Identify the geographical location of each waterbody on the list, using a nationally recognized georeferencing system such as reach codes.
- Priority rank all waterbody and pollutant combinations on Part 1 of the list.
- Include a schedule for completing TMDLs for all waterbody and pollutant combinations on Part 1 of the list in accordance with the priority ranking (130.31)
- Be submitted to EPA for review and action by October 1 of every [reserved] year starting 2000 (§ 130.30).

A waterbody and pollutant or pollution combination must remain on the list until new data and information indicate that there is no longer an impairment or threat of impairment (§ 130.28)

Only Part 1 of the § 303(d) list must be prioritized (§ 130.25-27). The priority ranking

- Must assign a high, medium, or low priority ranking to each waterbody and pollutant combination on Part 1 of the list taking into account the severity of the impairment or threatened impairment and the designated uses of the waterbody.
- Must assign a high priority to waterbodies with water quality standards uses as public drinking water supplies and for waterbodies in which species listed as endangered or threatened under §4 of the Endangered Species Act (ESA) are present. When identifying high priority waterbodies, the presence of sensitive aquatic species and secondary factors such as the historical, cultural, economic, and aesthetic uses of the waterbody may also be considered.
- May assign a medium or low priority to waterbodies which have endangered or threatened species present, and have an approved Habitat Conservation Plan or other specific, enforceable mechanism developed in accordance with the Endangered Species Act, as long as the approved plan or other mechanism is specific to the pollutant and the waterbody of concern and demonstrates that water quality standards will be attained or maintained.
- Must explain how the severity of the impairment or threat of impairment and the designated use to be made of the waterbody were considered in assigning each priority ranking.
- May consider other factors in assigning each priority ranking, including efficiencies gained by developing TMDLs for waterbodies located in the same watershed; the value and vulnerability of particular waterbodies; the recreational, economic, and aesthetic importance of particular waterbodies; TMDL complexity; the degree of public interest and support; and State, Tribal, Territorial or national policies and priorities. Each additional factor must be identified and how it was used to assign priority rankings must be explained.

The schedule must reasonably pace the workload over time, ensuring that TMDLs are completed no later than 15 years from the date of the initial listing on Part 1 of the list.

States, Territories, and authorized Tribes must submit to EPA, and make public, information on how they assembled existing and readily available data and how those data were used in identifying impaired or threatened waterbodies. This requirement can be fulfilled by either applying an existing § 305(b) reporting methodology to the § 303(d) process or by using a different listing methodology for the § 303(d) list. In either case, this methodology must be made available to the public for review (for no less than 60 days) and then must be submitted to EPA by January 31 of each year in which a list is due. If States, Territories, or authorized Tribes fail to submit a § 303(d) list, EPA is required to identify and list impaired or threatened waterbodies for the State, Territory, or authorized Tribe.

Required Components and Format of the § 303(d) List

Each threatened or impaired waterbody and pollutant or pollution combination must be listed by States, Territories, and authorized Tribes on one of four distinct parts of the § 303(d) list. These parts are described below.

Part 1: Waterbodies impaired or threatened by a pollutant as defined in 40 CFR 130.2(d). EPA anticipates that the largest proportion of impaired and threatened waterbodies will be included on Part 1 of the list. TMDLs must be scheduled and established for all waterbodies listed in Part 1. If the cause of impairment is unknown at the time of listing, the waterbody should be included on Part 1 of the list and you must, to the extent possible, identify the class of pollutants, e.g., metals, pesticides, industrial chemicals, or nutrients.

Waterbodies are often impaired or threatened by more than one pollutant. It is important to recognize that each waterbody and pollutant combination must be listed separately on Part 1 of the list and TMDLs are to be scheduled for each waterbody and pollutant combination.

If you do not know whether a waterbody is impaired by a pollutant or some type of pollution, the waterbody must be included on Part 1and the class of pollutant identified. Supplemental data collection and analysis should assist in identifying the impairing pollutant so that the TMDL can be established. EPA anticipates that the pollutant will be identified when the TMDL is initiated.

Part 2: Waterbodies impaired or threatened by pollution as defined by 40 CFR 130.2(c) but not impaired or threatened by one or more pollutants. Waterbodies impaired or threatened by pollution, not by a pollutant, are included on Part 2 of the list. Review of the available data and information for the particular waterbody should show that no pollutants pose a significant threat or are a significant cause of impairment to the waterbody. If this is the case, the waterbody is listed on Part 2. EPA believes that in situations where the impairment is not caused by a pollutant, a TMDL is generally not the appropriate solution to the problem. In keeping with the principle that the § 303(d) list is an accounting of all impaired and threatened waterbodies, however, these types of waterbodies must remain on Part 2 of the list until water quality standards are attained by some other means.

EPA believes that Part 2 waterbodies will primarily consist of waterbodies impaired due to hydromodification. For example, a stream designated for aquatic use support might be impaired due to a dam that restricts flow. In this situation, there is no pollutant to allocate and a TMDL is not required. As well, there might be situations where water withdrawals eventually lead to some pollutant-related impairments (e.g., flow is so low that a pollutant concentration exceeds numeric criteria), EPA does not believe that TMDLs should be the solution to problems substantially caused by hydromodification.

Other conditions that may cause listing under Part 2 include exotic species (e.g., zebra mussels), noxious aquatic plants, radiation, and taste and odor problems.

Part 3: Waterbodies for which EPA has approved or established a TMDL and water quality standards have not yet been attained. Part 3 includes waterbodies and pollutant combinations for which TMDLs have been approved or established by EPA. These waterbodies must remain on the list until water quality standards are attained. Procedures for tracking implementation and monitoring the water quality conditions of these waterbodies are identified in the TMDL. These monitoring data must be considered when evaluating Part 3 waterbodies for potential delisting.

Part 4: Waterbodies that are impaired, but for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works or controls enforceable by State or Federal law or regulation that are expected to result in attainment of water quality standards by the next listing cycle. Part 4 includes waterbody and pollutant combinations for which TMDLs are not required because other required CWA controls are expected to attain water quality standards by the next listing cycle. The only controls that justify not listing an impaired or threatened waterbody on the § 303(d) list are the point source controls identified in § 301 and § 402 of the CWA. The listing submittal should identify the specific controls, funding, and construction schedules that are expected to result in implementation of the identified treatment needs. Supplementary analysis that demonstrates that the implementation of the point source controls will result in attainment of water quality standards should also be included (e.g., permit applications and limits, dilution analyses, and other modeling results). If a waterbody and pollutant combination listed on Part 4 does not attain water quality standards by the time the next list must be submitted to EPA, the waterbody and pollutant combination must be moved to Part 1 of the list, unless it is documented that failure to attain water quality standards is due to failure to comply with applicable technology-based requirements.

Submitting the § 303(d) List

Figure 2-1 presents a sample format for organizing the four parts of the § 303(d) list. In identifying specific waterbody and pollutant/pollution combinations on the list, States, Territories, and authorized Tribes should use the common data elements identified in this table. These data elements include information on the location of the waterbody, including the code of the U.S. Geological Survey (USGS) hydrologic unit (HU) in which the waterbody is located, the type of waterbody and size of impairment, the pollutant or type of pollution causing the impairment, all identified sources of the pollutant or pollution, and the designated uses of the impaired waterbody. Many of these data elements are already available within State/Territory/Tribal § 305(b) Waterbody System databases. Appendix A summarizes relevant codes for identifying pollutants. Appendix B, Table B-1, summarizes codes for identifying sources. For Part 1 of the list, information on the priority ranking of each waterbody and pollutant combination and the scheduled date for TMDL submittals should also be reported. As shown in Figure 2-1, certain data elements will not be relevant for certain parts of the list.

To specify a unique waterbody for the § 303(d) list, the same waterbody ID used in the State/Territory/Tribal § 305(b) Waterbody System database should be used, with a suffix added to the § 303(d) ID for the year of the listing cycle. To accommodate situations where the geographic scale of the § 303(d) waterbody is either larger or smaller than that of the reported § 305(b) waterbody, a separate § 303(d) ID may be derived. The resulting § 303(d) ID can then be used in association with other information on use attainment status or pollutant/pollution causes and sources and can be added to

Waterbody Name	303(d) ID[b]	305(b) ID[a]	HUC	Watershed ID	Waterbody Type	Waterbody Size	Pollutant	Type of Pollution	Source(s) of Impairment	Designated Uses	TMDL Establishment Priority	Anticipated Date of TMDL Submittal	Date First TMDL Established for Waterbody	Date Final TMDL Approved or Established by EPA
Part 1:														
Eagle Creek	SX-ABC123(1)-2000	SX-ABC123	01234567	Basin A	RIVER	2	Pathogens	---	Agriculture, Septage Disposal	Primary Contact	High	2002	2000	
Eagle Creek	SX-ABC123(2)-2000	SX-ABC123	01234567	Basin A	RIVER	2	Nitrogen	---	Municipal Point Sources	Aquatic Life	Medium	2003	2000	
Make-Believe Bay	SX-E123-2000	SX-E123	23568972	Basin B	ESTUARY	15	Chlorine	---	Municipal Point Sources	Aquatic Life	Low	2002		

Part 2:														
Dog Creek	SX-(*)GHI789-2000	Multiple	04567910	Basin C	RIVER	3.5	---	Flow Alterations	Hydromodification (Dam Construction)	Aquatic Life	---			
							---				---			
							---				---			
							---				---			
							---				---			
Part 3:														
Horse Lake	SX-XYZ-2000	SX-YYY	88887526	Basin E	LAKE	200	Nutrients	---	Agriculture, Municipal Point Sources	Recreation			2000	2000
Eagle Creek	SX-ABC(3)-2000	SX-ABC123	01234567	Basin A	RIVER	2	BOD	---	Municipal Point Sources	Aquatic Life			2000	2000

Part 4:														
Apple River	SX-KLM357-2000	SX-BBB	68792431	Basin E	RIVER	0.7	Cyanide	---	Industrial Point Source	Aquatic Life				

								---						

[a]303(d) ID and 305(b) ID are the same (except for the year suffix) if there is a 1:1 correspondence between a Waterbody ID and the geographic extent of the 303(d) waterbody.
[b]303(d) listing ID should be cross-referenced by the State to the Reach File 3.0 system.

Part 1: Waterbodies impaired or threatened by one or more pollutants
Part 2: Waterbodies impaired or threatened by pollution
Part 3: Waterbodies for which EPA has approved or established a TMDL and WQ standards have not yet been attained
Part 4: Waterbodies that are impaired, for which implementation of best practicable control technology for point Sources and secondary treatment for publicly owned treatment plants are expected to result in attainment of WQ standards by next listing cycle

Figure 2-1. Sample format for organizing the four parts of a § 303(d) list

geographic information system (GIS) data layers to facilitate mapping of § 303(d) and other water quality information.

EPA has created a national TMDL Tracking System database from the States' 1998 § 303(d) lists. EPA used State-supplied 303(d) IDs or developed new § 303(d) IDs where State IDs were not available. States, Territories, and authorized Tribes should use these existing IDs from the TMDL Tracking System whenever possible for their future § 303(d) lists. Doing so will save significant EPA and State, Territory, or authorized Tribe labor and avoid errors in georeferencing future § 303(d) lists to the EPA Reach File and its successor, the National Hydrography Dataset. TMDL Tracking System files including the existing § 303(d) IDs are available from the National 303(d) Coordinator.

EPA Reach File Version 3 (RF3) forms the basis for linking the § 303(d) ID to geographic information. RF3 is a national hydrologic database that uniquely identifies and interconnects more than three million stream segments or "reaches" that compose the nation's surface water drainage system. RF3 was created from digital hydrography data produced by the USGS. EPA enhanced these hydrography datasets by assigning a unique reach code to each stream segment, determining the upstream/downstream relationships of each reach, and, when possible, identifying the stream name for each reach. A variety of other reach-related attributes that support mapping, pollutant routing, and spatial analysis applications are also available. EPA and USGS are currently finalizing the National Hydrography Dataset (NHD). This successor to RF3 will have greatly improved accuracy and power.

Over the past four years, EPA has worked with several States, Territories, and authorized Tribes to georeference or reach index their § 305(b) waterbodies to RF3. Georeferencing means linking individual waterbodies to the coordinates of a hydrographic database like RF3. The process is done in a geographic information system (GIS) environment.
Concurrent with this reach indexing, EPA is creating a national TMDL Tracking System database that contains all waterbodies listed on 1998 § 303(d) lists. The Tracking System and reach indexing products are linked by unique § 303(d) IDs for mapping and spatial analysis.

States, Territories, and authorized Tribes may either develop their own GIS coverages/ shapefiles of § 303(d) waterbodies and submit them to EPA with their § 303(d) lists or adopt the standardized approach (preferred by EPA) of georeferencing their waterbodies to RF3. This standardized approach relies on reach indexing tools and GIS-related data files (event tables) developed by EPA in coordination with the States, Territories, and authorized Tribes.

The advantages of EPA's standardized approach to reach indexing include the following:

- The States, Territories, and authorized Tribes, the public, and EPA will be able to

Option 1: A State, Territory, or authorized Tribe uses the EPA approach. EPA's standardized approach is based on the creation of GIS event tables linked to the latest version of RF3. Event tables are an efficient alternative to creating large GIS coverages for every type of data (e.g., § 303(d) waterbodies, § 305(b) waterbodies, water quality standards segments, monitoring sites, etc.) and they are highly portable between systems. Reach indexing is performed by 8-digit USGS cataloging units (CUs). The participating State, Territory, or authorized Tribe will store a complete set of RF3 CU coverages, as well as event tables containing the locational data for the § 303(d) listed waterbodies. These two types of files (event tables and RF3 coverages) enable GIS mapping and spatial analysis. EPA has developed a process to assign a unique ID number for each § 303(d) record to link it to RF3, using the State, Territory, or authorized Tribe waterbody IDs whenever possible. To update § 303(d) event tables to reflect a new § 303(d) list, States, Territories, and authorized Tribes will use an ArcView-based program called the Reach Indexing Tool. With the Reach Indexing Tool, it is simple to add new § 303(d) waterbodies, delete old § 303(d) waterbodies, or change the geographic extent of waterbodies according to the wishes of the State, Territory or authorized Tribe.

view the locations of § 303(d) waterbodies and other features in a consistent format.

- The standardized approach allows spatial analysis of water quality problems across political boundaries (e.g., when a watershed crosses a State, Territory, or authorized Tribal jurisdiction). Without a standardized approach, agencies often have technical problems using each other's GIS coverages.

- Other approaches used by States, Territories, and authorized Tribes usually alter the underlying RF3 coverage, which destroys compatibility with other EPA, State, Territory, or authorized Tribe coverages. The EPA approach leaves the underlying RF3 (and eventually NHD) coverages unaltered to allow for EPA and the States, Territories, and authorized Tribes to have a common hydrographic dataset for all GIS-related activities in the future.

Option 2: A State, Territory, or authorized Tribe uses its own GIS coverages or shapefiles. Some States, Territories, and authorized Tribes have developed § 303(d) GIS coverages or shapefiles from their § 305(b) coverages. States, Territories, and authorized Tribes that elect to continue developing their own coverages should provide them to EPA along with their § 303(d) lists. These coverages must contain a field (typically a unique § 303(d) or § 305(b) ID) that links each record or shape to a specific entry in the § 303(d) list. EPA will then convert the State-, Territory-, or authorized Tribe-provided coverages or shapefiles to the standard national format (event tables) and give the State, Territory, or authorized Tribe an opportunity to review the resulting GIS maps before release to the public. Even States, Territories, and authorized Tribes with their own GIS coverages should consider maintaining a set of event tables georeferenced to RF3 because of the advantages listed below. The Reach Indexing Tool has a utility that helps automate the conflation of existing GIS coverages to event tables.

- The approach provides a link to other water quality data and permits coverages.

- EPA has developed user-friendly indexing tools and provides training and technical support. EPA will also support the transfer of locational information on § 303(d) waterbodies to the forthcoming NHD.

- RF3 segments in an event table can be broken to accurately delineate the waterbodies of a State, Territory, or authorized Tribe without altering the underlying RF3 coverage. Event tables can also accommodate certain complexities of some waterbodies, such as § 303(d) waterbodies that have overlapping extents.

- With updates of locational data each §303(d) cycle will become more routine and timely.

Key Questions to Consider When Formatting a § 303(d) List

- Has the list been divided into four distinct parts?
- Are specific waterbody and pollutant or pollutant type combinations listed on parts 1, 3, and 4 of the list?
- Are specific waterbody and pollution combinations listed on Part 2?
- Have all listed waterbodies been georeferenced?
- Has each listed waterbody been assigned a unique identifier?

2.2 Methodology for Identifying Impaired or Threatened Waterbodies

EPA regulations require States, Territories, and authorized Tribes to submit a written methodology that describes their approach for considering and evaluating the data and information used to develop their lists, as well as methodologies for prioritizing and scheduling TMDLs. Each State, Territory, and

authorized Tribe must provide the public the opportunity to review and comment on this methodology for no less than 60 days. After the review period, the methodology must be submitted to EPA by January 31 of each year the § 303(d) list is due. Following submittal, EPA will review the listing and priority ranking methodology and provide, as appropriate, comments on the methodology in advance of the list submission. EPA will not approve or disapprove a listing methodology, but will consider the methodology in its review of the list.

The methodology should include the "decision rules" used to identify impaired or threatened waterbodies and to put waterbodies on Parts 1 through 4 of the list. It should include a description of the State's, Territory's, or authorized Tribe's overall approach to listing, including priority setting and scheduling; a description of how existing and readily available data and information were assembled, evaluated, and considered; and an explanation of how the State, Territory, or authorized Tribe considered data and information from habitat assessments, bioassessments, physical/chemical monitoring, and waterbody impairment and drinking water susceptibility analyses required under §130.22(b). The listing methodology must also include a description of a process for resolving disagreements involving the condition and priority of waterbodies crossed by State, Territory, authorized Tribal, or international boundaries. The decision process and justification for removing waterbody and pollutant or pollution combinations from the list must also be clearly explained.

Although EPA does not specify which information or rules States, Territories, and authorized Tribes must use to identify impaired and threatened waterbodies, the Agency does require, at a minimum, a description of existing and readily available data and information and an explanation of how the following factors are considered in making listing and priority ranking decisions:

- Data quality and age.

- Degree of confidence in the information used to determine whether waterbodies are impaired or threatened.

- Number and degree of exceedances of numeric or narrative criteria and designated uses used to determine whether waterbodies are impaired or threatened.

The purpose of submitting the listing methodology eight months prior to submitting the § 303(d) list is to ensure that the public and EPA know and understand how the State, Territory, or authorized Tribe is assembling and considering existing and readily available data and information to develop its list. EPA believes that the process most States, Territories, and authorized Tribes use for completing § 305(b) reports is sufficient to characterize the quality of their waterbodies, including those impaired and threatened waterbodies required to be listed under § 303(d).

Figure 2-2 describes the conceptual relationship between § 305(b) use support decisions and § 303(d) impaired or threatened waterbodies. In the past, different characterizations of the same waterbodies in these reports has caused confusion and led to questions concerning the integrity of all CWA assessment and listing requirements. In most situations, waterbodies identified as not supporting or partially supporting their designated uses in the § 305(b) report should be identified as impaired on the § 303(d) list. Similarly, waterbodies identified in the § 305(b) report as threatened should also be identified as threatened and considered for inclusion on the § 303(d) list.

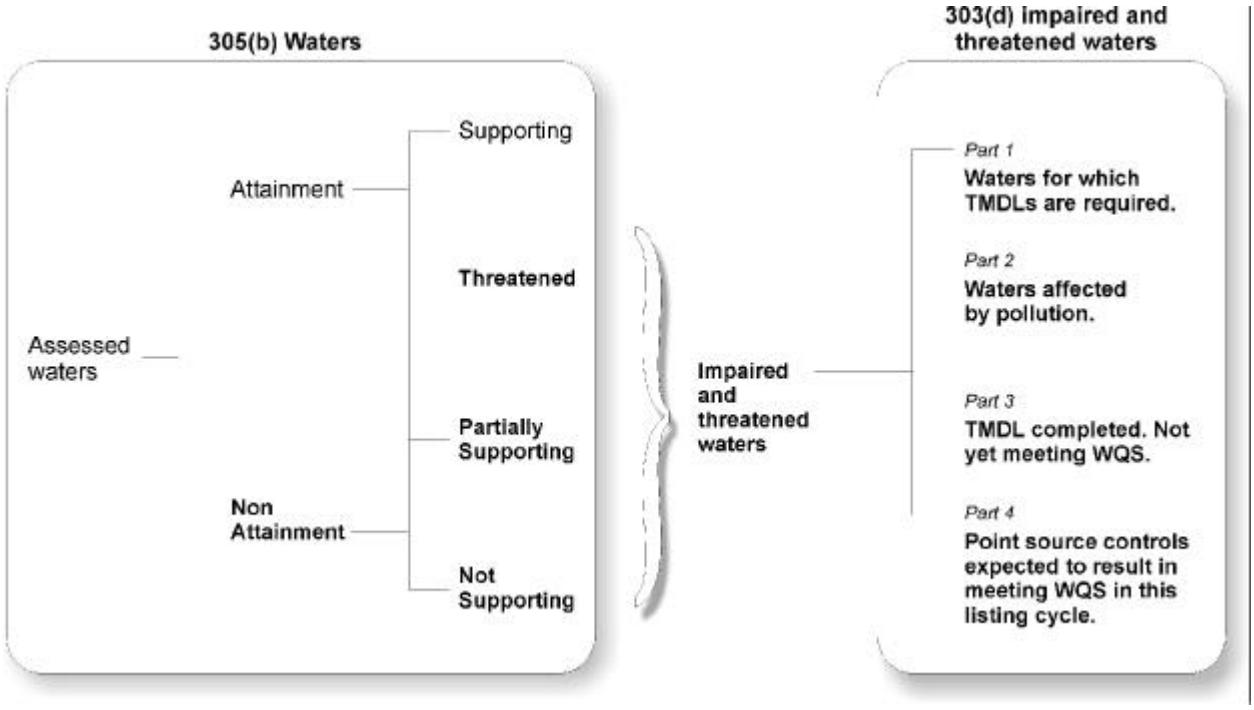


Figure 2-2. Conceptual Relationship between 305(b) and 303(d) lists.

Key Questions to Consider When Developing a Listing Methodology

- What are the "decision rules" for identifying impaired or threatened waterbodies?
- What sources of data and information will be used to identify impaired or threatened waters?
- How do data quality and age affect listing and priority ranking decisions?
- What are the specific minimum requirements for data used to support listing decisions?
- How does the degree of confidence in available data and information affect listing and priority ranking decisions?
- How do the number and degree of exceedances of numeric or narrative criteria and designated uses affect listing and priority ranking decisions?
- How are priorities established for the waterbody and pollutant combinations listed on Part 1?
- What factors are considered when establishing the schedule for completing TMDLs?
- How are data and information from habitat assessments, bioassessments, physical/chemical monitoring, and waterbody impairment and drinking water susceptibility analyses considered?

2.3 Identifying Impaired or Threatened Waterbodies

To develop a comprehensive list of all impaired or threatened waterbodies, as well as the scope of the impairment or threat, a State, Territory, or authorized Tribe is required to consider (see Section 1-3) all existing and readily available data and information. The monitoring programs and cooperative data collection efforts of States, Territories, and authorized Tribes form the basis for listing decisions. Other sources of existing and readily available data and information include the public and Federal, State, and local agencies.

How Does Monitoring Support Listing Decisions?

A well-designed monitoring program is vital to a State's, Territory's, or authorized Tribe's efforts to characterize, identify, and ensure the protection and restoration of impaired or threatened waterbodies. Monitoring supports both listing and TMDL establishment decisions, as well as post-TMDL evaluation and tracking of standards attainment. Monitoring is essential to accurate lists, strategic collection of data to support TMDL establishment, streamlined TMDL establishment, and an improved understanding of water quality concerns, sources, and processes. As experience is gained in the TMDL process and related monitoring efforts, the design of monitoring strategies and interpretation of data will continue to improve. Specific areas where monitoring provides information to support listing decisions are summarized below:

- Identifying impaired or threatened waterbodies, including evaluating the pollutant(s) or pollution causing the impairment, evaluating potential sources, examining the magnitude or severity of the problem, and confirming the need to list the waterbody.

- Assigning a priority ranking to Part 1 waterbody and pollutant combinations and determining efficient schedules for TMDL development.

- Tracking compliance with water quality standards for Part 3 and Part 4 waterbody and pollutant combinations.

- Determining whether TMDL refinement is needed for Part 3 waterbody and pollutant combinations.

Monitoring performed before and during the list development process also supports establishing the TMDL. Some of the key points at which monitoring supports TMDL analysis include

- Selection of target values and evaluation of deviation from target
- Evaluation of the pollutant sources
- Estimation of source loadings
- Data for modeling and analysis of the TMDL linkage between source and targets

Although different types and quantities of monitoring data might be collected to support the various components of the listing and TMDL establishment processes, data are often used to support multiple objectives (e.g., § 305(b), § 303(d), TMDL establishment, and compliance monitoring). By coordinating various data collection activities, these multiple objectives can be addressed efficiently.

One of the techniques used by States, Territories, and authorized Tribes to organize water quality evaluations and management is the rotating watershed or basin approach. This approach can lead to a more comprehensive assessment of problems in individual watersheds, increase stakeholder involvement in watershed restoration, and ensure more efficient use of staff and financial resources in the water quality agency. The rotating basin approach involves monitoring a delineated watershed or basin according to a predetermined cycle (e.g., for one full year every five years) and using the data (1) to identify impaired or threatened waterbody and pollutant combinations causing impairments or threats, (2) to prepare or update a basinwide plan including a schedule for establishing TMDLs, (3) to implement controls, and (4) to monitor progress toward attainment of water quality standards. Selection of monitoring sites for each rotating basin survey is based on various factors:

- Known and suspected areas of point and nonpoint source impacts
- Previous § 303(d) listed and § 305(b) reported impaired waterbodies
- Outstanding resource waters
- Location of water intakes, landfills, and other features

Use of a rotating basin approach helps ensure that key information sources and other tools will be organized in a way that facilitates timely identification of impaired or threatened waterbodies and establishment of TMDLs.

Meeting TMDL Requirements in Mississippi Using a Rotating Basin Approach

The Mississippi Department of Environmental Quality (MDEQ) is implementing a Basinwide Approach to Water Quality Management to enable the state to comprehensively assess its waters for segments needing TMDLs, and establish those TMDLs over the next 13 years. Mississippi's 1998 § 303(d) list contains approximately 180 waterbody segments in need of TMDLs, and includes several hundred more segments listed as "potential waters of concern" based on previously evaluated information (i.e., information that does not include sufficient monitoring data to support decisions about the need for TMDLs).

MDEQ has divided the state into five basin groups to coordinate and administer key water quality activities. For each basin group, MDEQ plans to work through a five-phased management cycle to develop and implement watershed management plans that detail TMDLs, including implementation strategies. The five phases are: (1) Planning; (2) Data Collection; (3) Data Assessment and TMDL Development; (4) Basin Plan and TMDL Implementation Strategy Development; and (5) Implementation.

It is not feasible or cost-effective for MDEQ to conduct the same phase in every basin group at the same time. Therefore, MDEQ has established a schedule for sequencing the phases across the basin groups to balance workloads and provide for more focus in any given year. For example, in 2002 MDEQ will be implementing basin plans and TMDLs in the Big Black/Tombigbee group, developing basin plans and TMDL implementation strategies in the Yazoo group, conducting § 305(b) assessment and TMDL development in the South Independent/Pearl group, collecting data in the Pascagoula group, and prioritizing issues and planning data collection for the Coastal/North Independent/Tennessee group. Under this schedule, the first full iteration of the management cycle will have been completed in all basin groups by the end of 2006.

MDEQ plans to use this repeating cycle to coordinate its update of the State's § 303(d) list and to develop all currently needed TMDLs by the end of the second iteration of the cycle. During the first iteration of the cycle, MDEQ will—to the extent that resources are available—develop TMDLs for all waterbody segments on the § 303(d) list that are based on assessments made using monitoring data. Segments identified as "potential waters of concern" will be monitored during the first iteration of the basin cycle to verify whether the segments are actually impaired. Those previously evaluated segments that are verified by monitoring data as impaired will then have TMDLs developed for them during the second iteration of the basin cycle (currently scheduled to end in 2011), along with lower priority TMDLs not completed during the first iteration. As the cycle proceeds, waters added to the § 303(d) list during one iteration will be prioritized for TMDL development during the next iteration.

For more information about the rotating basin approach and its advantages, refer to *Watershed Protection: A Statewide Approach* (EPA-841-R-95-004) and Appendix B of the 1998 § 305(b) guidelines (EPA-841-B-97-002B), as well as the *Watershed Management Facilitation* and *Academy 2000 Distance Learning* pages on the EPA Watershed Academy website (http://www.epa.gov/owow/watershed/wacademy/).

Assembling Existing and Readily Available Data

EPA regulations require that States, Territories, and authorized Tribes assemble all existing and readily available data and information to develop a list of impaired or threatened waterbodies (40 CFR 130.22). EPA regulations also explain that existing and readily available data include, at a minimum, the following data and information:

- Most recent EPA-approved § 303(d) list.
- Most recent § 305(b) report.
- CWA § 319 nonpoint source assessments.
- Drinking water source water assessments under § 1453 of the Safe Drinking Water Act, where the assessment results demonstrate for one or more pollutants regulated as drinking water contaminants under § 1412 that either a water quality standard has been exceeded or is at risk of being exceeded, or the concentration of a pollutant has increased since use of the waterbody as a public water supply began.
- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical, or biological integrity of streams, rivers, lakes, and estuaries.
- Data, information, and water quality problems reported by local, State, Territorial, or Federal agencies, Tribal governments, members of the public, and academic institutions.

In addition to these six categories of data and information, Table 2-1 identifies several other types of information to be considered for § 303(d) listing decisions. Many of these categories of information are included in States', Territories', or authorized Tribes' § 305(b) reports or databases.

Table 2-1. Other examples of existing and readily available data and information to be considered for § 303(d) listing decisions.

1	Waterbodies where fishing or shellfish bans and/or advisories are currently in effect or are anticipated and waterbodies where there have been repeated fish kills or where abnormalities (cancers, lesions, tumors, etc.) have been observed in fish or other aquatic life during the last 10 years.
2	Waterbodies where there are restrictions on water sports or recreational contact.
3	Waterbodies identified by the State, Territory, or authorized Tribe as priority waterbodies. (Water quality management plans often include lists of priority waterbodies, which are those waterbodies which most need water pollution control decisions to achieve water quality standards or goals.)
4	Waterbodies where ambient data indicate potential or actual exceedances of water quality criteria due to toxic pollutants from an industry classified as a primary industry in Appendix A of 40 CFR Part 122.
5	Waterbodies for which effluent toxicity test results indicate possible or actual exceedances of State, Territorial, or authorized Tribal water quality standards, including narrative "free from" water quality criteria or EPA water quality criteria where State, Territorial, or authorized Tribal criteria are not available.
6	Waterbodies classified for uses that will not support the "fishable/swimmable" goals of the CWA.
7	Waterbodies identified by the State, Territory, or authorized Tribe as impaired in its most recent Clean Lake Assessment conducted under § 314 of the CWA.
8	Surface waterbodies impaired by pollutants from hazardous waste sites on the National Priority List prepared under § 105(8)(A) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Existing and readily available data and information include both monitored data and evaluated data and information. Monitored data refers to direct measurements of water quality, including sediment and some fish tissue analyses. Evaluated data and/or information provides an indirect appraisal of water quality through such sources as information on historical adjacent land uses, riparian health and habitat, location of sources, results from predictive modeling, and some surveys of fish and wildlife.

For types of impairment amenable to assessment using monitored data, EPA prefers that States, Territories, and authorized Tribes base § 303(d) listing decisions on monitored data for all their waterbodies. EPA recognizes, however, that most environmental agencies' monitoring networks might not be comprehensive enough to provide such information, in terms of both the geographic scope and the types of data collected. In addition, some types of impairments might not be amenable to monitored data. As a result, agencies might sometimes need to use evaluated data and information. For example, evaluated data and information can be especially useful in determining attainment of uses. This information is appropriate to use in direct support of listing decisions only when it is reliable and in accordance with applicable data collection and/or QA/QC program requirements.

Using Dilution Calculations and Predictive Models to Support Listing

Dilution calculations and predictive models can also be used in some cases to identify impaired and threatened waterbodies. Models provide techniques for relating meteorologic conditions, pollutant loads, and waterbody characteristics to ambient water quality conditions. Some models are developed as statistical relationships between measured conditions and monitoring. Other more complex models evaluate and/or simulate in more detail environmental processes such as rainfall, snowmelt, runoff, or pollutant transport. Other models have been developed for specific applications. Discussion of the use of mixing zone and dilution models in TMDL development and wasteload allocation analyses is provided in *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a).

Models and supplementary analyses may be used by States, Territories, and authorized Tribes to support the following evaluations of existing or threatened impairments:

- Evaluation of potential existing impairment under current loading conditions (i.e., based on existing permits and historic nonpoint source loadings). This evaluation is often used to examine the overlapping effects of multiple point source discharges.

- Evaluation of the threat of future impairment under proposed loading conditions based on revised permit limits, existing permit limits, and existing or future nonpoint source loading conditions.

- Evaluation of the applicability of old or outdated monitoring data to current conditions. If historic monitoring showed impairment and loading conditions have changed significantly over time, modeling can be used to consider the level of impairment under existing loading conditions.

- Evaluation of specific critical conditions, such as persistent low flow conditions, under various loading scenarios to determine whether water quality standards are likely to be violated. This analysis allows the extrapolation from existing monitoring data to the critical conditions under which problems are likely to occur and water quality standards need to be protected.

- Identification of waterbodies where high pollutant loads may affect sensitive receiving waters.

Decision Process for Identifying Impaired or Threatened Waterbodies

It is very important that § 303(d) listing decisions be based on sound, high-quality, scientific information. As a reflection of this, EPA is requiring States, Territories, and authorized Tribes to document the level of information quality (or rigor) used in making listing decisions. EPA is also requiring that States, Territories, and authorized Tribes use specific minimum data requirements for considering and evaluating chemical, physical, and biological data. The documentation regarding the level of information quality and specific minimum data requirements used in making listing decisions are to be explained in the listing methodology.

305(b) Aquatic Life Use Support Guidelines as a Decision Process

EPA believes that the aquatic life use support guidelines available in the § 305(b) guidelines (EPA-841-B-97-002A and -002B) are the best decision rules available for use by States, Territories, and authorized Tribes in assessing the quality of data. EPA recommends that States, Territories, and authorized Tribes consider the process developed by the EPA/State § 305(b) Consistency Workgroup for defining levels of information quality or rigor for assessing aquatic life use support (ALUS). The tables developed by the Workgroup show a hierarchy of information quality for bioassessment data, habitat data, and physical/chemical data. In these tables, level 3 or 4 data provide a relatively high level of certainty of aquatic life use support or impairment. Level 1 or 2 data represent less rigorous approaches adequate for ALUS determinations, although generally with a lower degree of certainty.

The tables illustrate an approach for evaluating rivers and streams, although a similar approach is appropriate and possible for other waterbody types. Table C-1 in Appendix C, for bioassessment approaches covers the range of bioassessment information needed for § 305(b) and § 303(d) determinations. It points out, for example, that the highest level of bioassessment information requires assessment of two assemblages (e.g., fish and macroinvertebrates) by professional biologists, the use of regional reference conditions, and broad spatial coverage of sampling sites. Some States, Territories, and authorized Tribes are achieving level 3 or 4 data in their biomonitoring programs, while several other State, Territorial, or authorized Tribal programs are at level 2. Habitat Approaches, Table C-2 in Appendix C, reflects the fact that habitat measures are important to assessing ALUS. The highest level of information is based on quantitative measurements of numerous instream and floodplain characteristics, comparisons to a reference habitat condition, and broad spatial coverage. Physical/chemical approaches, Table C-4 in Appendix C, requires broad spatial and temporal coverage with sufficient frequency to capture acute events to achieve level 3 certainty.

The § 305(b) guidelines also include recommendations for minimum data requirements for making ALUS determinations based on different types of monitoring data. Table C-5 in Appendix C summarizes these minimum data requirements and serves as a good example of the type of information that EPA expects States, Territories, and authorized Tribes to submit with their listing methodologies.

Interpreting Narrative and Designated Use Impairments

Narrative criteria and designated use impairments must also be interpreted in making listing decisions. Whenever possible this should be done by identifying a quantified target that more readily interprets a designated use or narrative criterion impairment. For example, a narrative criterion specifying no "nuisance algal growths" in a lake could be related to a specific average summer chlorophyll *a*

concentration. Similarly, a spawning use might be quantified by identifying the specific percentage of cobble embeddedness associated with a decline in the fishery.

EPA's Advance Notice of Proposed Rulemaking (ANPRM) describes current requirements for States, Territories, and authorized Tribes to identify the procedures they intend to use to interpret and implement narrative criteria as they pertain to point source discharges of toxics (63 FR 36765, July 7, 1998). EPA believes that similar requirements are necessary for the interpretation of narratives as they pertain to nonpoint sources and pollutants in addition to toxics. As such requirements are developed in the future, they should be applied for § 303(d) listing decisions.

Interpreting Antidegradation Policies

State, Territorial, and authorized Tribal antidegradation policies are a part of a complete water quality standards program (40 CFR 131.3(i)). There are three tiers to such an antidegradation policy:

- *Tier 1:* Maintain existing uses of surface waterbodies and prevent degradation that could interfere with those uses.

- *Tier 2:* Protect high quality waters.

- *Tier 3:* Provide special protection for "Outstanding Natural Resource Waters," such as waters of national or state parks, waters of wildlife refuges, or other waters of exceptional recreational or ecological significance.

At 40 CFR 130.26, EPA explains how to apply a water quality standards antidegradation policy when developing your § 303(d) list. A Tier 2 waterbody is impaired and must be listed when the level of water quality that existed at the time the waterbody was designated as Tier 3 has declined. A Tier 3 waterbody is threatened and must be listed when adverse trend data and information indicates that a designated use will no longer be attained by the time of the next listing cycle. A Tier 1 waterbody is impaired and must be listed if it is not maintaining a designated or more protective existing use. A Tier 1 waterbody is threatened and must be listed when an adverse trend indicates that a designated use or a more protective existing use will no longer be attained by the time of the next listing cycle.

Geographic Scope of Listed Waterbodies

Listed waterbodies can vary in size from stream segments of a few miles to entire watersheds. The geographic extent of

A Good Starting Point for Preparing § 303(d) lists

In preparing their § 303(d) lists, approximately three-fourths of the States, Territories, and authorized Tribes use the geographic units called waterbodies from the §305(b) process. They track their water quality assessment data (including designated use support, pollutants/stressors, and sources of impairment) by waterbody. Many States, Territories, and authorized Tribes also have GIS data layers of these waterbodies for mapping. The use of § 305(b) waterbodies can thus simplify the listing process and promote consistency within the water quality agency. Site-specific considerations are applied to decide whether the waterbody should be based on an aggregation of several waterbodies or whether the waterbody requires the definition of a portion within a 305(b) waterbody (a subwaterbody component, segment, or detail). For instance, if the TMDL involves restoration measures for spawning habitats for anadromous fishes, the geographic range might involve numerous waterbodies over a series of watershed units. If the TMDL issues involve the remediation of a very limited extent of contaminated sediment in a river, the appropriate geographic range might be a short segment within a larger 305(b) waterbody.

the listing should correspond to where water quality is impaired or threatened. When an impairment is caused by a single point source discharger or a nonpoint source issue affecting only a small area, the listed waterbody might encompass only a small geographic area (e.g., a 2-mile stream segment or a portion of an estuary). When impairments occur throughout a larger geographic area, as might be the case for impairments associated with some nonpoint sources, the size of a listed waterbody might involve larger segments of a stream, an entire lake or estuary or, in some cases, all waterbodies in a watershed.

It is important to recognize that the geographic extent of a listed waterbody and pollutant or pollution combination will not necessarily be the same as the geographic extent of the TMDL(s) developed for each combination. Many water quality impairments or threats are caused by multiple sources within a watershed and require complex solutions. The impairment of a lake due to excessive nutrient concentrations, for example, might require the allocation of load reductions to sources distributed throughout a watershed. In this situation the lake would be listed as impaired although the subsequent TMDL and implementation would be established to address the entire watershed.

Key Questions to Consider When Identifying Impaired or Threatened Waterbodies

- How can you monitoring program be used to help identify impaired or threatened waterbodies?
- Have all sources of the data and information used to identify impaired or threatened waterbodies been clearly identified?
- Do these include the minimum data and information sources that EPA requires to be used?
- If no, is there a sound explanation as to why a specific data/information source was not used?
- Has the process developed by the EPA/State § 305(b) Consistency Workgroup for defining levels of information quality or rigor for assessing aquatic life use support been used to identify impaired or threatened waterbodies?
- Has Antidegradation Policy been considered?

2.4 Developing the Four Parts of the List

Each threatened or impaired waterbody and pollutant or pollution combination must be listed by the State, Territory, or authorized Tribe on one of four distinct parts of the § 303(d) list. These parts are described in Section 2.1 and listed below:

- *Part 1:* Waterbodies impaired or threatened by a pollutant as defined in 40 CFR 130.2(d).

- *Part 2:* Waterbodies impaired or threatened by pollution as defined by CFR § 130.2(c) but not impaired or threatened by one or more pollutants.

- *Part 3:* Waterbodies for which EPA has approved or established a TMDL, and water quality standards have not yet been attained.

- *Part 4:* Waterbodies that are impaired, for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works or controls enforceable by State, Territorial, authorized Tribal or Federal law or regulation are expected to result in attainment of water quality standards by the next listing cycle. A TMDL is not required for waterbodies on this part of the list. If a waterbody on Part 4 does not attain water quality standards by the time the next list is due to EPA, it must be included on Part 1 of the list.

Figure 2-3 illustrates the relationships among the four separate parts of a § 303(d) list. EPA anticipates that most waterbody and pollutant combinations will be reported on Part 1. TMDLs are to be established for these waterbody and pollutant combinations. At the time of the next listing cycle, waters will remain

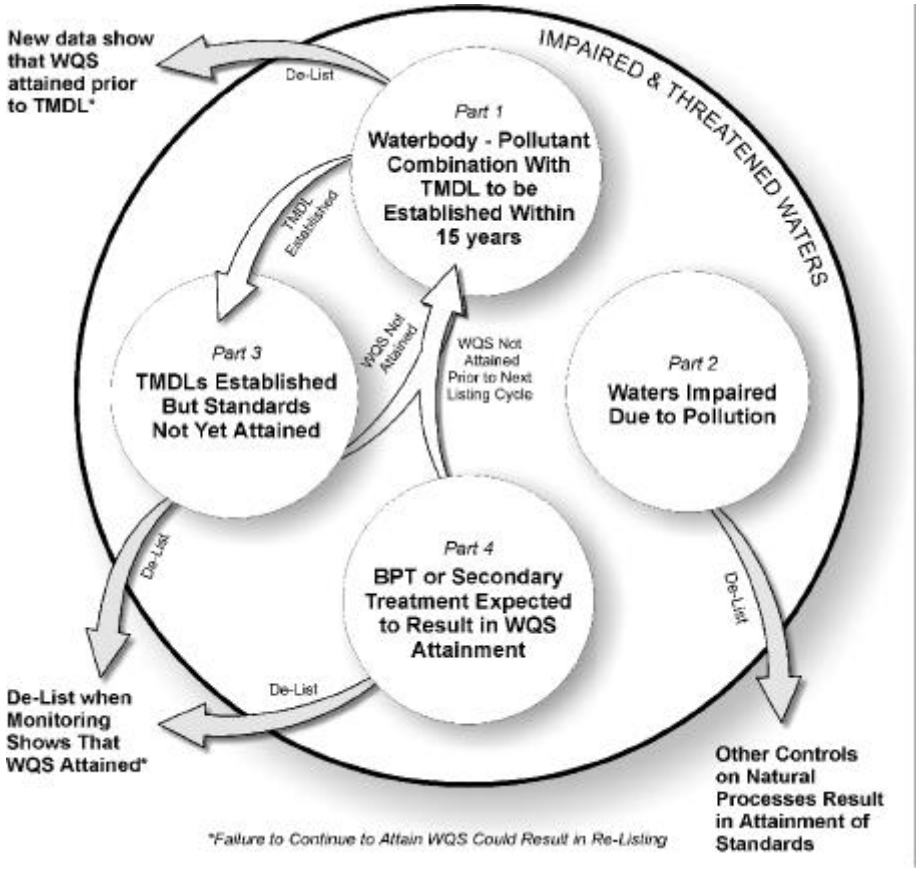


Figure 2-3. Relationships between the four parts of the § 303(d) list.

on the list, be removed from the list (if water quality standards have been attained) or moved to Part 3 of the list (if a TMDL is established and water quality standards have not been attained). Waterbody and pollutant combinations can also be removed from Part 1 of the list if new data or information indicate that the waterbody has attained water quality standards or is no longer threatened.

Waterbody and pollution combinations are reported on Part 2 of the list. The only way that these waterbodies can be removed from the list is if water quality standards are attained or if new data and information demonstrate that the waterbody was incorrectly identified as impaired by pollution.

Waterbody and pollutant combinations where a TMDL has been established are reported on Part 3 of the list. If monitoring demonstrates that water quality standards have been attained, the waterbody and pollutant combination is removed from the list. Under some conditions evaluation of new information might determine that the TMDL is not appropriate or sufficient to result in attainment of water quality standards. A Part 3 waterbody would then be returned to the Part 1 list for revision of the TMDL.

Waterbody and pollutant combinations identified on Part 4 of the list are expected to attain water quality standards before the next listing cycle because of the implementation of best practicable control technology for point sources or secondary treatment for publicly owned treatment works or controls enforceable by State or Federal law or regulation that are expected to result in attainment of water quality standards by the next listing cycle. No TMDLs are required for these waterbody and pollutant

combinations. If a waterbody does not attain water quality standards by the time the next list is due to EPA, the waterbody and pollutant combination must be moved to Part 1 of the list unless it can be documented that the failure to attain water quality standards is due to failure to comply with applicable technology-based requirements.

When deciding to remove a waterbody and pollutant or pollution combination from any part of the list, you must use at least the same level of data as used for making the initial listing decisions.

In developing the four-part list, a clear decision process should be established and described in the State's, Territory's, or authorized Tribe's methodology. The decision process should be well documented and clearly conform to the definitions and requirements set out in the regulation and guidance. An illustration of the steps in sorting waterbodies into the four parts of the list is provided in Figure 2-4. This illustration shows the sequential questions and the supporting data used at each point in the decision process. The first step differentiates between waterbodies impaired by pollution and waterbodies impaired by pollutants. Waterbodies may be listed as waterbody and pollutant and waterbody and pollution combinations on Part 1 and Part 2 of the list, respectively. The second step moves those waterbody and pollutant combinations with completed TMDLs to Part 3 of the list. The third step moves waterbody and pollutant combinations with point source management activities, where compliance with water quality standards is expected to occur before the next listing cycle, to Part 4 of the list. All remaining waterbody and pollutant combinations are placed on Part 1 of the list.

Key Questions to Consider When Developing the Four Parts of the List

- Is Part 1 of the list composed only of waterbodies impaired or threatened by a pollutant, as defined in 40 CFR 130.2(d)?
- Is Part 2 of the list composed only of waterbodies impaired or threatened by pollution, as defined by CFR § 130.2(c)?
- Is Part 3 of the list composed only of waterbodies for which EPA has approved or established a TMDL, but where water quality standards have not yet been attained.
- Is Part 4 of the list composed only of waterbodies that are impaired, but for which implementation of best practicable control technology for point sources and secondary treatment for publicly owned treatment works are expected to result in attainment of water quality standards by the next listing cycle?
- If deciding whether to remove a waterbody and pollutant or pollution combination from the list, is the new data/information at least the same level as that used to list the combination originally?

2.5 Priority Ranking

The goal of priority ranking is to focus attention on the right waterbodies at the right time, while enabling a State, Territory, or authorized Tribe to make efficient use of its available resources and meet the objectives of the CWA. Once waterbodies needing TMDLs have been identified, a State, Territory, or authorized Tribe should prioritize those waterbodies using established ranking procedures that consider all water pollution control activities within the State, Territory, or lands of the authorized Tribe. EPA anticipates that the priority rankings will reflect the relative value and benefit of those waterbodies within the State, Territory, or Tribal land and take into account the severity of the impairment or threatened impairment, especially threats to human health and endangered species, and the designated uses of the waterbody (CWA § 303(d)(1)(A); 40 CFR 130.28).

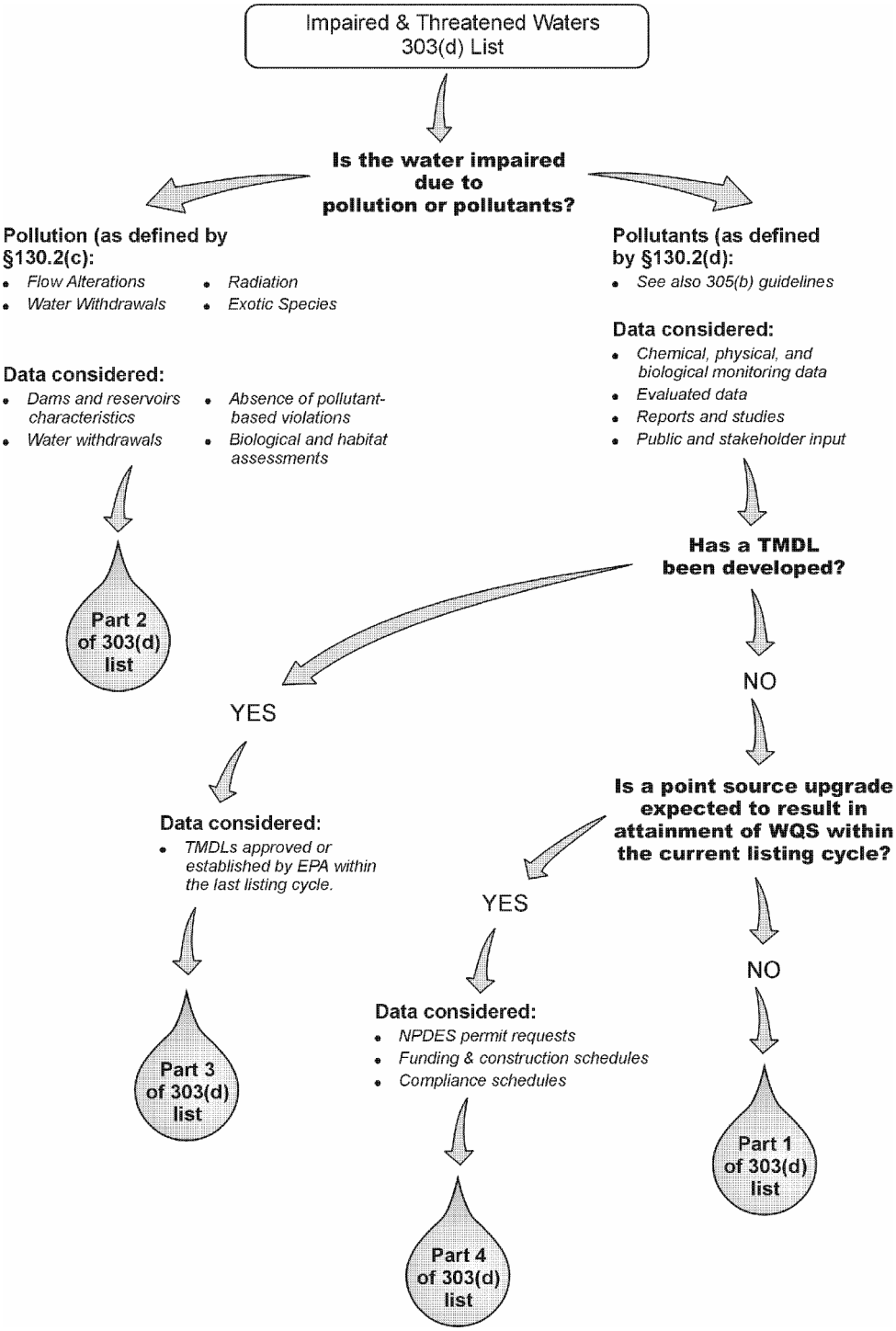


Figure 2-4. Decision process for distributing waterbodies in the four parts of the 303(d) list.

Minimum Requirements for Priority Ranking

Prioritization strategies may vary in complexity and design and should be thoroughly documented in the § 303(d) listing methodology. However, there are minimum requirements for such strategies, and regardless of their complexity and design, they are expected to result in a schedule for completing TMDLs that is realistic and distributed proportionately over time. These requirements, summarized below, must be submitted to EPA for review and approval as part of the § 303(d) list:

- A priority ranking of "high," "medium," or "low" for each waterbody and pollutant combination on Part 1 of the list, taking into account the severity of the impairment or threatened impairment and the designated uses (40 CFR 130.28(a)).

- A priority ranking of "high" for all waterbodies that are public water supplies for which there is a violation of an MCL and/or have pollutants that are causing an impairment or threat for species listed as threatened or endangered under §4 of the Endangered Species Act, unless there is information showing that the impairment does not affect the species. When identifying your high priority waterbodies, you may also consider the presence of sensitive aquatic species and, as secondary factors, historical, cultural, economic, and aesthetic uses of the waterbody (40 CFR 130.28(b)).

- An explanation of how the State, Territory, or authorized Tribe has accounted for the severity of the impairment or threat of impairment and the designated uses of a waterbody in assigning priority rankings to each waterbody and pollutant combination on Part 1 of the list (40 CFR 130.28(c)).

- Identification of any additional factors that are considered in the prioritization strategy. These may include, but are not limited to, efficiencies gained by developing TMDLs for waterbodies located in the same watershed; the value and vulnerability of particular waterbodies; the recreational, economic, and aesthetic importance of particular waterbodies; TMDL complexity; the degree of public interest and support; and State, Tribal, Territorial, or national policies and priorities (40 CFR 130.28(e)).

- If these or any other factors are considered, each must include a clear, concise explanation about how it is used in assigning priorities (40 CFR 130.28(f)). A schedule for establishing TMDLs for all waterbodies and pollutant combinations on Part 1 at a reasonable pace that distributes the workload for TMDL establishment over the entire duration of the schedule. All waterbody and pollutant combinations should have TMDLs established within 15 years after the date of the initial listing of Part 1 of the list (40 CFR 130.31).

EPA recognizes that each waterbody and pollutant combination on Part 1 of the § 303(d) list may be at a different stage on the path to an approved TMDL. Some might require additional data collection to adequately define the problem and conduct an analysis. Some might need outreach to increase stakeholder involvement and buy-in. Others might need to have a technical strategy outlined, budgeted, and scheduled. Some could be ready for completion of the TMDL and its submittal to EPA for approval. Some might need additional consideration and data collection if establishment of the TMDL is expected to be complex or there is uncertainty regarding the listing. It is important to understand that the identification of a high-priority waterbody and pollutant combination means that TMDL should be established before TMDLs for lower-priority waterbody and pollutant combinations. It means that high

priorities should be first to receive the resources needed to advance them to the next stage(s) of the TMDL process during the fiscal year under consideration. While there is flexibility in making decisions among a group of high priority waterbody and pollutant combinations; high priority waterbodies should be addressed before a medium or low priorities.

Developing a Priority Ranking for Waterbodies Listed on Part 1

The prioritization strategy developed by a State, Territory, or authorized Tribe must thoroughly describe the procedures used. Some of the considerations in developing a priority ranking process are discussed below.

Identify Primary and Secondary Objectives of the Prioritization Process

Before developing the priority ranking and schedule for Part 1 of the list, it is helpful to restate and clarify the objectives of each activity.

Priority ranking clarifies the urgency for establishing TMDLs based on environmental, social, and political factors. Priority ranking should clearly reflect environmental concerns and place special emphasis on severity of the impairment or threatened impairment and the designated uses of the waterbody. Priority ranking is performed before developing a schedule. However, consideration should be given to how the information collected for the priority ranking process can be used to support the schedule development.

The schedule is the plan for establishing TMDLs at a reasonable pace over its duration. Its development provides an opportunity to synchronize and optimize management activities within the State's, Territory's, or authorized Tribe's overall water quality program. The schedule can be used to show how TMDLs will be coordinated with basin planning processes. The schedule is also where various economies of scale can be realized, either by grouping TMDLs within larger watersheds or developing methods to address specific categories of pollutants.

Identify and Explain the Ranking Factors Considered

EPA has identified factors to use when developing a priority ranking strategy. EPA has also provided the opportunity to identify additional factors as needed. Figure 2-5 is a conceptual diagram of the required and optional factors to be considered by the priority ranking process. It is helpful to group the factors used in reviewing Part 1 waterbody and pollutant combinations in order to evaluate the implication of each factor on the resulting priority.

The first step, as outlined by the regulation, is to identify the high priority waterbody and pollutant combinations. A high priority designation recognizes the severity of impact and need to protect uses. A high priority waterbody and pollutant combination is first identified by a designated use in water quality standards for the waterbody as a public drinking water supply (where MCL is exceeded) and/or an impairment or threat for species listed as threatened or endangered under §4 of the Endangered Species Act (unless data shows no affect). The presence of sensitive aquatic species or secondary factors such as historical, cultural, economic, and aesthetic uses may also be considered in determining high priority waterbodies. The combination of the primary and secondary factors will result in identifying the suite of high priority waterbodies for which TMDLs must first be established within the 15-year time frame. It is intended to determine the waterbody and pollutant combinations for which there is the highest urgency to

make immediate progress. Therefore, high-priority waterbody and pollutant combinations are those where resources should first be targeted for monitoring, assessment, TMDL analyses, and ultimately establishment of the TMDL.

The second step is to evaluate the remaining waterbody and pollutant combinations based on a broader range of factors. In Figure 2-4, two categories of factors are presented—those related to use of the water and those related to practical and programmatic considerations.

Some of the waterbody uses and related factors identified in the regulation include value and vulnerability of particular waterbodies as aquatic habitat and recreational, economic, and aesthetic importance. Other factors that could be considered in this category include court orders and decisions relating to water quality, national policies and priorities, and imminence of any threat to the environment.

The practical and planning-level considerations identified in the regulation include public interest and support, TMDL complexity, and efficiencies gained by developing TMDLs for waterbodies located in the same watershed. Other factors that could be considered include

- Immediate programmatic needs such as wasteload allocations needed for permits that are coming up for revision or for new or expanding discharges, or load allocations for needed best management practices.

- Hardships to point sources from not having a TMDL in place to allow for increased pollutant loads.

- Opportunities to influence actions or decisions that will not be open for review or revision over a long (i.e., greater than 5-year) term (e.g., with Federal Energy Regulatory Commission [FERC] relicensing for dams).

- The complexity of correcting the water quality problem, including the availability of controls; the value of, or need for, a longer TMDL process to collect more data, identify sources, and/or refine analyses; the degree to which an iterative approach to the TMDL is likely to be needed (e.g., because efficacy of control measures is very uncertain); the number of different types of sources on listed waterbodies; the size and characteristics of the waterbody (e.g., physical complexity, bathymetry, tides, currents); and the number of jurisdictions involved in the TMDL development process (as with interstate and international waters).

- The ease with which TMDLs could be established for lower-priority pollutants at the same time as higher-priority pollutants for the same waterbody.

- Opportunities to "nest" TMDL processes geographically to more efficiently and effectively advance environmental protection goals, conduct monitoring, identify sources, select solutions, engage the public, and advance implementation.

In some cases the States, Territories, and authorized Tribes may need to consider waterbody and pollutant combinations that are difficult to address. Some types of problems where priority ranking and scheduling should consider the resource implications include when TMDL establishment

- requires the use of highly sophisticated and detailed analyses to evaluate the interrelationships between pollutant loading and achievement of water quality standards (i.e., complex estuarine systems).

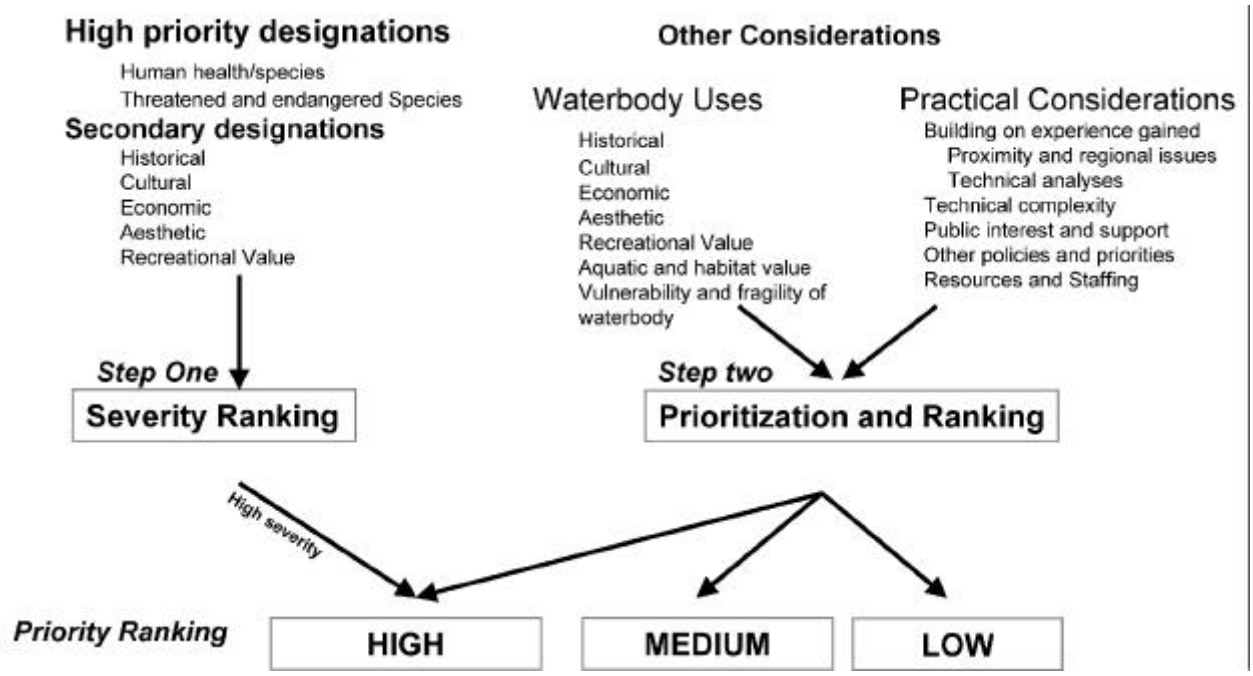


Figure 2-5. The priority ranking factors.

- involves the assessment of "legacy" pollutants. In this case the legacy pollutant is the predominant or only cause of the waterbody listing. This may include situations where the solution would cause more environmental harm than good (e.g., contaminated sediments for which a risk assessment performed pursuant to CERCLA, RCRA, or a similar clean-up authority demonstrates that natural recovery is the preferred approach). Management of these pollutants (i.e., chlordane) is limited due to adverse environmental impacts from disturbance or dredging.

- involves a pollutant where the predominant or only source is atmospheric deposition or acid rain. Implementation of the TMDL allocation would require substantive reductions of atmospheric deposition or acid rain, (i.e., pH violation where source is acid rain).

Perform the Priority Ranking

States, Territories, and authorized tribes must submit to EPA a description of their rationale for supporting priority ranking decisions. When a strategy has been established, the priorities and associated rankings can then be developed for the remaining waterbodies. Some helpful references are listed in the box. Although the required

EPA Documents Can Facilitate Developing a Strategy for Setting Priorities and Geographic Targeting

Setting Priorities: The Key to Nonpoint Source Control (OWRS, July 1987).

Selecting Priority Nonpoint Source Projects: You Better Shop Around (OW and OPPE, EPA 506/2-89/003 August 1989).

The Lake and Reservoir Restoration and Guidance Manual, First Edition (OWRS, EPA 440/5-88-002).

The Lake and Reservoir Restoration and Guidance Manual, Second Edition (OWRS, EPA 440/4-90-006).

State Clean Water Strategies: Meeting the Challenges for the Future (OW, December 1988).

Geographic Targeting: Selected State Examples, (OW, EPA-841-B-93-001 February 1993).

submittal of the ranking requires only the high, medium, and low designation, the information used in developing the priority ranking strategy can also assist in the development of schedules for establishing TMDLs. In some cases States, Territories, and authorized Tribes might choose to perform watershed-wide characterization studies to evaluate the listed waterbodies. These characterization studies can then be used to illuminate factors to consider when priority ranking (e.g., related activities, public involvement, availability of data), to support the development of schedules and strategic planning, and to contribute to the TMDL analysis. Not only does this information result in more efficient scheduling of monitoring and analytical activities, but the effort expended in watershed characterization reporting also provides an opportunity to "front-load" some of the analysis required for establishing TMDLs. An example outline for watershed characterization studies to support priority ranking, scheduling, and planning for monitoring and analysis is shown in the box on the next page.

Key Questions to Consider When Establishing a Priority Ranking Strategy

- Are there opportunities to "nest" TMDL activities geographically?
- What are the primary factors to consider for priority ranking?
- What are the secondary factors to consider for priority ranking?
- What are the objectives of the prioritization process?
- Does each waterbody and pollutant combination on Part 1 of the § 303(d) list have a priority ranking?

2.6 Developing the Schedule

EPA requires that a schedule for establishing TMDLs for waterbody and pollutant combinations on Part 1 of the list be submitted with the § 303(d) list (40 CFR 130.31). Although EPA will not approve or disapprove the schedule, the schedule will be considered in reviewing the list and priority rankings. The schedule must be consistent with the following:

- The pace of establishing TMDLs must reasonably spread the workload over the entire duration of the schedule.

- TMDLs should be established in accordance with the priority rankings. That is, TMDLs for high-priority waterbody and pollutant combinations should be established before medium and low-priority waterbody and pollutant combinations.

- States, Territories, and authorized Tribes may alter the actual establishment of high-priority TMDLs, medium-priority TMDL, and low-priority TMDLs from the sequence provided in its schedule. High-priority TMDLs should be completed first, medium-priority TMDLs should be completed next, and low-priority TMDLs should be completed last; the overall pace of TMDL establishment remains reasonable; and all TMDLs are established within the 15-year timeframe.

The schedule for completing TMDLs can be provided as target numbers of TMDLs to be completed for each year or as more specific completion dates for individual TMDLs. The schedule is considered a plan, and individual TMDL establishment dates may vary as needs are more clearly identified, problems are encountered, or opportunities for combining TMDL efforts are identified. The development of the schedule is likely to consider management factors such as staff availability, training, technical capabilities, funding for monitoring and technical support, basin planning cycles, coordination with

monitoring and analysis activities, geographic clusters of TMDLs, and types of waterbody and pollutant combinations listed.

The schedule is not intended to rigidly constrain the process of establishing TMDLs and should be considered an opportunity to explain how TMDLs for Part 1 waterbodies will be completed. When synchronized with the broader planning process of a State, Territory, or authorized Tribe, the schedule can be the basis for a practical plan for managing and completing the required TMDLs in order of priority. Modifications to the schedule should allow for public review and comment.

If the State, Territory, or authorized Tribe chooses to use the rotating basin approach, as in the box below, this decision will have implications for scheduling. For example, all the listed waterbodies in one basin can be scheduled for TMDL establishment and approval in one year. While the State, Territory, or authorized Tribe is working to complete and get approval for the TMDLs in one basin, it can be working concurrently on characterizing the problems for the listed waterbodies in another basin. It is recommended that funding and other resources be distributed in each basin, and throughout the State, Territory, or authorized Tribe's jurisdiction, according to the established priorities, with high-priority waterbodies given first consideration.

Key Questions to Consider When Establishing a Schedule for Completing TMDLs

- Is the schedule for completing TMDLs balanced over time?
- Are high-priority waters scheduled to be completed first before other waterbody and pollutant combinations on Part 1 of the list?
- Are all other waterbody and pollutant combinations scheduled to be completed no later than 15 years of being placed on Part 1 of the list?

2.7 Listing and the Public Participation Process

Communicating with the public and promoting public input into the § 303(d) listing process is an integral component of a successful TMDL Program. At a minimum, EPA regulations require that States, Territories, and authorized Tribes provide the public with at least 60 days to review and comment on the methodology that will be used to develop the list. States, Territories, and authorized Tribes must also provide the public with at least 30 days to review and comment on the list itself, the priority rankings, and the schedule for TMDL establishment. This public comment period must occur before the list is submitted to EPA. States, Territories, and authorized Tribes must also provide a summary of all public comments received, a description of how they considered the comments, and whether they agreed with the comments. States, Territories, and Tribes must provide an explanation when they disagree with a comment (40 CFR 130.31).

Sample Guidance for Public Submissions of Data and Information for the § 303(d) List

- Provide data on or before dates in §303(d) listing schedule
- Relate to waterbodies in a specific geographic focus area
- Reflect water quality conditions during period of assessment (for example, 1 June 1993 - 31 May 1998)
- Identify waterbodies of concern (and preferably specific geographic areas within waterbodies)
- State specific impairment or pollutant of concern
- Numeric data should include documentation of quality assurance methods used to collect data
- Non-numeric information must be scientifically sound and defensible and must be verifiable; it must describe events or conditions outside the natural range of conditions

In addition to meeting these regulatory minimums, States, Territories, and authorizes

Tribes should take advantage of involving the public as often as possible during the listing process. Although this approach might initially result in the expenditure of more time and resources, in the long run it will lead to better-supported, more cost-effective and expeditiously implemented TMDLs. States, Territories, and Tribes should actively solicit data and information from the public and encourage the public to nominate waterbodies for inclusion on the list. Informal public meetings should be held to help explain the TMDL process and to solicit input from the public, especially in watersheds where public interest is high. States, Territories, and authorized Tribes should also encourage high-quality private citizen or private organization water quality monitoring and clearly communicate how and when such information can be incorporated into the listing and TMDL establishment activities. A State's, Territory's, or authorized Tribe's general approach for involving the public in § 303(d) listing decisions must be described in its Continuing Planning Process document.

TMDL-related Tasks in the Mississippi Basin Management Cycle

Phase 1 Planning:
- Identifying TMDL-related issues to be addressed this iteration of the basin cycle
- Clarifying information needs to support TMDL establishment for priority watersheds and determining available resources for information collection
- Preparing strategic data collection plans to fill information gaps as efficiently as possible

Phase 2 Data Collection:
- Conducting field surveys to support TMDL establishment
- Collecting non-monitoring information to support assessment and TMDL establishment (land use/land cover data; implementation rates of best management practices; source inventories; assessment information from other agencies and sources)
- Collecting supplemental ambient monitoring data to assess unassessed areas (~1 station per 11-digit watershed) and follow up on "potential waters of concern" (suspected areas of impairment based on previously evaluated information)

Phase 3 Data Assessment and TMDL Establishment
- Developing and applying models or analytical tools for establishing loading capacities for § 303(d) listed waters scheduled for TMDL establishment this cycle iteration
- Determining allocations of the TMDL target load to point sources, nonpoint sources, a margin of safety, and future growth
- Updating § 303(d) list for basin to add waters where new monitoring data indicate impairment or the threat of impairment before the next listing cycle and delist waterbodies where monitoring data indicate full use support

Phase 4 Basin Plan and TMDL Implementation Strategy Development
- Developing and documenting draft implementation strategies for TMDLs
- Compiling updated § 303(d) listings and TMDL implementation strategies within Basin Plans for public review and comment
- Revising § 303(d) listings and implementation plans as needed to address public comments appropriately

Phase 5 Implementation
- Conducting outreach to raise awareness of Basin Plan provisions, including TMDL implementation strategies
- Targeting program resources (permitting, enforcement, assistance grants, technical assistance, pollution prevention) to carry out basin plans and implement TMDLs
- Monitoring and evaluating progress to adapt plans, as needed, and enhance implementation

2.8 EPA Action on the Methodology and List

EPA will not approve or disapprove the listing methodology of the State, Territory, or authorized Tribe but will, if appropriate, provide comments. EPA will consider the methodology when it reviews and approves or disapproves the § 303(d) list. EPA's comments on the methodology will include a description of whether the Agency believes that the methodology will result in the identification of impaired or threatened waterbodies. When EPA reviews the State's, Territory's, or authorized Tribe's

list, it will review how the State, Territory, or authorized Tribe responded to EPA's comments on the methodology. EPA may cite any deficiencies it raised in comments to the State, Territory, or authorized Tribe as a factor in a decision to disapprove all or part of the State's, Territory's, or authorized Tribe's list.

Within 30 days of receipt of a complete listing package, EPA must approve or disapprove a State's, Territory's, or authorized Tribe's list and priority ranking (40 CFR 130.30(b)). EPA may approve or disapprove the entire list or it may disapprove deficient portions and approve the remaining portions. If EPA disapproves a portion of the list, including the identification of certain waterbody and pollutant or pollution combinations or priority rankings, the Agency must, within 30 days, identify all (or the disapproved portion of) waterbodies and pollutant or pollution combinations or priority ranking as needed to make the list consistent with EPA regulations. EPA will notify the public in the *Federal Register* and a general circulation newspaper of its actions and request public comment for at least 30 days. When the comment period concludes, EPA will evaluate the public comments and compile a revised list. In the absence of significant public comment, EPA will send the portion of the list that it has corrected back to the State, Territory, or authorized Tribe for incorporation into the water quality management plan (40 CFR 130.30(d)).

Chapter 3. Establishing and Implementing TMDLs

The purpose of this chapter is to provide guidance on establishing and implementing TMDLs. The chapter summarizes the minimum elements of a TMDL submittal and provides guidance on strategies for conducting the technical analyses on which TMDLs and their maximum allowable pollutant loads are based. Documentation of decision-making during the TMDL establishment process is emphasized. States, Territories, and authorized Tribes are also encouraged to develop an implementation strategy that stresses tracking specific, appropriate measures; achieving carefully selected milestones; and providing for timely intervention actions if a TMDL is not meeting expectations.

3.1 What is a TMDL?

A total maximum daily load (TMDL) is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads. It is intended to provide an opportunity to compare relative contributions from all sources and consider technical and economic trade-offs between point and nonpoint sources. A TMDL must be established for each waterbody and pollutant combination on Part 1 of your list of impaired or threatened waterbodies.

The goal of a TMDL is to allocate pollutant loads and (through its implementation plan) define a set of actions such that water quality standards will be achieved. The resulting allocation should also be feasible to implement. In cases with limited data, it is recommended that States, Territories, and authorized Tribes proceed with establishing a TMDL, collect and interpret additional data, and track progress toward the goal of meeting water quality standards. The conditions under which a TMDL would be revised should be clearly articulated in the implementation portion of the TMDL submittal.

The TMDL process is an essential element of the water quality-based approach to watershed management. It develops the pollution reduction needed to meet water quality standards and then links the development and implementation of control measures to the attainment of water quality standards. Through the establishment and implementation of a TMDL; pollutant loadings from all sources are estimated; links are established between pollutants, sources, and impacts on water quality; maximum pollutant loads are allocated to each source; and appropriate control mechanisms are established or modified so that water quality standards can be achieved.

Within each TMDL is a carefully identified maximum allowable pollutant load or loads needed to meet water quality standards for defined critical conditions. This is the maximum amount of a pollutant that may be contributed to a waterbody so that it attains and maintains water quality standards. The TMDL may vary with time or the specific location and distribution of the pollutant sources, therefore, it is necessary to determine the waterbody's critical conditions or periods for which the TMDL or TMDLs are developed. The maximum allowable pollutant load is distributed to the wasteload allocations for point sources, load allocations for nonpoint sources, a margin of safety sufficient to account for uncertainty and lack of knowledge, consideration of seasonal variation, and allowances for future growth.

Summary of Statutory and Regulatory Requirements for Establishing TMDLs

A TMDL must be established for all waterbody and pollutant combinations on Part 1 of the list. TMDLs are not required for waterbodies on Part 2, 3, or 4 of the list (§ 130.31(a)).

A TMDL must be established according to the priority rankings and schedules (§ 130.31(b)).

TMDLs must be established at a level necessary to attain and maintain water quality standards, as defined by 40 CFR 131.3(I), considering reasonably foreseeable increases in pollutant loads (§ 130.33(b)(9)).

TMDLs must include the following minimum elements (§ 130.33(b)):

1. The name and geographic location, as required by §130.27(c), of the impaired or threatened waterbody for which the TMDL is being established and the names and geographic locations of the waterbodies upstream of the impaired waterbody that contribute significant amounts of the pollutant for which the TMDL is being established;
2. Identification of the pollutant for which the TMDL is being established and quantification of the pollutant load that may be present in the waterbody and still ensure attainment and maintenance of water quality standards;
3. Identification of the amount or degree by which the current pollutant load in the waterbody deviates from the pollutant load needed to attain or maintain water quality standards;
4. Identification of the source categories, source subcategories, or individual sources of the pollutant for which the wasteload allocations and load allocations are being established consistent with §130.2(f) and §130.2(g);
5. Wasteload allocations to each industrial and municipal point source permitted under §402 of the Clean Water Act discharging the pollutant for which the TMDL is being established ; wasteload allocations for storm water, combined sewer overflows, abandoned mines, combined animal feeding operations, or any other discharges subject to a general permit may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated to attain or maintain water quality standards may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that wasteload allocations when implemented, will attain and maintain water quality standards;
6. Load allocations, ranging from reasonable accurate estimates to gross allotments, to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources; if possible, a separate load allocation must be allocated to each source of natural background or atmospheric deposition; load allocations may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that load allocations, when implemented, will attain and maintain water quality standards;
7. A margin of safety expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL; e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions which ensures attainment and maintenance of water quality standards for the allocated pollutant;
8. Consideration of seasonal variation such that water quality standards for the allocated pollutant will be met during all seasons of the year;
9. An allowance for future growth which accounts for reasonably foreseeable increases in pollutant loads; and
10. An implementation plan

As appropriate to the characteristics of the waterbody and pollutant, the maximum allowable pollutant load may be expressed as daily, monthly, seasonal or annual averages in one or more of the following ways (40 CFR 130.34(b)):

- The pollutant load that can be present in the waterbody and ensure that it attains and maintains water quality standards;
- The reduction from current pollutant loads required to attain and maintain water quality standards;
- The pollutant load or reduction of pollutant load required to attain and maintain riparian, biological, channel or geomorphological measures so that water quality standards are attained and maintained; or
- The pollutant load or reduction of pollutant load that results from modifying a characteristic of the waterbody, e.g., riparian, biological, channel, geomorphological, or chemical characteristics, so that water quality standards are attained and maintained.

The TMDL implementation plan must include the following (§ 130.33(b)(10)):

- A description of the control actions and/or management measures which will be implemented to achieve the wasteload allocations and load allocations, and a demonstration that the control actions and/or management measures are expected to achieve the required pollutant loads;
- A time line, including interim milestones, for implementing the control actions and/or management measures, including when source-specific activities will be undertaken for categories and subcategories of individual sources and a schedule for revising NPDES permits;
- A discussion of your reasonable assurances, as defined at 40 CFR §130.2(p), that wasteload allocations and load allocations will be implemented;
- A description of the legal under which the control actions will be carried out;
- An estimate of the time required to attain and maintain water quality standards and discussion of the basis for that estimate;
- A monitoring and/or modeling plan designed to determine the effectiveness of the control actions and/or management measures and whether allocations are being met;
- A description of measurable, incremental milestones for the pollutant for which the TMDL is being established for determining whether the control actions and/or management measures are being implemented and whether water quality standards are being attained; and
- A description of your process for revising TMDLs if the milestones are not being met and projected progress toward attaining water quality standards is not demonstrated.

Previously, EPA did not distinguish between a TMDL and its maximum allowable pollutant load. A TMDL itself was defined as the amount of a pollutant or pollutants that can be present in a waterbody and still attain and maintain water quality standards and was considered to be equal to or less than the loading capacity or assimilative capacity of the waterbody for that pollutant. In the 1999 Regulation, the definition of "TMDL" is expanded to encompass the entire submittal package, including the ten required elements listed below. The term " maximum allowable pollutant load" is introduced as the amount of pollutant or pollutants that can be present in a waterbody such that it attains and maintains water quality standards.

Required Elements of the TMDL Submittal

EPA will only approve TMDL submittals that include the ten elements listed below:

1. The name and geographic location, as required by §130.27(c), of the impaired or threatened waterbody for which the TMDL is being established and the names and geographic locations of the waterbodies upstream of the impaired waterbody that contribute significant amounts of the pollutant for which the TMDL is being established (40 CFR 130.33(b)(1)).

2. Identification of the pollutant for which the TMDL is being established and quantification of the maximum pollutant load that may be present in the waterbody and still ensure attainment and maintenance of water quality standards (40 CFR 130.33(b)(2)).

3. Identification of the amount or degree by which the current pollutant load in the waterbody deviates from the pollutant load needed to attain or maintain water quality standards (40 CFR 130.33(b)(3)).

4. Identification of the source categories, source subcategories, or individual sources of the pollutant for which the wasteload allocations and load allocations are being established consistent with §130.2(f) and §130.2(g) (40 CFR 130.33(b)(4)).

5. Wasteload allocations to each industrial and municipal point source permitted under § 402 of the Clean Water Act discharging the pollutant for which the TMDL is being established ; wasteload allocations for storm water, combined sewer overflows, abandoned mines, combined animal feeding operations, or any other discharges subject to a general permit may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated to attain or maintain water quality standards may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that wasteload allocations when implemented, will attain and maintain water quality standards (40 CFR 130.33(b)(5)).

6. Load allocations to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources. If possible, a separate load allocation must be allocated to each source of natural background or atmospheric deposition; load allocations may be allocated to categories of sources, subcategories of sources or individual sources. Pollutant loads that do not need to be allocated may be included within a category of sources, subcategory of sources or considered as part of the background load. supporting technical analyses must demonstrate that load allocations, when implemented, will attain and maintain water quality standards (40 CFR 130.33(b)(6)).

7. A margin of safety expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL; e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions which ensures attainment and maintenance of water quality standards for the allocated pollutant (40 CFR 130.33(b)(7)).

8. Consideration of seasonal variation and high and low flow conditions such that water quality standards for the allocated pollutant will be met during all seasons of the year and during all design flow conditions (40 CFR 130.33(b)(8)).

9. An allowance for future growth which accounts for reasonably foreseeable increases in pollutant loads (40 CFR 130.33(b)(9)).

10. An implementation plan, which may be developed for one or a group of TMDLs (40 CFR 130.33(b)(10)).

Quantifying the Allowable Pollutant Load

A waterbody's allowable pollutant load contains wasteload allocations for point sources, load allocations for nonpoint sources, a margin of safety (MOS) sufficient to account for uncertainty and lack of knowledge, and an allowance for future growth. The allowable pollutant load must ensure that the waterbody will attain and maintain water quality standards regardless of seasonal variations or design flow conditions and in consideration of reasonably foreseeable increases in pollutant loads. The illustration below shows how the allowable pollutant load is the total of these components.

$$\text{Allowable Pollutant Load} = \sum\text{Wasteload Allocation} + \sum\text{Load Allocation} + (\text{MOS}) + (\text{Future Growth})$$

The components making up the allowable pollutant load have a place within the overall TMDL strategy, but the relationship is likely to be more complex than a simple equation would imply. For example, the pollutant from individual pollutant sources may decay or transform in the process of transport to a waterbody. The MOS is in parentheses because it might not always be a separate component of the allowable pollutant load, but might instead be included as part of the wasteload allocations and load allocations through conservative assumptions. Future growth is also in parentheses because the maximum allowable pollutant load may allow for future growth by including a separate allocation for this purpose or by allocating acceptable wasteloads and loads in a way that incorporates potential growth.

EPA Documents Providing Technical Support for Establishing TMDLs

Technical support document for water quality-based toxics control (EPA/505/2-90-001 PB91-127415, 1991)

Compendium of tools for watershed assessment and TMDL development (EPA841-B-97-006, 1997)

Protocol for developing pathogen TMDLs (Draft, 1998)

Protocol for developing sediment TMDLs (Draft, 1998)

Protocol for developing nutrient TMDLs (Draft, 1998)

TMDLs must contain an expression of the allowable pollutant load as a load or reduction of load necessary to ensure that the waterbody will attain and maintain water quality standards, including aquatic or riparian habitat, biological, channel or geomorphological or other conditions that represent attainment and maintenance of water quality standards (§ 130.34(a)).

The terms used to express a TMDL and its allowable pollutant load may be adapted to be appropriate to the characteristics of the waterbody and pollutant for which the TMDL is being established. These terms include,

but are not limited to, (1) The pollutant load that can be present in the waterbody and ensure that it attains and maintains water quality standards; (2) The reduction from current pollutant loads required to attain and maintain water quality standards; (3) The pollutant load or reduction of pollutant load required to attain and maintain riparian, biological, channel or geomorphological measures so that water quality standards are attained and maintained; or (4) The pollutant load or reduction of pollutant load that results from modifying a characteristic of the waterbody, e.g., riparian, biological, channel, geomorphological, or chemical characteristics, so that water quality standards are attained and maintained (§ 130.34(b)).

The allowable pollutant load, in whatever way it is expressed, may be allocated in many ways, allowing for trade-offs among sources. However, It is critical that all sources of a pollutant be accounted for in computing the load capacity. If a receiving water has only one point source discharger, the allowable pollutant load is the sum of that point source's wasteload allocation plus the load allocations for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments, plus an MOS. If point sources do not have the reasonable potential to cause or contribute to the impairment or threat to the waterbody, the allowable portion of the overall load to point source dischargers would be their existing permitted load. Similarly, if nonpoint sources are not causing or contributing to the impairment or threat to the waterbody, the allowable portion of the overall load to nonpoint sources for that waterbody would be their existing nonpoint load of the pollutant. Depending upon the specific pollutant, there may be a load allocation to account for natural background sources. In most cases, wasteload allocations and load allocations may be established for categories of sources, subcategories of sources, or individual sources. Wasteload allocations may be increased if there are reasonable assurances that loads from nonpoint sources will be similarly reduced, and water quality standards will be attained.

Some minor or remotely located point and nonpoint sources may be treated as background as long as the actual allocations to specific sources will result in the attainment or maintenance of water quality standards. Documentation that supports the technical validity of the relationship among the components of the allowable pollutant load must be submitted with the TMDL documentation.

Wasteload Allocations

A wasteload allocation is defined at 40 CFR 130.2(g) as the portion of a TMDL's pollutant load allocated to a point source of a pollutant. Wasteload allocations for industrial and municipal point source facilities permitted under section 402 of the Clean Water Act must be allocated to individual point sources of the pollutant that need to be controlled to attain and maintain water quality standards. (See Appendix B for a list of point source categories used by the Permit Compliance System.) Pollutant loads that do not need to be reduced to attain or maintain water quality standards can be included within a category of sources, a subcategory of sources, or considered as part of background loads.

Industrial and municipal point source facilities with individual NPDES permits must receive individual wasteload allocations. Wasteload allocations for point source discharges subject to a general permit may be allocated to the category of sources subject to the general permit, a subcategory of those sources, or the individual sources. The nature of the wasteload allocation also depends upon the type of point source. Relatively continuous discharges (dry and wet weather) or controlled batch discharges may receive a numeric wasteload allocation that can be translated into a numeric water quality-based effluent limit (see Technical Support Document). The quality and quantity of non-continuous discharges (e.g., storm water, combined sewer overflows) tend to be episodic and more difficult to model and predict. Initial wasteload allocations for these sources may be narrative and subsequently be revised to incorporate numeric

requirements as information and models for the waterbody system are refined to account for wet weather and episodic events.

Load Allocations

A load allocation is defined at 40 CFR 130.2(f) as the portion of a TMDL's pollutant load allocated to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loadings. Natural background sources, atmospheric deposition, and nonpoint source loads should be distinguished. Load allocations may be allocated to categories of sources, subcategories of sources, or individual sources. Load allocations must be reflected in the implementation plan.

Like wasteload allocations, load allocations are ultimately estimates of pollutant loading that take into account temporal fluctuations. It is often necessary to recognize that nonpoint source pollutant loading estimates will vary depending on hydrologic conditions and human activities.

Clean sediment loads from a watershed, for example, can often vary significantly from year to year depending on whether the year is relatively "wet" or "dry." Similarly, bacterial or nutrient runoff associated with applied poultry litter is likely to vary significantly within a year depending on when the litter is applied and rainfall events occur. When a range of values is identified to represent a nonpoint source load, the most appropriate value in the range should be designated as the load allocation. The most appropriate value will be the one that is protective of water quality during those periods when water quality problems would be expected to occur (e.g., during warm weather conditions). The selection should account for seasonal variation and be protective of the waterbody when water quality problems occur (e.g., during the growing season or during ice-out) and must ensure that at any given time the allocation will attain the water quality standard. In some cases it might be appropriate to select different load allocations for different seasons of the year.

Possible Categories and Subcategories of Nonpoint Sources

Urban	Roads and Highways
	New Development
	Existing Development
	Individual Septic Disposal Systems
Agriculture	Grazing/Pasture
	Cropland
Forest	Roads
	Active Cuts
	Old Cuts
	Undisturbed Areas

Care should be taken in considering the potential cumulative impacts from source loading on the receiving waters. In some cases loading throughout the year has an impact that is manifested only when the appropriate conditions occur. For example, metals from various sources are accumulated throughout the year in the bottom sediments of the receiving water. Under certain flow conditions resuspension of the sediment and associated metals may result in a violation of water quality standards.

Margin of Safety

The margin of safety (MOS) is a required component of a TMDL's maximum allowable pollutant load that accounts for uncertainty about pollutant loadings and waterbody response. The allowable pollutant load for each TMDL must include an MOS sufficient to account for uncertainties in establishing the TMDL and describe the manner in which an MOS is provided. The MOS may be established by leaving a portion of

the assimilative capacity unallocated or by use of conservative analytical assumptions to account for the uncertainties in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions). If a separate allocation of a capacity is set aside to provide an MOS, the amount of such allocation should be described. If protective assumptions are relied on to provide an MOS, the specific areas of the analysis that accommodate the MOS should be identified.

3.2 The Process for Establishing a TMDL

TMDL establishment is a process during which each of the discrete TMDL submittal elements will be developed. Figure 3-1 describes the relationship between the elements of a TMDL submittal and the steps of the TMDL establishment process. The following steps are identified as the process for establishing TMDLs:

- Name and geographic location
- Problem identification
- Target analysis
- Source identification and assessment
- Linkage of the source and target
- Allocating pollutant loads
- Implementation and monitoring plan development

The sections below describe this process in greater detail and provide guidance about how to approach the most difficult steps of the TMDL process.

Name and Geographic Location of Waterbody

The first step in the technical approach for establishing a TMDL is to specify the specific name and geographic location of the threatened or impaired waterbody (40CFR 130.33(b)(1)). EPA Reach File Version 3 (RF3) forms the basis for linking the 303(d) ID to geographic information. RF3 is a national hydrologic database that uniquely identifies and interconnects more than three million stream segments or "reaches" that compose the nation's surface water drainage system. RF3 was created from digital hydrography data produced by USGS. EPA enhanced these datasets by assigning a unique reach code to each stream segment, determining the upstream/downstream relationships of each reach, and, when possible, identifying the stream name for each reach. States, Territories and authorized Tribes may either develop their own GIS coverages/shape files of their threatened and impaired waterbodies and submit them to EPA with their 303(d) lists, or adopt the standardized approach (preferred by EPA) of georeferenceing their waterbodies to RF3.

Problem Identification

The second step in the technical approach for establishing a TMDL is to identify the problem. Problem identification highlights and clarifies the key factors and background information for a listed waterbody and pollutant combination, and describes the nature of the impairment and the context for the TMDL. This step can be the key to successfully developing a strategy for completing the remaining components of the TMDL process.

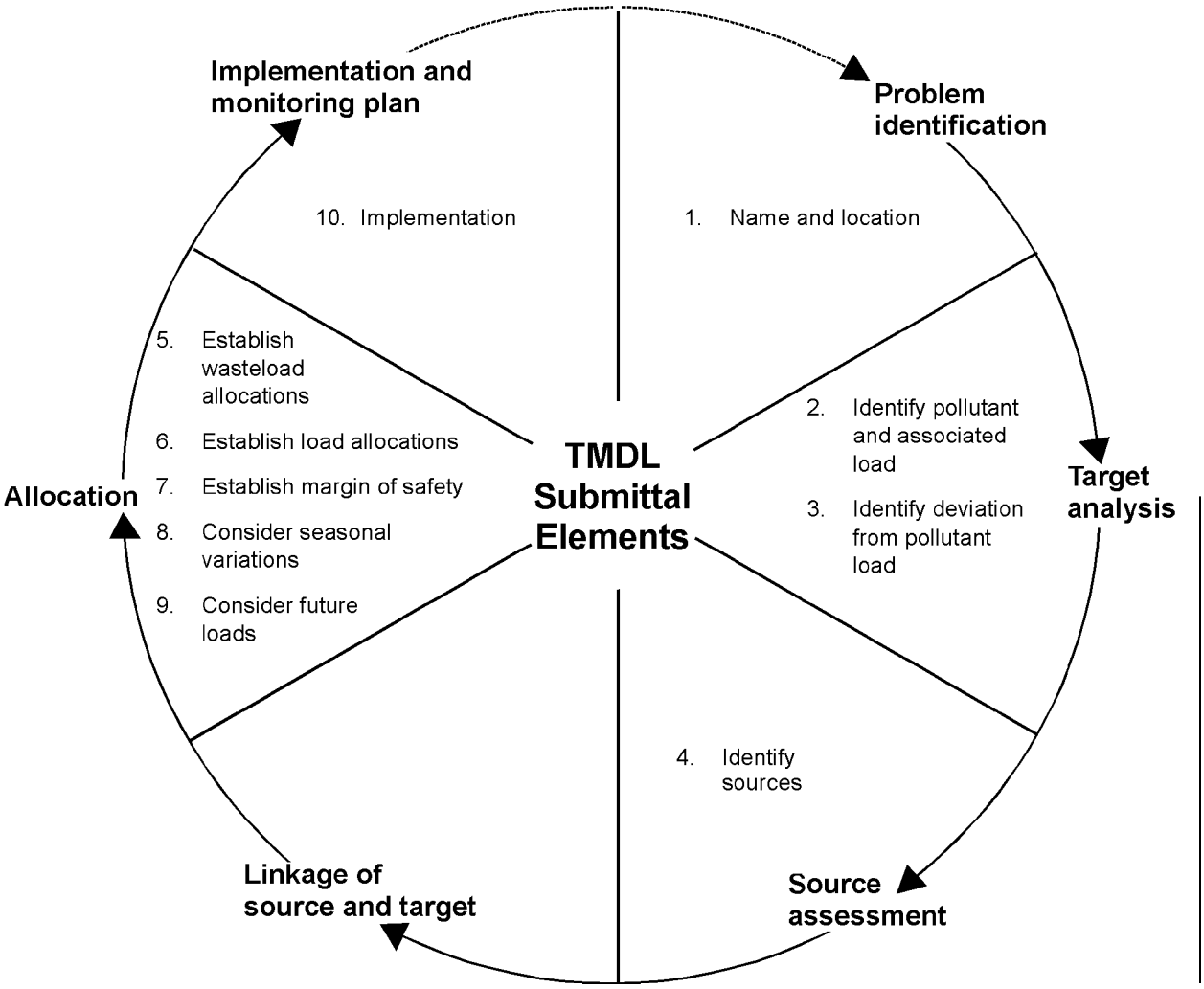


Figure 3-1. Components of the TMDL establishment process.

When developing a TMDL, it is necessary to formulate a strategy that addresses the causes and potential sources of the water quality impairment and available management options. The characterization of the causes and sources should be an extension of the process originally used to place the waterbody and pollutant combination on the section § 303(d) list. Typically, the impairment or threat that resulted in the listing will be related to water quality standards that are being violated—either pollutant concentrations that exceed numeric criteria or waterbody conditions that do not match those specified by narrative criteria. In many cases, the problem itself will be self-evident and its identification will be relatively straightforward. In other cases, the complexity of the system might make it more difficult to definitively state the relationship between the sources and impairment.

EPA suggests that a number of specific questions be addressed during this initial strategy-forming stage. (See the box below.) Answering these questions will help define an approach for establishing the TMDL. Developing a clear, concise problem statement based on the problem identification analysis will describe

the setting addressed by the TMDL, making the TMDL more understandable for public participation activities and useful for implementation planning.

Key Questions to Consider When Identifying the Problem

- What are the designated or existing uses and associated impairments?
- What was the violation of water quality standards that caused the listing of the waterbody and pollutant combination?
- What data support the listing of the waterbody as impaired or threatened?
- What pollutant is preventing the attainment of designated uses?
- What are the known and potential sources of the pollutant and what are the pathways it might take to reach the waterbody? What are the upstream contributions?
- What characteristics of the waterbody or its watershed might be exacerbating or mitigating the problem?
- What data are readily available?
- What is the geographic setting of the TMDL?
- What temporal considerations will affect development of the TMDL?
- How will margin of safety and uncertainty issues be addressed in the maximum allowable pollutant load?
- What efforts to protect the watershed are already under way?
- What are some potential control options?

Target Analysis

Target analysis is the third component of the technical approach for establishing TMDLs. From a broad management perspective, the purpose of target analysis is to define the relationship between designated uses, numeric measure(s) of success, and pollutant loading. The primary goals of target analysis are (1) to clarify whether the ultimate goal of the TMDL is to comply with a numeric water quality criterion, comply with an interpretation of a narrative water quality criterion, or attain a desired condition that supports meeting a specified designated use; (2) to identify the waterbody's critical conditions; (3) to identify appropriate ways to measure (track) progress toward achieving stated goals; and (4) to tie the measures to pollutant loading.

Identification of the maximum allowable pollutant load is one required element of an approvable TMDL. It must be expressed in a manner that will ensure the waterbody will attain and maintain water quality standards or some desired condition—expressed as aquatic or riparian habitat, biological, channel, geomorphological, or other condition—that represents attainment and maintenance of water quality standards (40 CFR 130.34(a)).

This section suggests using a simple three-point strategy for conducting a target analysis for TMDLs:

1. How does the designated use relate to the allowable pollutant load?

States, Territories, and authorized Tribes begin to answer this question during § 303(d) listing and the problem identification step in the TMDL establishment process. To be put on Part 1 of the § 303(d) list, a waterbody and pollutant combination is identified and, usually, the designated use that is impaired by the pollutant is evident.

The waterbody and pollutant combination for which a TMDL is established affects how the maximum allowable pollutant load is expressed, as well as its relationship to other relevant targets. The problem statement developed during problem identification is often the best place to begin explaining how the

maximum allowable pollutant load and various targets and measures interrelate. For example, excessive phosphorus might make swimming in a lake unpleasant because of blue-green algae blooms. In this case, phosphorus loading might be most appropriately managed for a 30-day average load of phosphorus or a 5-year running average over a 90-day growing season to properly incorporate natural cycles and interactions into decision making. For example, variations in rainfall from year to year will affect nutrient inputs from atmospheric deposition as well as runoff from the watershed. Available data might be used to establish the mathematical relationship between phosphorus loading, in-lake phosphorus concentrations, and algae biomass.

Typical Use Designations

- Drinking Water
- Recreation
  - Primary Contact
  - Secondary Contact
- Aquatic Life
  - Warm Water
  - Cold Water
- Agriculture
- Industry

Alternatively, a river where the health of the aquatic community is affected by excessive copper concentrations during storm events is most appropriately managed for acute concentrations during a storm event. The relationship between copper loading and in-stream copper concentrations during a storm must be established to support decisions about limiting copper loads.

Numeric or narrative water quality criteria can be used to establish the relationship between an impaired use and maximum allowable pollutant load. Water quality standards, as defined by 40 CFR 131.3(I), are composed of designated uses and numeric or narrative water quality criteria, which are intended to represent attainment of specific uses. For conventional pollutants, numeric water quality criteria are usually the most appropriate target.

When no numeric water quality criterion is available, a site-specific quantified target that results in the attainment or maintenance of water quality standards must be developed as part of the TMDL. Development of a site-specific target requires information on the type of waterbody, its geographic location, how seasonal variations in rainfall and temperature affect waterbody functions, the designated use, and stakeholder preferences and concerns.

2. Are surrogate targets appropriate or necessary?

In some situations, there are no numeric water quality criterion or quantifiable pollutant load that can be used to define the allowable pollutant load and express the TMDL. In these situations, surrogate targets that have a quantifiable relationship with the water quality criterion or pollutant load can be used to provide numeric indicators or quantified measures to express the TMDL. The relationship between a surrogate measure, the water quality standard, and the pollutant load should be clearly described. For example, although an allowable pollutant load that addresses excursions of temperature criteria because of a denuded riparian corridor is ultimately expressed in terms of heat units over time, it is most appropriately discussed in terms of degrees of temperature (degrees Fahrenheit or Celsius). Most water quality criteria that address heat list a range of acceptable temperatures over a specific period of time (e.g., a daily maximum, minimum, and average during the spring). The management measures implemented to reduce the overall heat load may actually be miles, meters, or square yards of riparian zone restored. These measures must be related to their impact on heat load and also temperature: *X* miles of riparian zone restored is expected to cause water temperature to decrease by *Y* degrees Fahrenheit. Table 3-1 provides some examples of how a TMDL and these associated targets may be expressed for various pollutants.

Table 3-1. Expressing a TMDL and its associated targets

Use Impaired	Likely Expression of Associated Water Quality Criterion	Surrogate or Suite of Surrogate Measures	Pollutant and Possible Load Expression
• Coldwater aquatic life	• Temperature must not exceed 20°C for trout waters or 24°C for non-trout waters. • No discharge at a temperature over 70°F is permitted at any time to streams classified for trout. From June through September, no discharge is permitted that will raise the stream temperature more than 2°F over that which existed before the addition of heat. From October through May, no discharge is permitted that will raise the stream temperature more than 5°F over that which existed before the addition of heat of artificial origin or to a maximum of 50°F, whichever is less.	• Riparian shading • Width-depth ratio • Sinuosity (meander pattern) • Miles of restored riparian zone • Number of trees planted • Percentage of increased shading	**Temperature** (e.g., excess heat) • kilojoules/day
• Coldwater aquatic life • Warmwater aquatic life • Industry	• A healthy population of native coldwater species. • Turbidity in the water column must not exceed 20 NTUs.[a] • Total dissolved solids must not exceed 500 mg/L.	• Turbidity • Suspended sediment • Miles of stabilized stream bank • Embeddedness of bottom sediments • Size distribution of bottom sediments (e.g., D_{50} or D_{84}) • Diversity of fish populations • Population of fish of a species of interest • Miles of restored bank • Number of BMPs[b] implemented • Number of acres of BMPs implemented	**Clean sediment** • tons of sediment per year • kilograms of sediment per day
• Coldwater aquatic life • Primary and secondary contact recreation • Drinking water • Agriculture • Industry	• In no case may nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna. • Nutrient concentrations must be at concentrations that prevent the stimulation of aquatic growths that are injurious to designated uses. • Nitrate as nitrogen concentrations in surface waters must not exceed 10 mg/L or any criteria that exceeds the narrative nutrient criteria.	• Biomass • Dissolved oxygen concentration • Secchi depth • Residence time or degree of flushing (for lakes) • Positive user survey response (for lakes) • Decreased # algae blooms • Increased clarity	**Nutrients (phosphorus, nitrogen)** • kilograms total phosphorus per year (running 5-year average) • pounds of total nitrogen during the 3-month growing season
• Coldwater aquatic life • Warmwater aquatic life • Primary and secondary contact recreation	• Must not average less than 5.0 mg/L in a 24-hour period and must never be less than 4.0 mg/L.	• Phosphorus concentration • Nitrogen concentration • Biochemical oxygen demand • Biomass • Sediment oxygen demand • Temperature	**Dissolved oxygen** • Load of phosphorus • Load of BOD[c]

[a] NTU: Nephelometric turbidity unit
[b] BMP: Best management practice
[c] BOD: Biochemical oxygen demand

3. What are appropriate ways to measure (track) progress?

There are numerous ways to measure progress toward attainment of water quality standards. The most obvious is a decreasing trend of pollutant loads. When a surrogate or suite of surrogates is selected as a more understandable way to measure attainment of water quality standards, measures of progress can also

be defined more broadly. In some cases surrogate indicators may be more responsive, allowing for the progress to be more quickly discerned. The key is to clearly state how progress will be measured.

Identifying the Amount or Degree of Deviation from the Allowable Pollutant Load

One of the elements of an approvable TMDL submittal to EPA requires States, Territories, and authorized Tribes to identify the amount or degree by which the current pollutant load deviates from the target representing attainment or maintenance of water quality standards. This determines how much the pollutant load must be reduced to meet the maximum allowable pollutant load and therefore sets the stage for allocation of the pollutant among its sources. It also facilitates linking water quality targets and sources by relating targets and surrogate measures to the expression of source loads.

In some cases the analysis of required pollutant reductions may lead to a preliminary conclusion that the water quality standard is unattainable. It might be appropriate to conduct a use attainability analysis to determine whether it is appropriate to remove or otherwise change the use. Technical guidance on conducting use attainability analyses is available from EPA in the *Water Quality Standards Handbook* (USEPA, 1994b).

Key Questions to Consider When Conducting a Target Analysis

- What is the water quality standard that applies to the waterbody?
- How does the designated use relate to the maximum allowable pollutant load?
- Are surrogate targets appropriate or necessary?
- What factors affect the selection of a surrogate target?
- What is the maximum allowable pollutant load?
- What is the amount or degree by which current conditions deviate from the allowable load?
- What are appropriate ways to measure (track) progress?

Source Identification and Assessment

Source identification and assessment is the fourth component of the technical approach for establishing TMDLs (40 CFR 130.33(b)(4)). A source assessment lists and characterizes individual pollutant source(s), categories of sources, or subcategories of sources that are responsible for waterbody impairment and quantifies the degree to which each source (source category or subcategory) contributes to the problem. It is at this point that the character of each pollutant source, its temporal loading variability, and its location with respect to the waterbody of concern become important. The factors to identify when conducting a source assessment include the following:

- Source type (e.g., point, nonpoint, background, atmospheric)
- Relative location of each source category
- Magnitude of loads from each source category
- Transport mechanisms of concern (e.g., runoff, erosion)
- Time scale of loading to the waterbody (i.e., duration and frequency of pollutant loading to receiving waters)

The evaluation of pollutant loading is typically performed using a variety of tools, including existing monitoring information, air photography analysis, simple calculations, spreadsheet analysis using empirical

methods, and a range of computer models from simple to sophisticated. The selection of the appropriate method for determining loads is based on the complexity of the problem, the availability of resources, time constraints, the availability of monitoring data, and the management objectives under consideration.

Grouping sources into categories should be carefully considered during source identification and assessment. The appropriate selection of the various loading categories will facilitate completion of subsequent analyses. Sources can be grouped into categories by type, ownership, location (e.g., by subwatershed or distance from the waterbody), and other factors. Factors that might be useful to consider include the following: delivery mechanisms; type and location of sources relative to waterbody of concern; management options under consideration; social, political, and economic factors; and physical characteristics of the watershed including slope, geology, soils, and drainage network. When grouping sources into categories or subcategories, it is important that there is a recognizable link between the categories, the allocation of loads, and the implementation plan.

Key Questions to Consider When Identifying and Assessing Sources

- What sources are contributing to the problem and how can they best be characterized?
- How should sources be grouped to facilitate load estimation and allocation?
- What are the primary processes or delivery mechanisms from the various source categories under consideration?
- What is the appropriate level of spatial and temporal detail for determination of the source loading?
- What are the appropriate analysis techniques for estimating the source loads?

Linking Water Quality Targets and Sources

Linking water quality targets and pollutant sources is the fifth component of the technical approach for establishing TMDLs. Establishing the relationship between the in-stream water quality target and pollutant loads allows an estimation of the degree to which historical and existing loads exceed allowable loads, and the associated degree of pollutant reduction needed to attain water quality standards. In addition, linkage analysis facilitates the evaluation of management options that will achieve the desired load reductions. The link can be established through a range of techniques from the use of qualitative assumptions backed by sound scientific justification to the use of sophisticated modeling techniques. Ideally, the linkage will be supported by monitoring data that associate certain waterbody responses to flow and loading conditions. When long-term monitoring data are unavailable, it might be necessary to use a combination of methods, including monitoring data, analytical tools (including simulation models), and qualitative information. The monitoring data help to define characteristics such as baseline water quality conditions, pollutant source loading rates, and waterbody system dynamics. The available monitoring data will be supplemented by analytical tools that represent system processes or their responses to specified inputs and the best professional judgement of persons collecting data. The linkage consists of evaluating the relationship between source loadings and the waterbody's response to those loads over time if long-term data is available.

Key Questions to Consider When Linking Sources and Water Quality Targets

- What type of analysis is appropriate for linking the water quality target and the sources?
- What are the basic components of analysis for linking the water quality targets and the sources?
- What are the complicating factors that can influence the linkage analysis?

Allocating Pollutant Loads

Allocating pollutant loads is the sixth component of the technical approach for establishing TMDLs. Its purpose is to create a technically feasible and reasonably fair division of the allowable load among sources. To be approved, a TMDL's allocation scheme must demonstrate that (1) water quality standards will be attained and maintained and (2) the load reductions are technically achievable. Ultimately, the allocation strategy is used as the foundation for the implementation and monitoring plan. Understanding the relationship between pollutant loads and the condition of the waterbody is the basis for evaluating alternative allocation strategies. If there is a range of allocation strategies that could be implemented, the TMDL should provide various allocation options. This allows for a more rigorous evaluation and decision making process by the stakeholders and regulators. A waterbody's assimilative capacity can be allocated among sources in numerous ways (USEPA, 1991a, 1991b). States, Territories, and authorized Tribes may consider several factors, including technical and programmatic feasibility, cost-effectiveness, relative source contributions, equity, and the likelihood of implementation, to develop the most effective allocation strategy.

Possible Allocation Methods (adapted from USEPA, 1991b)

- Equal percent removal (equal percent "treatment")
- Equal concentrations
- Equal total mass per day, month, or year
- Equal reduction of raw load
- Equal ambient mean annual quality (mg/L)
- Equal cost per mass of pollutant removed
- Percent removal proportional to raw load per day, month, year
- Most significant contributors achieve higher removal rates
- Seasonal limits based on cost-effectiveness analysis
- Minimum total treatment cost

Although there are many ways to express the distribution of the maximum allowable pollutant load, the concept of allocation is central to the TMDL process because it reinforces the importance of identifying what sources need to be addressed to eliminate the impairment. Load-based allocations (e.g., allowable loads or needed load reductions per unit of time) are a required element of the TMDL submittal. The allocations provide a framework for identifying the specific source reduction levels needed to address individual sources, categories of sources, or subcategories of sources. In most TMDLs, the allocation component does not identify specific implementation measures; rather, those measures are identified in the implementation and monitoring plan. It is usually advantageous to develop at least portions of the implementation plan at the same time as the determination of allocations for the following reasons:

- Makes efficient use of assessment and planning resources and the time of participants.
- Increases the likelihood that actions needed to implement the allocations will actually be carried out.
- Improves the analytical basis for supporting arguments regarding "reasonable assurances" that allocations will be effective in meeting the maximum allowable pollutant load specified in the TMDL.

The type, number, and character of pollutant sources affecting an impaired or threatened waterbody will affect how a TMDL is established, which allocation strategy is most effective, and the follow-up monitoring and evaluation activities required. For example, a TMDL that addresses a waterbody impaired by a conventional pollutant, such as biochemical oxygen demand, that is discharged from a single point source will be relatively straightforward. A numeric target is available through State, Territorial, or authorized Tribal water quality standards. Source assessment should consider a low-flow condition (potentially using one of the well-developed analytical techniques available) and allocate maximum pollutant loads both to natural background and to the single discharger that ensures that the water quality standards are attained and maintained. The allocation can be implemented through the discharger's NPDES permit. Follow-up monitoring to ensure compliance with the allocation and success of the TMDL can be a requirement of the permit or can be conducted by the State, Territory, or authorized Tribe at one or two monitoring sites downstream of the discharge.

Establishing a TMDL that addresses a lake or river impaired by a nutrient load comprised of the discharge from several wastewater treatment plants, runoff during storms from grazed pastures, and groundwater that is affected by failing septic systems is different. Narrative water quality standards for nuisance algae, color, and odor should be translated into a numeric surrogate target for the most limiting nutrient. Source assessment should consider how the low-flow and the storm-flow conditions interplay. Although allocations to the point source dischargers can be implemented through their NPDES permits, mechanisms for implementing the allocations to septic systems and pastureland should be formulated and explained in the implementation and monitoring plan.

Allocating Wasteloads to Point Sources

A wasteload allocation is a required element of a TMDL submittal (40 CFR 130.33(b)(5)). EPA has developed numerous technical guidance manuals to assist States, Territories, and authorized Tribes in calculating wasteload allocations for point sources that are identified as contributing to the impairment of a waterbody. The text box on Page 3-17 provides a list of these manuals, as well as a description of other relevant guidance documents. Wasteload allocations should be expressed as (1) numeric maximum allowable loads, (2) required numeric reductions in pollutant loads, and/or (3) narrative effluent requirements.

Expressing wasteload allocations as numeric maximum allowable loads and required numeric reductions in pollutant loads is particularly useful for individual, continuous discharges. The Abaseline@ permitting program and methods for developing water quality-based effluent limits from water quality standards and wasteload allocations were originally designed to regulate continuous discharges from industrial and municipal point sources, where variability of effluent flow and quality can be predicted and modeled using relatively simple techniques. Developing numeric wasteload allocations and numeric water quality-based effluent limits is a relatively straightforward process for these types of discharges.

On the other hand, many of the sources that have recently come under the regulatory umbrella of the NPDES program, or for which there has been renewed interest in controlling through the NPDES program, are associated with episodic runoff. Point sources composed predominately of runoff include: municipal storm water from large and medium-sized cities and runoff from construction and industrial sites (more than 250,000 sources regulated under the NPDES program by 2002); approximately 10,000 combined sewer overflow points across the country; and approximately 15,000-20,000 concentrated animal feeding operations anticipated to be subject to regulation and control as point sources.

For diffuse sources of pollutant loads that are managed through a point source discharge, the quantity and quality of the runoff tends to be episodic and can be difficult to model and predict. Polluted runoff collected and controlled as a point source is frequently discharged from a large number of outfalls, complicating measurement of effluent quality. It may be difficult to establish meaningful wasteload allocations for such point sources. The method of choice for controlling polluted runoff is generally a Abest management practice@ (e.g., silt fences, street sweeping) approach rather than the treatment systems commonly associated with continuous discharges. It is more difficult to monitor or predict the effectiveness of best management practices on reducing the discharge of pollutants into waterways and, therefore, more difficult for a permitting authority to determine with certainty that the requirements it places on sources of polluted runoff will meet a numeric wasteload allocation requirement.

Despite the complexity of addressing episodic sources as part of a TMDL, it is important to consider these sources when developing wasteload allocations in order to continue to make progress toward attaining water quality standards. While the total wasteload allocation computed in the TMDL is assigned an overall maximum numeric allowable load, narrative effluent requirements may be the most appropriate mechanism for achieving the numeric allocation of the non-continuous, wet weather discharge fraction, particularly in the first round of TMDLs and wasteload allocation development. As additional information is gathered and water quality models and the TMDL are refined, a numeric wasteload limit may be developed. The permitting authority may then require that the point source demonstrate that the best management practices it is implementing will achieve the required wasteload allocation or may develop a numeric water quality-based effluent limit that will apply to the discharge under specific wet weather conditions.

Allocating Loads to Nonpoint Sources and Natural Background Sources

A load allocation is a required element of a TMDL submittal (40 CFR 130.33(b)(6)). Load allocations should be expressed as (1) numeric maximum allowable loads, (2) required numeric reductions in pollutant loads, and/or (3) narrative statements of desired conditions (e.g., habitat, biology). EPA regulations allow load allocations for nonpoint sources to be based on "gross allotments" (40 CFR 130.2(f)) depending on the availability of data and appropriate techniques for predicting loads. In addition, before EPA approves a TMDL in which some of the load reductions are allocated to nonpoint sources in lieu of additional load reductions allocated to point sources, there must be reasonable assurances that the nonpoint source reductions will in fact occur.

Allocating a Margin of Safety

An MOS, expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the allowable pollutant load (e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions), is a required element of the TMDL submittal (40 CFR 130.33(b)(7)). Table 3-2 presents six approaches for incorporating an MOS into a TMDL's maximum allowable pollutant load. The approach used should be clearly identified in the submittal of the TMDL.

Table 3-2. Approaches for incorporating a margin of safety in a TMDL

Type of Margin of Safety	Available Approaches
Explicit	• Set numeric targets at more conservative levels than analytical results indicate • Add a safety factor to pollutant loading estimates • Do not allocate a portion of available loading capacity; reserve for MOS
Implicit	• Use conservative assumptions in derivation of numeric targets • Use conservative assumptions when developing numeric model applications • Use conservative assumptions when analyzing prospective feasibility of practices and restoration activities.

The following factors should be considered in evaluating and deriving an appropriate MOS for the waterbody and pollutant combination of concern:

- The limitations in available data for characterizing the waterbody and the pollutant, for addressing the components of the TMDL establishment process.

- The analysis and techniques used in evaluating the components of the allowable pollutant load, and for deriving an allocation scheme.

  - Characterization and estimates of source loadings (e.g., confidence regarding data limits, analysis limits or assumptions).

  - Analysis of relationships between the source loading and receiving water impact.

  - Prediction of receiving water response under various allocation scenarios (e.g., the predictive capability of the analysis, simplifications in the selected techniques).

- The expression of analysis results in terms of confidence intervals or ranges. Confidence may be addressed as a cumulative effect on the load allocation or individually for each component of the analysis.

- The implications of the MOS on the overall load reductions identified in terms of reduction feasibility and implementation time frames.

Establishing TMDLs requires the use of a variety of analytical techniques. Some analytical techniques are widely used and applied in evaluation of source loading and determination of the impacts on waterbodies. For certain pollutants the methods used are newer or in development. However, for some pollutants the process for allocating an explicit margin of safety may be more difficult.

Some of the considerations in evaluating confidence limits for analytical techniques include the following:

- *Interpretation of data in performing the analysis*. Application of traditionally employed analytical techniques still requires the analyst to interpret monitoring information and make the appropriate assumptions and simplifications. Trained analysts determine how to best apply the model to address the dominant and significant characteristics of the system. In some cases only a portion of the analysis will be relatively unknown. For example, when evaluating a river with oxygen violations, the

point source loadings, upstream nonpoint source loading, and in-stream characteristics may be well defined. The contribution of in-stream BOD from bottom sediments may, however, be unclear. The analyst may make an assumption on the significance of this source and estimate a value for the purpose of deriving the allowable pollutant load; however, the monitoring and implementation plan would target this assumption for further investigation.

- *Adequacy of the calibration*. The analysis may be well verified under some, but not all, conditions of concern. For example, statistical analysis between observed and simulated values may show good agreement under a number of flow conditions, but data may not be available to check other flow conditions.

- *New and developing methods*. When applying new and developing methods, the selection of analysis techniques should be based on scientific rationale and/or interpretation of observed data. Concerns regarding the appropriateness and scientific integrity of the analysis should be defined, and the approach for verifying the analysis through monitoring and implementation should be addressed. Without the benefit of long-term experience and testing of the methods used to derive the maximum allowable pollutant load, the potential for the estimate to require refinement is high.

The confidence that an analyst has in the conclusions can be expressed as a range or a confidence interval. For example, the source loading could be expressed as varying within ± 10 percent of the estimated values. The confidence measure can range from small to large depending on the specific characteristics of the analysis. Further data collection and analysis might result in improving the estimate and narrowing the range. In establishing a maximum allowable pollutant load with limited data, the range of the confidence interval could be large (e.g., ±50 percent). In these cases caution should be used to select an MOS that is

Useful EPA Documents For Calculating Wasteload Allocations for Point Sources

Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers. Chapter 1, Biochemical Oxygen Demand/Dissolved Oxygen (EPA 440/4-84-020, 1984)

Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers. Chapter 2, Nutrient/Eutrophication Impacts (EPA 440/4-84-021, 1984)

Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers. Chapter 3, Toxic Substances (EPA 440/4-84-022, 1984)

Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries. Part 1, Estuaries and Waste Load Allocation Models (EPA 823/R-92-002, 1992)

Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries. Part 2, Application of Estuarine Waste Load Allocation Models (EPA 823/R-92-003, 1992)

Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries. Part 3, Use of Mixing Zone Models in Estuarine Waste Load Allocations (EPA 823/R-92-004, 1992)

Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries. Part 4, Critical Review of Coastal Embayment and Estuarine Waste Load Allocation Modeling (EPA 823/R-92-005, 1992)

Technical Guidance Manual for Performing Wasteload Allocations - Book IV, Lakes and Impoundments. Chapter 2, Nutrient/Eutrophication Impacts (EPA 440/4-84-019, 1984)

Technical Guidance Manual for Performing Wasteload Allocations - Book IV, Lakes and Impoundments. Chapter 3, Toxic Substances Impact (EPA 440/4-87-002, 1987)

Technical Guidance Manual for Performing Wasteload Allocations - Book VI, Design Conditions. Chapter 1, Stream Design Flow for Steady-State Modeling (EPA 440/4-86-014, 1986)

Technical Guidance Manual for Performing Wasteload Allocations - Book VI, Design Conditions. Chapter 2, Temperature, pH, and Hardness (EPA 440/4-86-014, 1986)

Technical Guidance Manual for Performing Wasteload Allocations - Book VII, Permit Averaging. (EPA 440/4-84-023, 1984)

Technical Guidance Manual for Performing Wasteload Allocations - Simplified Analytical Method for Determining NPDES Effluent Limitations for POTWs Discharging to Low-Flow Streams. (EPA 440/4-86-015, 1986)

reasonable and results in an overall allocation that represents the best estimate of how standards can be achieved. The selection of the MOS should clarify the implications for monitoring and implementation planning in refining the estimate, if necessary. The TMDL process accommodates the ability to track and ultimately refine assumptions within the TMDL implementation planning component.

Two conceptual examples can be used to illustrate how an appropriate MOS can be selected by integrating consideration of these factors.

> Example 1. The impact of several point source discharges is evaluated using steady-state modeling under low- flow (e.g., 7Q10) conditions. The point source discharges and the upstream background conditions and known, accepted modeling techniques are used to evaluate the appropriate load reductions for each source. The MOS could be defined explicitly based on evaluation of the model accuracy or implicitly through the use of equivalent conservative assumptions regarding the model development. The MOS is based on a direct assessment of model accuracy, as well as historical experience in using this model throughout the country. Conducting a sensitivity analysis on the precision of point source loads (10%) and background conditions (20%) shows a change of 5% on model runs. The MOS is well defined and results in an additional 5 percent load reduction from the contributing sources.
>
> Example 2. A eutrophic lake requires significant load reductions from nonpoint sources within the contributing watershed. A simplified loading assessment was performed to evaluate the average annual loadings. A defensible eutrophication model was used to evaluate the in-lake target of chlorophyll *a*. Adequate data were available for calibration and validation of the model. Considerable discussion has been held among the stakeholders over the accuracy of the loading estimate. Four different analyses have been proposed with loading numbers that range ±40 percent from the initial load estimate used to derive the allowable pollutant load. Stakeholders have agreed that additional monitoring of lake inflows should be initiated to better refine this number. The allowable pollutant load, based on an average value from four analyses, is established with a cautious 10 percent MOS, and the monitoring and implementation plan is initiated with the intention that the load reductions will be revised, if necessary. Follow-up monitoring is initiated at the major tributary inflows to the lake. Three years of monitoring data show that the observed load is consistent with the predicted load used in the analysis. The in-lake condition shows an improving trend. Since monitoring milestones are met, there is no indication that the TMDL needs to be revised.

Seasonality

Consideration of seasonal variation such that water quality standards for the allocated pollutant will be met during all seasons of the year is a required element of a TMDL submittal (40 CFR 130.33(b)(8)). TMDLs must maintain or attain water quality standards throughout the year and consider variations in the waterbody's assimilative capacity caused by seasonal changes in temperature and flow, or sensitive periods for aquatic biota (e.g., algae growth, fish spawning, larval emergence), and other factors.

TMDLs should also consider seasonal fluctuations in pollutant loads to the waterbody. Some nonpoint sources contribute pollutant loads only during precipitation events, a distinct rainy season, or snowmelt. Similarly, some point sources operate only during certain times of year (e.g., food processing during canning season or wastewater treatment during tourist season).

The issue of seasonality may or may not affect the final character of a TMDL, depending on when the waterbody impairment occurs and how pollutant loading is related. For example, the algae growth in a lake may be a response to total annual phosphorus loading, rather than just the loading that occurs during the summer growth season. Therefore, all sources may need allocations and control measures implemented throughout the year, not just the sources shown to contribute during the summer.

Future Growth

In many instances, population growth and the land use changes that accompany new development have the potential to negatively impact threatened and impaired waters. Increased sewage treatment flows, increased runoff from expanded areas of impervious surface cover, and other hydromodifications associated with urban growth can make the challenge of protecting and restoring the nation's waters even more difficult. Therefore, as states develop effective TMDLs and implementation strategies, they must give serious consideration of the consequences of reasonably foreseeable increases in pollutant loads attributed to future growth. As such, an allocation to future growth is a required element of a TMDL submittal (40 CFR 130.33(b)(9)). EPA expects States, Territories, and authorized Tribes to include future growth in their allocation strategy and carefully document their decision-making process (states/territories/and authorized tribes can decide on a zero allocation if they desire). The TMDL documentation should clearly explain the implications of the growth allocation decision on new and existing point and nonpoint sources of a pollutant. It should also explain what other local planning processes may be affected .

Supporting Decisions Within the TMDL Record

EPA, States, Territories, and authorized Tribes should carefully document and support the decision-making process that they use. If it is determined that a TMDL should be developed, States, Territories, and authorized Tribes and EPA should clarify the role of any assumptions and ensure that judgment is exercised by trained and experienced professionals, based on the best available science and data. Assumptions should be well documented and submitted as part of the TMDL submittal. The implications of key assumptions should be addressed in the formulation of the MOS for the allowable pollutant load. Monitoring plans, also included within the TMDL submittal should address specialized data collection needs for addressing uncertainty in the analysis. Stakeholders should be informed and involved early in the TMDL establishment process to promote understanding, acceptance and commitment to implementation.

Some Ways to Support Important Decisions

- Expert opinions
- Scientific or technical advisory groups
- Literature, preferably peer-reviewed studies
- Reports or studies by local institutions
- Documented surveys and observations of local conditions
- Documentation that no data are available or that the best available data were used
- Identifying supplemental monitoring and data collection efforts

Equity Issues

Allocations entail distribution of control needs or expectations among different point and nonpoint sources. Because costs of controlling different sources can vary substantially, the allocation analysis should consider whether the allocations reasonably distribute control costs . Analysts should develop and consider cost/benefit analyses of potential control actions to assist in fairly distributing control costs. Responsible parties will be more likely to carry out actions needed to implement TMDLs if they feel their share of the

control burden is fair. Therefore, analysts should consult with affected stakeholders during the development of an allocation strategy. Many methods for developing allocations that can result in equitable control burdens are available. See *Guidance for water quality-based decisions: The TMDL process (USEPA, 1991b)* for additional guidance on allocation development. In some communities, stakeholders may already have laid the groundwork for allocating pollutant loads and addressed potential equity issues through local watershed planning.

Example of Establishing a Sediment TMDL

- *Problem Identification:* Fish are unable to spawn in a creek because excess sediment is clogging the interstitial spaces of the stream bottom, there is no habitat for the insects that are a food source for fish, and the concentration of dissolved oxygen is insufficient for eggs and young fish to survive. Although the ultimate target for this problem may be to increase successful spawning by 20 percent, the maximum allowable pollutant load analysis and load allocation will be based on decreasing the amount of clean sediment in the stream system. The TMDL will need to establish a quantified link between spawning success and the amount of clean sediment on the stream bottom.
- *Target Analysis:* Characterize the sediment transport regime of the stream system given the hydrologic conditions at hand; that is, determine how much sediment the stream can carry through the system without too much settling. Quantify how far the current system deviates from this ideal.
- *Source Assessment:* Identify and characterize sources of sediment input, such as eroding banks or storm runoff.
- *Linkage of the Source and Maximum Allowable Pollutant Load:* Use available data and information to develop relationships between the sources of sediment and the maximum allowable pollutant load. If necessary, establish a specialized monitoring strategy to obtain the data needed to establish this relationship.
- *Allocation:* Allocate the total allowable sediment load; that is, determine the amount of sediment that each source may contribute or, conversely, determine by how much each source must decrease the amount of sediment it is contributing. Identify the appropriate MOS based on an understanding of the fundamental assumptions in the analysis regarding the in-stream endpoint, the load estimation, and the loading processes.
- *Implementation Plan:* Identify the measures, such as specific best management practices or the number of miles of stream bank stabilization, that must be implemented to help identified sources meet their allocations (i.e., to help identified sources decrease their contribution to the total sediment load).
- *Monitoring Plan:* Develop a set of milestones for evaluation of the implementation and progress toward meeting water quality standards using a suite of measures (i.e., BMP implementation, load estimates, bank conditions, percent fine sediments, and presence of fish). Since uncertainty is high, identify the conditions under which the TMDL might need to be revised.

Innovative Approaches

TMDLs provide excellent opportunities to consider alternative approaches for making watershed based water quality management decisions. One opportunity is to consider alternatives for making wasteload and load allocation decisions among point and nonpoint sources and evaluating the social and economic consequences of these allocations. States, Territories, and authorized Tribes are encouraged to consider innovative approaches (e.g., watershed permitting and pollutant trading) when establishing a pollutant load allocation strategy. Watershed-based pollutant trading is one example of an innovative approach that can be employed in the TMDL allocation process. In it's broadest sense, trading involves one source of a pollutant buying reductions in releases of that pollutant from another source elsewhere on the same waterbody or watershed, instead of implementing tighter controls on that pollutant at his/her facility. Trading is a feasible option in those situations where there are substantial differences in the marginal cost of additional controls between contributors of a pollutant to a common waterbody. Not only does trading offer a means of achieving water quality goals in a more cost-effective fashion, but it also can be used to encourage attainment of goals sooner than applicable deadlines and/or generate greater reductions than

required by law. (See *Draft Framework for Watershed-Based Trading* USEPA May 1996, EPA-800-R-96-001). Trading and reallocation of loadings may occur once a TMDL has been approved and does not require that the TMDL be reopened provided that the following guidelines fro trades or systems for reallocating loadings are met:

- The TMDL implementation plan should provide reasonable assurances that allocations will be achieved and water quality standards met when using the approach.

- All legal requirements associated with the allocation process (and the TMDL process in general) are met.

- Any trades or systems for reallocation of loadings involving point sources are established as enforceable conditions of NPDES permits and are consistent with the overall loading requirement established in the TMDL.

- The TMDL implementation plan should contain detailed, specific provisions for follow-up evaluation of the innovative approach and potential revision or elimination of the innovative approach in favor of a more traditional approach based on that review.

Implementation and Monitoring

Implementation and monitoring is the seventh component of the technical approach for establishing TMDLs. Without implementation, a TMDL merely provides estimates of the pollutant load reductions needed to attain water quality standards. Therefore, EPA firmly believes that implementation and follow-up monitoring of TMDLs is crucial to the success of any State water quality program.

The regulation at 40 CFR 130.33(b)(10) requires States, Territories, and authorized Tribes to include an implementation plan as an element of a TMDL submittal. The plan may be developed for one or a group of TMDLs. Once EPA approves the TMDL, the plan must be included as an update to the State water quality management plan. States, Territories, and authorized Tribes are required to update their water quality management plans as needed to reflect changing water quality conditions and the results of implementation actions.

Minimum Elements of an Approvable Implementation Plan

Whether an implementation plan is for one TMDL or a group of TMDLs, it must include at a minimum the following eight elements:

- *Implementation actions/management measures:* a description of the implementation actions and/or management measures required to implement the allocations contained in the TMDL, along with a a description of the effectiveness of these actions and/or measures in achieving the required pollutant loads or reductions.

- *Time line:* a description of when activities necessary to implement the TMDL will occur. It must include a schedule for revising NPDES permits to be consistent with the TMDL. The schedule must also include when best management practices and/or controls will be implemented for source

categories, subcategories and individual sources. Interim milestones to judge progress are also required.

- *Reasonable assurances:* reasonable assurance that the implementation activities will occur. Reasonable assurance means a high degree of confidence that wasteload allocations and /or load allocations in TMDLs will be implemented by Federal, State or local authorities and /or voluntary action. For point sources, reasonable assurance means that NPDES permits (including coverage under applicable general NPDES permits) will be consistent with any applicable wasteload allocation contained in the TMDL. For nonpoint sources, reasonable assurance means that nonpoint source controls are specific to the pollutant of concern, implemented according to an expeditious schedule and supported by reliable delivery mechanisms and adequate funding (see box).

- *Legal or regulatory controls:* a description of the legal authorities under which implementation will occur (as defined in 40 CFR 130.2(p)). These authorities include, for example, NPDES, Section 401 certification, Federal Land Policy and Management programs, legal requirements associated with financial assistance agreements under the Farm Bills enacted by Congress and a broad variety of enforceable State, Territorial, and authorized Tribal laws to control nonpoint source pollution.

- *Time required to attain water quality standards:* an estimate of the time required to attain water quality. The estimates of the time required to attain and maintain water quality standards must be specific to the source category, subcategory or individual source and tied to the pollutant for which the TMDL is being established. It must also be consistent with the geographic scale of the TMDL, including the implementation actions.

- *Monitoring plan:* a monitoring or modeling plan designed to determine the effectiveness of the implementation actions and to help determine whether allocations are met. The monitoring or modeling plan must be designed to describe whether allocations are sufficient to attain water quality standards and how it will be determined whether implementation actions, including interim milestones, are occurring as planned. The monitoring approach must also contain an approach for assessing the effectiveness of best management practices and control actions for nonpoint sources.

- *Milestones for attaining water quality standards:* a description of milestones that will be used to measure progress in attaining water quality standards. The milestones must reflect the pollutant for which the TMDL is being established and be consistent with the geographic scale of the TMDL, including the implementation actions. The monitoring plan must contain incremental, measurable milestones consistent with the specific implementation action and the time frames for implementing those actions.

- *TMDL revision procedures:* a description of when TMDLs must be revised. EPA expects that the monitoring plan would describe when failure to meet specific milestones for implementing actions or interim milestones for attaining water quality standards will trigger a revision of the TMDL.

Identifying Control Actions and/or Management Measures for Implementing Allocations

The implementation plan should describe what actions will be implemented by source category, source subcategory, or individual sources. The description of the actions should include an analysis of the anticipated or past effectiveness of the control actions and/or management measures expected to meet the allocations. The implementation plan should describe where the control actions and/or management measures will be implemented. Finally, this description should tie the implementation activity to the pollutant and the geographic scale of the TMDL.

> 40 CFR § 130.2(p) *Reasonable assurance*. Reasonable assurance means that you demonstrate that each wasteload allocation and load allocation in a TMDL will be implemented. For point sources regulated under section 402 of the Clean Water Act you must demonstrate reasonable assurance by procedures that ensure that enforceable NPDES permits (including coverage to individual sources under a general NPDES permit) will be issued expeditiously to implement applicable wasteload allocations for point sources. For nonpoint sources you must demonstrate reasonable assurance by specific procedures and mechanisms that ensure load allocations for nonpoint sources will be implemented for that waterbody. Specific procedures and mechanisms for nonpoint sources must apply to the pollutant for which the TMDL is being established, must be implemented expeditiously and must be supported by adequate funding. Examples of specific procedures and mechanisms which may provide reasonable assurance for nonpoint sources include State, Territorial, and authorized Tribal regulations, local ordinances, performance bonds, contracts, cost sharing agreements, memoranda of understanding, site specific or watershed-specific voluntary actions, and compliance audits of best management practices.

Point Sources. One of the key TMDL implementation tools is the wastewater permitting program known as the National Pollutant Discharge Elimination System (NPDES). Under NPDES, all facilities which discharge pollutants from any point source into waters of the United States are required to obtain a permit. For these point sources, States, Territories and authorized Tribes must provide a list of NPDES permits, including applicable general permits, and a schedule for revising the permits based on the TMDL.

The permit provides two enforceable levels of control: technology-based limits (based on the ability of dischargers in the same industrial category to treat wastewater) and water quality-based limits (if technology-based limits are not sufficient to provide protection of the water body). Permit limits based on TMDLs are water quality-based limits. These water quality-based permit limits must be consistent with any applicable wasteload allocation contained in the TMDL for that watershed and pollutant combination. These discharge limits are expressed as numerical restrictions on discharges (e.g., not to exceed 10 kg/day copper) or when numerical restrictions are infeasible, as best management practices (BMPs). (See 40 CFR 122.44(k)). BMPs are more commonly used as effluent limits for point sources such as urban or industrial storm water, or for concentrated animal feeding operations.

In addition, the Clean Water Act (and corresponding State statutes) authorizes imposition of monitoring and data collection requirements on the owner or operator of a point source discharge for the purposes of supporting permit development and compliance assessment. Requirements may include effluent monitoring, ambient and biological assessments, toxicity reduction evaluations, in-plant monitoring, and others. Information collected from point sources may be used when developing or assessing the effectiveness of a TMDL. The primary mechanism for data collection from point sources is a requirement in the NPDES permit. Permit requirements for data collection are particularly useful when longer-term data (e.g., for several seasons) are needed. In addition, information may be collected through administrative orders or through a direct request under Section 308 if there is a reasonable need for the information for EPA to carry out the objectives of the Clean Water Act. (This request must also meet requirements of the Paperwork Reduction Act.) These authorities can be used to collect data from point sources when developing or assessing the effectiveness of a TMDL affecting those point sources, or deciding if current permits need revision. EPA recommends that permit requirements for data collection be required when ever needed to support TMDLs.

As part of the implementation plan, States, Territories, and authorized Tribes must provide a list of NPDES permits, including applicable general permits, and a schedule for revising or reissuing the permits.

Nonpoint Sources. For nonpoint source load allocations, States, Territories and authorized Tribes must prepare an implementation plan that includes a description of the proposed control measures. EPA expects that the State's, Territory's, or authorized Tribe's § 319 nonpoint source management program will be the basis for implementing load allocations. The implementation plan must contain a description of best management practices or other management measures. The plan will contain a description of who will carry out the controls and identify the source categories, subcategories, or individual sources of the pollutant for which the TMDL was approved. The implementation plan may deal with sources on a watershed basis as long as the scale of the implementation plan is consistent with the geographic scale for which the TMDL pollutant load allocations are established.

Nonpoint source pollution may be managed through implementation of best management practices (BMPs), regulatory processes, siting criteria, and operating methods. These control measures should be based on load allocations developed using the TMDL process. In establishing an overall allocation strategy, there is a strong interdependence between the nonpoint and point source elements. .For example, when permits are established for individual point sources based on an expectation of reductions from nonpoint sources there must be a reasonable assurance that nonpoint source controls will be implemented. Assurances may include local ordinances, grant conditions, or other enforcement authorities. For example, it might be appropriate to provide that a permit be reopened for a wasteload allocation that requires more stringent limits because attainment of a nonpoint source load allocation was not demonstrated.

To fully address waters that are impaired or threatened by nonpoint source pollution, States, Territories, and authorized Tribes should implement their nonpoint source management programs and ensure adoption of control measures by all contributors of nonpoint source pollution in those watersheds. Example BMPs and the primary pollutants controlled are presented in Table 3-3. Information on the cost and effectiveness of various BMPs can be found in numerous guidance documents (see reference section for a list).

There are regional differences in the effectiveness of BMPs due to differences in climate and physical conditions. State, Territorial and Tribal nonpoint source management programs may include, as appropriate, nonregulatory or regulatory load allocation programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects.

Enforceable Mechanisms To Control Nonpoint Source Water Pollution (ELI, 1997)

An enforceable mechanism has three components:

1. A *standard* applicable to an identified entity or entities.
2. A *sanction* such as a civil, criminal, or administrative penalty, loss of a license, or performance of required remedial action, but not mere loss of an incentive.
3. A *process*, either explicit or implied, for applying the standard and imposing the sanction.

The achievement of nonpoint source load reductions is a complex challenge. Therefore, States, Territories, and authorized Tribes must describe nonpoint source load reductions and establish a procedure for reviewing and revising BMPs in TMDL documentation. Achievement of water quality standards is tracked using the selected milestones and measures. The key objective for documenting load reduction goals and review procedures is to establish a rational and self-correcting procedure for site-specific evaluation of TMDLs with significant nonpoint source pollution loads.

Mechanisms for Implementing Controls

Legal Authorities. The implementation plan must contain a description of the legal authorities under which implementation will occur. These authorities include, but are not limited to, NPDES, § 401 certification, Federal Land Policy and Management Act § 202, CZARA, State forest practices acts, CWA § 319 management programs, and various State, Territorial, Tribal and local programs.

Table 3-3. Common NPS management practices/measures and pollutants controlled

Source Category	Primary Pollutant(s) Controlled	Management Practices/Measures
Agriculture	Nitrogen, phosphorus, sediment	Tillage management for erosion control
	Nitrogen, phosphorus, pathogens, BOD	Control of runoff from confined animal facilities
	Nitrogen, phosphorus	Nutrient management
	Pesticides	Pesticide management
	Nitrogen, phosphorus, sediment, temperature (heat)	Grazing management
	Nitrogen, phosphorus, sediment, toxics	Irrigation water management
Forestry	Nitrogen, phosphorus, temperature (heat)	Preharvest planning
	Temperature (heat)	Streamside area management
	Sediment	Road construction/reconstruction/management
	Sediment	Timber harvest management
	Sediment	Site preparation and forest regeneration
	Sediment	Fire management
	Toxics	Forest chemical management
Urban	Sediment	New development
	Sediment	Watershed planning / protection
	Temperature, sediment	Site development
	Sediment	Construction site erosion and sediment control
	Toxics	Construction site chemical control
	Nitrogen, phosphorus, sediment	Existing development
	Nitrogen, phosphorus, pathogens	Onsite disposal systems management
	Nitrogen, phosphorus, toxics	Pollution prevention
	Nitrogen, phosphorus, sediment, toxics	Operation and maintenance of existing BMPs
Marinas/Boating	Pathogens, nitrogen, phosphorus, toxics	Marina/boating management
Hydromodification	Temperature (heat), sediment	Maintenance of physical, biological, and chemical characteristics of streams and surface water

Incentives may be used to demonstrate reasonable assurance that a control action and/or management measure will be implemented. If incentives are used, evidence of past success of the particular incentive should be included in the implementation plan. Examples of incentives that have proven successful include

cost sharing of BMP installation, grants for a specific activity (e.g., public education), long-term leases or rentals of environmentally sensitive land or buffers, and tax incentives and disincentives. Tax incentives and disincentives involve establishing a tax system to encourage or discourage certain behaviors by offering tax reductions or increases.

Identifying Responsible Parties. The implementation and monitoring plan should clearly identify those responsible for ensuring the implementation of specified control actions and/or management measures. The most appropriate party will vary depending on how sources are grouped, the control actions and/or management measures required, and who is funding implementation. For example, it might be most useful to identify the facility administrator and operator when control actions are required of an individual discharger, but to indicate an appropriate organization when control actions are required of a grouping of dischargers or when management measures are required for a nonpoint source category.

Possible Legal Authorities for Nonpoint Source Controls

General	General permits Municipal ordinances Sedimentation and erosion control laws
Forestry	Comprehensive statewide forest practice acts Forestry "bad actor" laws Licensing requirements for foresters Forestry taxes
Agriculture	Statewide erosion control requirements Agriculture "bad actor" laws Conservation district authorities Confined animal feeding operation (CAFO) regulations/permitting Agricultural taxes Registration of fertilizers/pesticides Licensing or certification of fertilizer/pesticide Dealers and commercial applicators
Urban	Municipal Stormwater advances Individual sewage disposal system (ISDS) codes General building codes Zoning Federal Emergency Management Agency (FEMA) requirements

Funding. Perhaps the most challenging element of reasonable assurance is the guarantee of adequate funding for nonpoint source controls. The identification of dedicated funding for specific program goals is important, but often difficult. For example, storm water utility fees are used in more than 100 communities. These utility fees provide reliable funding to pay for long-term storm water management planning, implementation, and operation and maintenance. A variety of program funding alternatives for local and state governments are presented in *A State and Local Government Guide to Environmental Program Funding Alternatives* (USEPA, 1994a.) Additional sources of funding that can be obtained from the Federal government for State and local governments as well as individuals (e.g., farmers) are presented in *Catalog of Federal Funding Sources for Watershed Protection* (USEPA, 1997g.)

Point source facilities generally have mechanisms in place to secure funds needed for implementing the retrofits, process modifications, and additional pollutant controls that may be required to meet the load allocations required within a TMDL. Whether they are affected individually or as part of a category of sources, facilities should be consulted about how to best fund required actions. EPA anticipates that the economic feasibility of various allocation strategies will be discussed at this stage of TMDL establishment.

Tracking Implementation

To achieve the specified load allocation, the implementation plan should include a time line for installation of identified management actions. Especially in the case of nonpoint source controls, the specific management actions will be distributed in various locations in the watershed. Tracking of the implementation of management actions over time will provide valuable information. The tracking of

implementation will assist in determining the success of the load allocation, the adequacy of funding and resources, the potential for water quality improvement, and the need for corrective actions. Tracking information in the various subwatersheds within the contributing area can assist in the evaluation of water quality monitoring data for beneficial trends. For areas with predominantly nonpoint source controls, the use of tracking information can support demonstration of progress in the absence of clear benefit through water quality monitoring. The variability in nonpoint source loadings due to hydrologic variability can often make it difficult to discern short-term trends.

A Time Line Unifies the Implementation Plan and the Allocations

States, Territories, and authorized Tribes should consider their TMDL time line as a vehicle for tying the most important components and elements of the TMDL into an adaptive management strategy. The time line can be used to clearly and effectively link measures of use attainment, controls, attainment of milestones, progress toward attainment of water quality standards, and a final decision about whether to revise the TMDL.

Figure 3-2 provides a sample template for what milestone review of TMDL monitoring, tracking, and implementation might look like. The very top of the template includes relevant information about the waterbody and pollutant combination, as well as about the TMDL itself. Below are a series of time lines—one for each measure of success (numeric criteria, surrogate measures, supporting surrogates)—which clearly illustrate goals, important decision points, and ongoing trends (tracking). The bottom of the template lists the milestones, the observed trends, the measures of success, and the recommendations for follow-up action.

The schedule must detail when specific control actions will be implemented for point and nonpoint source categories, subcategories, and individual sources. For point sources, specific items that should be considered are the schedule for revising NPDES permits, when necessary, and any compliance schedules for specific point sources. For nonpoint sources, specific items that should be considered include the grant program schedules and weather-related issues (e.g., rainy seasons when it would be more difficult to put management measures in place).

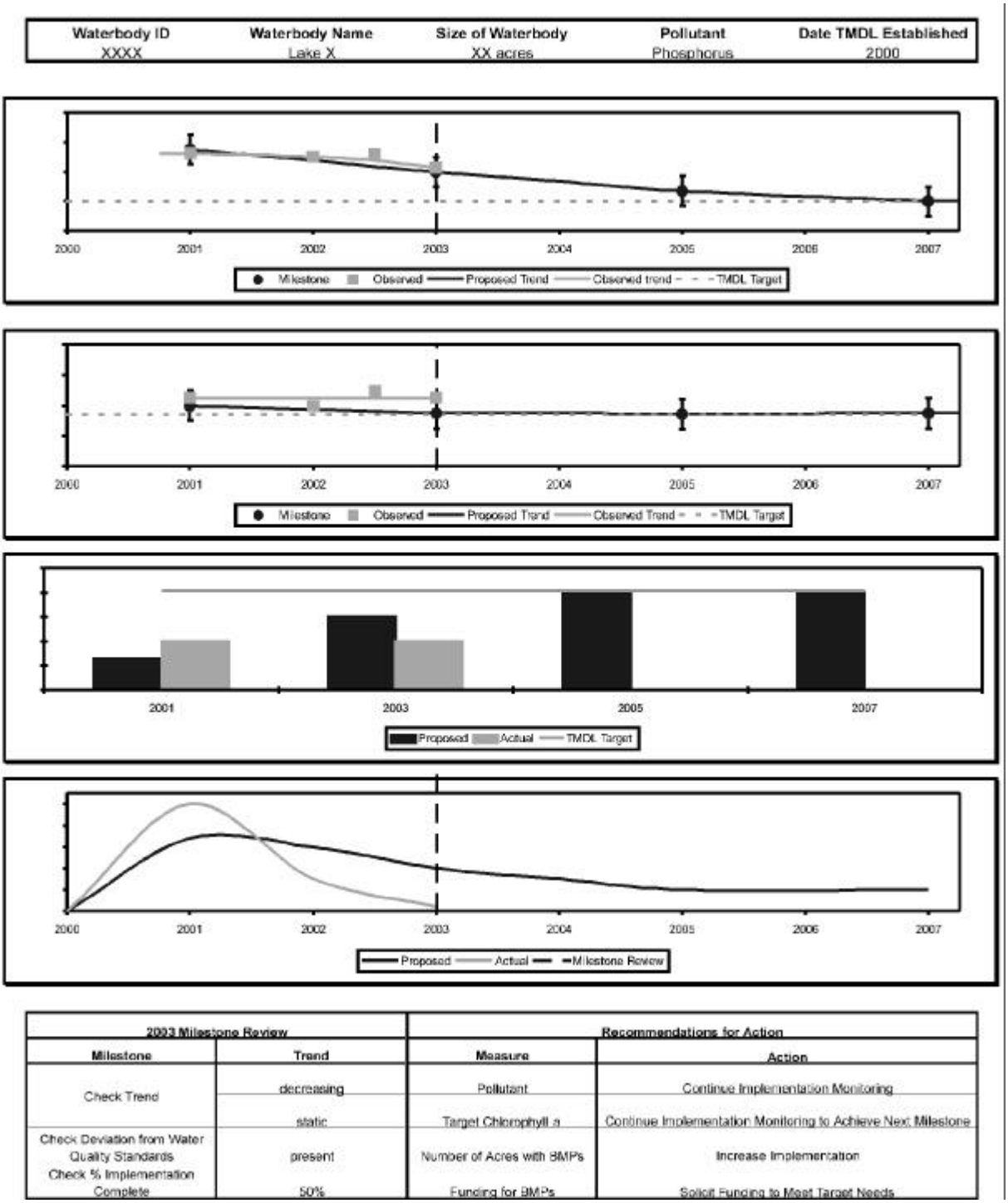
Interpretation of the data gathering and comparison with the designated milestones and schedules might result in reevaluation of the TMDL for waterbody and pollutant combinations on Part 3 of the § 303(d) list and recommendations for placement of the waterbody and pollutant combination back on Part 1 of the list. The TMDL would then need to be scheduled for revision and reestablished; follow-up implementation and monitoring would need to be reinitiated. Figure 3-3 provides a conceptual overview of the relationship between TMDL establishment, implementation tracking and monitoring, and the § 303(d) listing cycle. Once the TMDL is approved, (i.e., for Part 3 waterbody and pollutant combinations,) the State, Territory, or authorized Tribe would consider the following options:

- *Delisting*. Observed data confirm that the waterbody meets water quality standards for the specific pollutant.

- *Continued implementation and tracking*. The monitoring shows that milestones have been met and the TMDL appears to be appropriate.

- *Corrective actions identified*. Although milestones have not been met, corrective actions have been identified and initiated. There is no reason to believe that the TMDL is inappropriate.

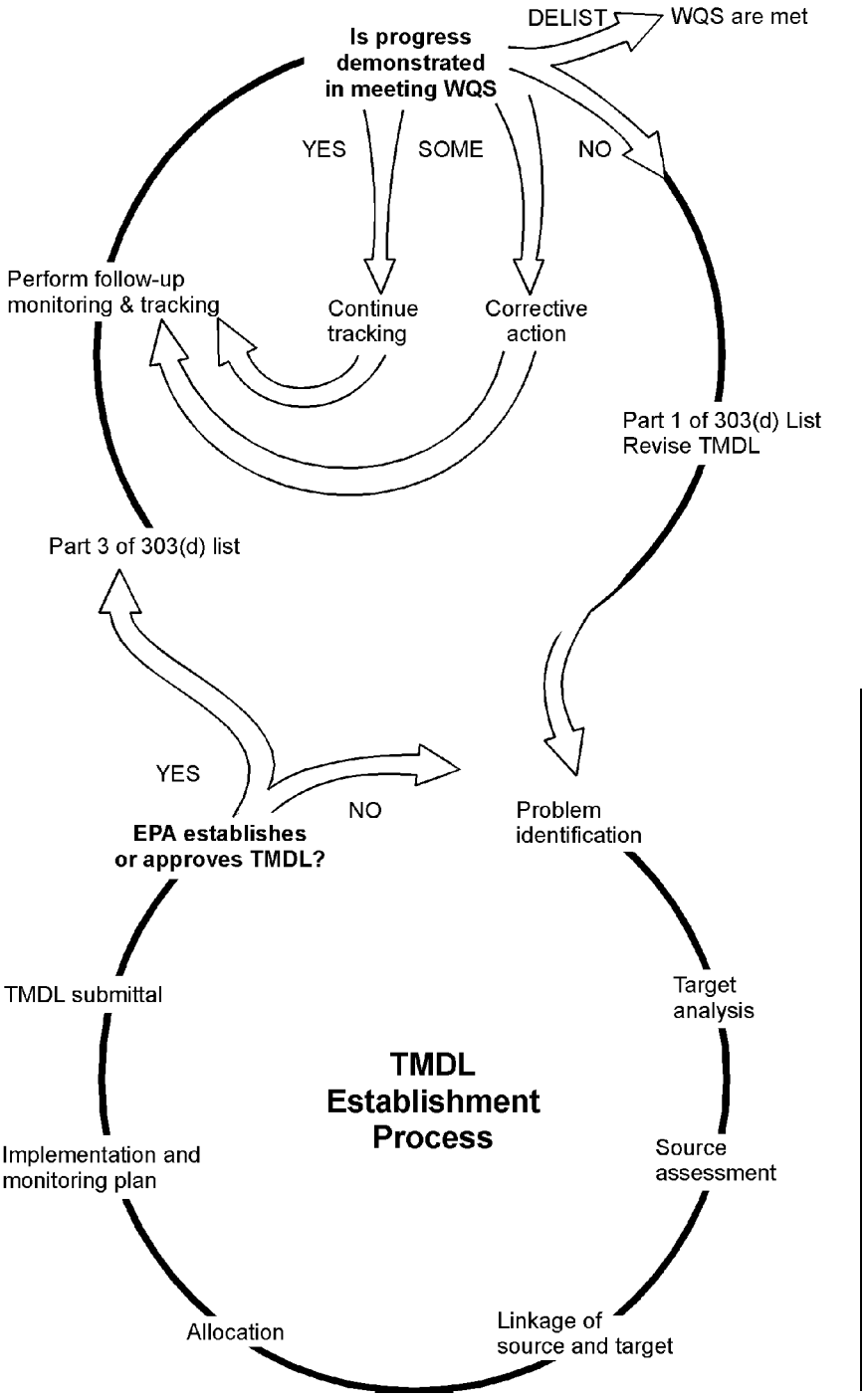
- *Placement on the Part 1 list*. The milestones have not been met, and monitoring shows that it is unlikely that the TMDL will be sufficient to meet water quality standards. Revision or refinement of the TMDL is recommended. The waterbody and pollutant combination is placed on Part 1 of the § 303(d) list and scheduled for revision.



2003 Milestone Review		Recommendations for Action	
Milestone	**Trend**	**Measure**	**Action**
Check Trend	decreasing	Pollutant	Continue Implementation Monitoring
	static	Target Chlorophyll a	Continue Implementation Monitoring to Achieve Next Milestone
Check Deviation from Water Quality Standards	present	Number of Acres with BMPs	Increase Implementation
Check % Implementation Complete	50%	Funding for BMPs	Solicit Funding to Meet Target Needs

Figure 3-2. Sample TMDL monitoring, tracking, and implementation template for milestone review.

Figure 3-3. Conceptual overview of the relationship between follow-up monitoring and TMDL revision.



Monitoring and Evaluation Ensures Timely, Informed Follow-up Actions

Each TMDL should include a monitoring plan designed to determine the effectiveness of control actions and/or management measures being implemented and whether the TMDL is working, as well as a procedure that will be followed if components of a TMDL must be refined. The monitoring and adaptive management plan is a central component of a TMDL. This plan should incorporate each of the components discussed below along with adequate rationale for the selected monitoring and adaptive management approach. The plan should clearly indicate the monitoring goals and hypotheses, the parameters to be monitored, the locations and frequency of monitoring, the monitoring methods to be used, the schedule for review and potential revision, and the parties responsible for implementing the plan. It must contain incremental, measurable targets consistent with the specific implementation action and the time frames for implementing those actions. This information is needed to adequately assess whether the specified actions are sufficient to attain water quality standards.

The following are key factors to consider when developing a TMDL monitoring plan:

- *Need to evaluate specific TMDL components*. TMDL problem identification, indicators, numeric targets, source estimates, and allocations might need reevaluation to determine whether they are accurate and effective. The monitoring plan should define specific questions to be answered about these components through the collection of monitoring information. Potential questions include the following:

  - Are the selected measures of success capable of detecting designated or existing use impacts of concern and responses to control actions?

  - Have baseline or background conditions been adequately characterized?

  - Are the numeric targets set at levels that reasonably represent the appropriate desired conditions for designated or existing uses of concern?

  - Have all important sources been identified?

  - Have sources been accurately estimated?

  - Has the linkage between sources and in-stream impacts been accurately characterized?

  - Have other watershed processes that affect the pollutant's impact(s) on designated or existing uses (e.g., hydrology) been accurately characterized?

  - Where reference sites were used to help determine TMDL targets and load reduction needs, were reference site conditions accurately characterized?

  - Were models or methods used for the TMDL accurately calibrated?

- *Need to evaluate implementation actions*. It is often important to determine whether actions identified in the implementation plan were actually carried out (implementation monitoring) and whether these actions were effective in attaining TMDL allocations (effectiveness monitoring). Specific questions to be answered concerning implementation actions should be articulated as part of the monitoring plan. Some illustrations of variables that can be used for implementation tracking are listed in Table 3-4.

Table 3-4. Example variables for assessing management measure implementation for urban, agricultural, and forestry sources (adapted from USEPA, 1997b)

URBAN SOURCES

Management Measure	Good Variable	Poor Variable	Appropriate Sampling Unit
New Development	· Number of county staff trained in ESC control. · Width of filter strips relative to area drained.	· Allocation of funding for development of education materials. · Scheduled frequency of runoff control maintenance.	· Subwatershed · Development site
Watershed Protection	· Percent of highly erodible soils left in an undeveloped state. · Percent natural drainage ways altered.	· Development of watershed analysis GIS system. · Assessed fines for violations of setback standards.	· Subwatershed
Construction Site Erosion and Sediment Control (ESC)	· Distance runoff travels on disturbed soils before it is intercepted by a runoff control device (relative to slope and soil type). · Adequacy of ESC practices relative to soil type, slope, and precipitation.	· Number of ESC BMPs used at a construction site. · Number of ESC plans written.	· Development site
Existing Development	· Proper operation and maintenance of surface water runoff management facilities. · Installation of appropriate BMPs in areas assigned priority as being in need of structural NPS controls.	· Development of a schedule for BMP implementation. · Setting priorities for structural improvements in development areas.	· Subwatershed
Operating Onsite Disposal Systems (OSDS)	· Increase in proper OSDS operation and maintenance 6 months after a public education campaign. · Average time between OSDS maintenance visits.	· Scheduled frequency of OSDS inspections. · Authorization of funding for public education campaign on OSDS.	· Subwatershed · City · Town

AGRICULTURE

Management Measure	Good Variable	Poor Variable	Appropriate Sampling Unit
Erosion and Sediment Control	· Area on which reduced tillage or terrace systems are installed · Area of runoff diversion systems or filter strips per acre of cropland · Area of highly erodible cropland converted to permanent cover	· Number of approved farm soil and erosion management plans · Number of grassed waterways, grade stabilization structures, filter strips installed	· Field · Acre
Facility Wastewater and Runoff from Confined Animal Facilities	· Quantity and percentage of total facility wastewater and runoff collected by a waste storage or treatment system	· Number of manure storage facilities	· Confined animal facility · Animal unit
Nutrient Management	· Number of farms following and acreage covered by approved nutrient management plans · Percent of farmers keeping records and applying nutrients at rates consistent with management recommendations · Quantity and percent reduction in fertilizer applied · Amount of fertilizer and manure spread between spreader calibrations	· Number of farms with approved nutrient management plans	· Farm · Field · Application

Management Measure	Good Variable	Poor Variable	Appropriate Sampling Unit
Pesticide Management	· Number of farms with complete records of field surveys and pesticide applications and following approved pest management plans · Number of pest field surveys performed on a weekly (or other time frame) basis · Quantity and percent reduction in pesticides use	· Number of farms with approved pesticide management plans	· Field · Farm · Application
Grazing Management	· Number of cattle-hours of access to riparian areas per day · Miles of stream from which grazing animals are excluded	· Miles of fence installed	· Stream mile · Animal unit

FORESTRY

Management Measure	Good Variable	Poor Variable	Appropriate Sampling Unit
Preharvest Planning	· Agreement between preharvest plan and harvest operation · Inclusion of all required elements in preharvest plan	· Number of preharvest plans developed/approved	· Harvest operation · Preharvest plan
Streamside Management Areas (SMAs)	· Width of SMAs · Leave trees in SMAs meet minimum requirements	· Presence of waterbody on harvest site · Number of stream crossings in SMA	· 100-ft stretch of SMA
Road Construction/ Reconstruction	· Compaction of fill materials adequate to prevent erosion · Culverts cross streams at right angles	· Miles of road constructed · Number of stream crossings installed	· Fill areas along forest roads · Stream crossings
Road Management	· Culverts free of obstructions · Temporary stream crossings removed	· Completion of road inspections · Number of temporary stream crossings removed	· Culverts · Forest road stream crossings
Timber Harvesting	· Proper slope at landings · Waterbodies free of slash materials	· Acres harvested · Number of cable yarding operations	· Landings · 100 yd of stream adjacent to harvest site
Site Preparation and Forest Regeneration	· Adequate distribution of seedlings on prepared sites · Nonmechanical site preparation used in SMAs	· Method of site preparation · Acres revegetated	· 100-yd^2 plots · 100 yd of SMA

- *Stakeholder goals for monitoring efforts*. Watershed stakeholders often participate in follow-up monitoring, and their interests, in addition to TMDL analysis, should be considered in devising monitoring plans.

- *Existing monitoring activities, resources, and capabilities*. Analysts should identify existing and planned monitoring activities to address TMDL monitoring needs in concert with these efforts, particularly where a long-term monitoring program is envisioned, the study area is large, or water quality agency monitoring resources are limited. Staff capabilities and training should also be considered to ensure that monitoring plans are feasible.
- *Practical constraints to monitoring*. Monitoring options can be limited by practical constraints (e.g., problems with access to monitoring sites and concerns about indirect impacts of monitoring on habitat).

Key Questions to Consider for Follow-Up Monitoring and Evaluation

- What key factors influence monitoring plan design?
- What is an appropriate monitoring plan?
- What is an appropriate review and revision schedule?
- What is an adequate description of the monitoring plan for the TMDL submittal?

3.3 Public Participation

Public participation is a requirement of the TMDL process and is vital to a TMDL's success. The regulation, at 40 CFR 130.37 states that the public must be allowed at least 30 days to review and comment on a TMDL prior to its submission to EPA for review and approval. In addition, with its TMDL submittal, a State, Territory, or authorized Tribe must provide EPA with a summary of all public comments received regarding the TMDL and the State's, Territory's, or authorized Tribe's response to those comments, indicating how the comments were considered in the final decision.

EPA believes, however, that stakeholders can contribute much more than their comments on a specific TMDL during the public review process. Given the opportunity, stakeholders can contribute credible, useful data and information about an impaired or threatened water body. They may also be able to raise funds for monitoring or to implement a specific control action and/or management measure.

More importantly, stakeholders can offer insights about their community that may ensure the success of one TMDL allocation strategy over an alternative, as well as the success of follow-up monitoring and evaluation activities. Stakeholders possess knowledge about a community's priorities, how decisions are made locally, and how different residents of a watershed interact with one another. A thorough understanding of the social, political, and economic issues of a watershed is as critical to successful TMDL development as an understanding of the technical issues. States, Territories, and authorized Tribes can create a sense of ownership among watershed residents and Adiscover@ innovative TMDL strategies through a properly managed public participation process.

Each State, Territory and authorized Tribe is required to establish and maintain a continuing planning process (CPP) as described in section 303(e) of the Clean Water Act. A CPP contains, among other items, a description of the process that the State, Territory or authorized Tribe uses to identify waters needing water quality based controls, a priority ranking of these waters, the process for developing TMDLs, and a description of the process used to receive public review of each TMDL. EPA encourages States, Territories, and authorized Tribes to use their CPP as the basis for establishing a process for public participation, involvement, and in many cases leadership, in TMDL establishment. On a watershed level, the continuing planning process allows programs to combine or leverage resources for public outreach and involvement, monitoring and assessment, development of management strategies, and implementation.

While stakeholder involvement in TMDL development and implementation may, in some cases, be a critical component to attaining water quality standards, this involvement must be balanced with the fact that EPA, States, Territories, and authorized Tribes are legally responsible for interpreting water quality standards, setting, targets, establishing a watersheds's total load, allocating loadings, and assuring implementation of all appropriate requirements.

Possible Approaches for Stakeholder Involvement/Public Participation in TMDL Development and Implementation

While the concept and possible benefits of involving the public in the TMDL process are potentially rewarding, the process of doing so is inherently challenging. As mentioned above, the involvement of key stakeholders in TMDL development and implementation does not change the legal responsibility of EPA, States, Territories, and authorized Tribes to meet water quality standards. However, early and ongoing stakeholder involvement generally leads to a more successful and effective TMDL development and implementation process. Therefore, consideration should be given to the following approach:

Encourage Public Participation: encourage and support a substantial role for stakeholders in TMDL development, particularly in funding and participating in appropriate data collection and analysis and in TMDL implementation. The agency legally responsible for TMDL development (the State, Territory, authorized Tribe or EPA) must ensure that TMDL activities carried out by stakeholders meet all requirements applicable to TMDLs developed by the State, Territory or authorized Tribe including providing adequate opportunities for public comment/participation.

Establish Written Agreements with Stakeholders: enter into a written agreement with stakeholders when allowing (and especially when relying upon) stakeholders to carry out any TMDL activities. The agreement should clarify stakeholder roles and State, Territory or authorized Tribe expectations for TMDL development, call for a balance of stakeholders to participate in TMDL activities, and specify when the overseeing State regulatory agency should step in if, at some agreed-upon point, adequate progress in TMDL development has not been made or the terms of the agreement are not being met. Prior to entering into an agreement with stakeholders to carry out any TMDL activities, States, Territories or authorized Tribes should clearly inform stakeholders of what is required for the TMDL.

Assure Broad Representation and Objectivity: help assure objectivity in TMDL activities conducted by stakeholders, by requiring in the written agreement that stakeholders provide information to assist in documenting assumptions (while respecting confidential business information), and that stakeholders consult early and often with the State, Territory or authorized Tribe and other stakeholders on planned and ongoing activities. The agreement should also specify how the regulatory agency will ensure there are adequate mechanisms for providing all interested stakeholders with a meaningful opportunity to participate. Use of a neutral facilitator should be considered where appropriate.

Establish Primacy of State, Territory, or authorized Tribal Responsibility: reaffirm that the State, Territory or authorized Tribe (in the written agreement and elsewhere) is legally responsible for interpreting water quality standards, setting targets, establishing the watersheds's total load, allocating loadings, and assuring implementation of all appropriate requirements. However, they should consider information voluntarily provided by stakeholders when developing a TMDL (to the extent such input is useful and deemed accurate, including stakeholder analyses or modeling to determine pollution sources and the watersheds's needed load reductions).

Establish Boundaries around Public Participation Efforts: establish that the legally responsible agency may not delegate its role of assuring adequate public participation processes, meeting all legal requirements, and providing all interested stakeholders an opportunity to

become involved. However, stakeholders may play an important role in public participation (e.g., by inviting and encouraging other stakeholders to participate fully in any parts of the TMDL process they undertake).

3.4 EPA Action on TMDLs

When EPA receives a TMDL for review and approval, it will first determine whether it contains the ten elements of a proper submittal. Once EPA ascertains that the TMDL submittal does contain the required minimum elements, the Agency's review will begin. EPA will then have 30 days to approve or disapprove the TMDL (40 CFR 130.35(a)). If the TMDL is approved, the State, Territory, or authorized Tribe is obliged to incorporate that TMDL into its water quality management plan. If EPA disapproves the TMDL, EPA will establish a new TMDL for that waterbody and pollutant within 30 days of the disapproval. Once developed, EPA will provide a 30 day public comment period on the new TMDL. If appropriate, EPA will revise the TMDL after the close of the public comment period. The TMDL will be sent to the State, Territory, or authorized Tribe for incorporation into its water quality management plan.

EPA may establish TMDLs for waterbodies and pollutants identified on Part 1 of the list if asked to do so; if EPA determines that the State, Territory, or authorized Tribe is not likely to establish TMDLs consistent with their schedule; or if EPA determines that TMDLs for interstate or boundary waterbodies must be established (40 CFR 130.36).

References

ELI. 1997. *Enforceable state mechanisms for the control of nonpoint source water pollution.* Environmental Law Institute Research Report. Project No. 970300.

USEPA. 1984. *Technical Guidance Manual for Performing Wasteload Allocations - Book VI, Design Conditions.* Chapter 2, Temperature, pH, and Hardness. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1984a. *Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers.* Chapter 1, Biochemical Oxygen Demand/Dissolved Oxygen. (EPA 440/4-84-020). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1984b. *Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers.* Chapter 2, Nutrient/Eutrophication Impacts. (EPA 440/4-84-021). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1984c. *Technical Guidance Manual for Performing Wasteload Allocations - Book II, Streams and Rivers.* Chapter 3, Toxic Substances. (EPA 440/4-84-022). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1984d. *Technical Guidance Manual for Performing Wasteload Allocations - Book VII, Permit Averaging*. (EPA 440/4-84-023). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1986a. *Technical Guidance Manual for Performing Wasteload Allocations - Book VI, Design Conditions.* Chapter 1, Stream Design Flow for Steady-State Modeling. (EPA 440/4-86-014). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1986b. *Technical Guidance Manual for Performing Wasteload Allocations - Simplified Analytical Method for Determining NPDES Effluent Limitations for POTWs Discharging to Low-Flow Streams*. (EPA 440/4-86-015). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1987a. *Setting Priorities: The Key to Nonpoint Source Control.* (OWRS). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1987b. *Technical Guidance Manual for Performing Wasteload Allocations - Book IV, Lakes and Impoundments.* Chapter 3, Toxic Substances Impact. (EPA 440/4-87-002). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1988a. *The Lake and Reservoir Restoration and Guidance Manual*, First Edition. (OWRS, EPA 440/5-88-002). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1988b. *State Clean Water Strategies: Meeting the Challenges for the Future*. (OW). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1989. *Selecting Priority Nonpoint Source Projects: You Better Shop Around*. (OW and OPPE, EPA 506/2-89/003). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1990a. *The Lake and Reservoir Restoration and Guidance Manual*, Second Edition. (OWRS, EPA 440/4-90-006). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1990b. *Technical support document for water quality-based toxics control*. (EPA/505/2-90-001 PB91-127415, 1991). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1991a. *Technical support document for water quality-based toxics control.* EPA/505/2-90-001 PB91-127415. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1991b. *Guidance for water quality-based decisions: The TMDL process.* EPA440/4-91-001. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992a. *Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries.* Part 1, Estuaries and Waste Load Allocation Models. (EPA 823/R-92-002). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992b. *Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries*. Part 2, Application of Estuarine Waste Load Allocation Models. (EPA 823/R-92-003). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992c. *Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries*. Part 3, Use of Mixing Zone Models in Estuarine Waste Load Allocations. (EPA 823/R-92-004). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992d. *Technical Guidance Manual for Performing Wasteload Allocations - Book III, Estuaries.* Part 4, Critical Review of Coastal Embayment and Estuarine Waste Load Allocation Modeling. (EPA 823/R-92-005). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992e. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* (EPA 840-B-92-002). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1993. *Geographic Targeting: Selected State Examples*. (EPA-841-B-93-001). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1994a. *A State and Local Government Guide to Environmental Program Funding Alternatives.* EPA841-K-94-001. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1994b. *Water Quality Standards Handbook - 2nd Edition.* EPA823-B-94-005. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1996a. *TMDL development cost estimates: Case studies of 14 TMDLs.* EPA R-96-001. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1996b. *Technical Guidance Manual for Performing Wasteload Allocations - Book IV, Lakes and Impoundments.* Chapter 2, Nutrient/Eutrophication Impacts. (EPA 440/4-84-019). United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997a. *Monitoring guidance for determining the effectiveness of nonpoint source controls.* EPA 841-B-96-004. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997b. *Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic updates: Report contents.* EPA-841-B-97-002A. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997c. *Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic updates: Supplement.* EPA-841-B-97-002B. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997d. *Compendium of tools for watershed assessment and TMDL development.* EPA841-B-97-006. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997e. *Techniques for tracking, evaluating, and reporting the implementation of nonpoint source control measures: Forestry.* EPA 841-B-97-009. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997f. *Techniques for tracking, evaluating, and reporting the implementation of nonpoint source control measures: Agriculture.* EPA 841-B-97-010. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1997g. *Catalog of Federal Funding Sources for Watershed Protection.* EPA841-B-97-008. United States Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1998a. *Protocol for developing pathogen TMDLs.* Draft. United States Environmental Protection Agency, Assessment and Watershed Protection Division, Watershed Branch, Washington, DC.

USEPA. 1998b. *Protocol for developing sediment TMDLs.* Draft. United States Environmental Protection Agency, Assessment and Watershed Protection Division, Watershed Branch, Washington, DC.

USEPA. 1998c. *Protocol for developing nutrient TMDLs.* Draft. United States Environmental Protection Agency, Assessment and Watershed Protection Division, Watershed Branch, Washington, DC.

USEPA. 1998d. *Report of the federal advisory committee on the total maximum daily load (TMDL) program.* EPA 100-R-98-006. Prepared by the National Advisory Council for Environmental Policy and Technology. United States Environmental Protection Agency, Office of the Administrator, Washington, DC.

USEPA. 1998e. *Techniques for tracking, evaluating, and reporting the implementation of nonpoint source control measures: Urban.* Draft. EPA 841-B-97-011. United States Environmental Protection Agency, Office of Water, Washington, DC.

APPENDICES

Table A-1. Relevant Cause/Stressor Codes from the Waterbody System for Classifying Pollutants.

CODE	TYPE	CODE	TYPE
0000	**Cause Unknown**	**0750**	**Sulfates**
0100	**Unknown Toxicity**	**0800**	**Other Inorganics**
0200	**Pesticides**	**0900**	**Nutrients**
0300	**Priority Organics**	0910	Phosphorus
0400	**Nonpriority Organics**	0920	Nitrogen
0410	**PCBs**	0990	Other Nutrients
0420	**Dioxins**	**1000**	**pH**
0500	**Metals**	**1100**	**Siltation**
0510	Arsenic	**1200**	**BOD/Dissolved Oxygen**
0520	Cadmium	**1300**	**Salinity/Total Dissolved Solids/ Chlorides/Sulfates**
0530	Copper	**1400**	**Thermal Modifications**
0540	Chromium	**1600**	**Habitat Alterations (other than flow)**
0550	Lead	**1700**	**Pathogens**
0560	Mercury	**1900**	**Oil and Grease**
0570	Selenium	**2100**	**Suspended Solids**
0580	Zinc	**2210**	**Excessive Algal Growth/ Chlorophyll α**
0600	**Ammonium (un-ionized)**	**2400**	**Total Toxics**
0700	**Chlorine**	**2500**	**Turbidity**
0720	**Cyanide**		

Bold type indicates a major cause category; regular type indicates a subcategory.

Table B-1. Impairment Source Categories (with National Codes from the Waterbody System).

Code	Source of Impairment
0100	**Industrial Point Sources**
0110	Major Industrial Point Sources
0120	Minor Industrial Point Sources
0200	**Municipal Point Sources**
0210	Major Municipal Point Sources (dry and/or wet weather discharges)
0212	Major Municipal Point Sources (dry weather discharges)
0214	Major Municipal Point Sources (wet weather discharges)
0220	Minor Municipal Point Sources (dry and/or wet weather discharges)
0222	Minor Municipal Point Sources (dry weather discharges)
0224	Minor Municipal Point Sources (wet weather discharges)
0230	Package Plants (Small Flows)
0400	**Combined Sewer Overflow**
0500	**Collection System Failure**
0900	**Domestic Wastewater Lagoon**
1000	**Agriculture**
1050	**Crop-Related Sources**
1100	Nonirrigated Crop Production
1200	Irrigated Crop Production
1300	Specialty Crop Production (e.g., horticulture, citrus, nuts, fruits)
1350	**Grazing-Related Sources**
1400	Pasture Grazing - Riparian and/or Upland
1410	Pasture Grazing - Riparian
1420	Pasture Grazing - Upland
1500	Range Grazing - Riparian and/or Upland
1510	Range Grazing - Riparian
1520	Range Grazing - Upland
1600	**Intensive Animal Feeding Operations**
1620	Concentrated Animal Feeding Operations (CAFOs; permitted, PS)
1640	Confined Animal Feeding Operations (NPS)
1700	Aquaculture
2000	**Silviculture**
2100	Harvesting, Restoration, Residue Management
2200	Forest Management (e.g., pumped drainage, fertilization, pesticide application)
2300	Logging Road Construction/Maintenance
2400	Silviculture Point Sources
3000	**Construction**
3100	Highway/Road/Bridge Construction
3200	Land Development
4000	**Urban Runoff/Storm Sewers**
4100	Nonindustrial Permitted
4200	Industrial Permitted
4300	Other Urban Runoff
4400	Illicit Connections/Illegal Hook-Ups/Dry Weather Flows

4500	Highway/Road/Bridge Runoff
4600	Erosion and Sedimentation
5000	**Resource Extraction**
5100	Surface Mining
5200	Subsurface Mining
5300	Placer Mining
5400	Dredge Mining
5500	Petroleum Activities
5600	Mill Tailings
5700	Mine Tailings
5800	Acid Mine Drainage
5900	Abandoned Mining
5950	Inactive Mining
6000	**Land Disposal**
6100	Sludge
6200	Wastewater
6300	Landfills
6350	Inappropriate Waste Disposal/Wildcat Dumping
6400	Industrial Land Treatment
6500	Onsite Wastewater Systems (Septic Tanks)
6600	Hazardous Waste
6700	Septage Disposal
7000	**Hydromodification**
7100	Channelization
7200	Dredging
7300	Dam Construction
7400	Upstream Impoundment
7500	Flow Regulations/Modifications
7550	**Habitat Modification (other than Hydromodification)**
7600	Removal of Riparian Vegetation
7700	Bank or Shoreline Modification/Destabilization
7800	Drainage/Filling of Wetlands
7900	**Marinas and Recreational Boating**
7910	In-Water Releases
7920	On-Land Releases
8050	**Erosion from Derelict Land**
8100	**Atmospheric Deposition**
8200	**Waste Storage/Storage Tank Leaks (above ground)**
8250	**Leaking Underground Storage Tanks**
8300	**Highway Maintenance and Runoff**
8400	**Spills (Accidental)**
8500	**Contaminated Sediments**
8520	**Debris and Bottom Deposits**
8530	**Internal Nutrient Cycling (primary lakes)**
8540	**Sediment Resuspension**
8600	**Natural Sources**

8700 Recreation and Tourism Activities (other than Boating; see 7900)
8710 Golf Courses

8900 Salt Storage Sites
8910 Groundwater Loadings
8920 Groundwater Withdrawal
8950 Other
9000 Unknown Source
9050 Sources Outside State Jurisdiction or Borders

Table C-1. Hierarchy of Bioassessment Approaches for Evaluation of Aquatic Life Use Attainment Based on Resident Assemblages

Level of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Visual observation of biota; reference conditions not used; simple documentation	Limited monitoring; extrapolations from other sites	Unknown or low precision and sensitivity; professional biologist not required	310, 320, 350, 322
2	One assemblage (usually invertebrates); reference conditions pre-established by professional biologist; biotic index or narrative evaluation of historical records	Limited to a single sampling; limited sampling for site-specific studies	Low to moderate precision and sensitivity; professional biologist may provide oversight	310, 320, 322, 350
3	Single assemblage usually the norm; reference condition may be site-specific, or composite of sites (e.g., regional); biotic index (interpretation may be supplemented by narrative evaluation of historical records)	Monitoring of targeted sites during a single season; may be limited sampling for site-specific studies; may include limited spatial coverage for watershed-level assessments	Moderate precision and sensitivity; professional biologist performs survey or provides training for sampling; professional biologist performs assessment.	310, 315, 320, 321, 330, 331, 350
4	Generally two assemblages, but may be one if high data quality; regional (usually based on sites) reference conditions used; biotic index (single dimension or multimetric index)	Monitoring during 1-2 sampling seasons; broad coverage of sites for either site-specific or watershed assessments; conducive to regional assessments using targeted or probabilistic design	High precision and sensitivity; professional biologist performs survey and assessment	310, 315, 320, 321, 330, 331, 340, 350

NOTE: Table is based on use in lotic systems. With some modification, these approaches would apply to other waterbody types.

[a] Level of information refers to rigor of bioassessment, where 1 = lowest and 4 = highest.

[b] Refers to ability of the ecological endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[c] WBS Assessment Type Codes from Table 1-1.

Source: *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* EPA 841-B-97-002B

Table C-2. Hierarchy of Habitat Assessment Approaches for Evaluation of Aquatic Life Use Attainment

Level Of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Visual observation of habitat characteristics; no true assessment; documentation of readily discernable land use characteristics that might alter habitat quality; no reference conditions	Sporadic visits; sites are mostly from road crossings or other easy access	Unknown or low precision and sensitivity; professional scientist (biologist, hydrologist) not required	365
2	Visual observation of habitat characteristics and simple assessment; use of land use maps for characterizing watershed condition; reference condition pre-established by professional scientist	Limited to annual visits and non-specific to season; generally easy access; limited spatial coverage and/or site-specific studies	Low precision and sensitivity; professional biologist or hydrologist not involved or only correspondence	370
3	Visual-based habitat assessment using standard operating procedures (SOPs); may be supplemented with quantitative measurements of selected parameters; conducted with bioassessment; data on land use compiled and used to supplement assessment; reference condition used as a basis for assessment	Assessment during a single season usually the norm; spatial coverage may be limited or broad and commensurate with biological sampling; assessment may be regional or site-specific	Moderate precision and sensitivity; professional biologist or hydrologist performs survey or provides oversight and training	375
4	Assessment of habitat based on quantitative measurements of instream parameters, channel morphology, and floodplain characteristics; conducted with bioassessment; data on land use compiled and used to supplement assessment; reference condition used as a basis for assessment	Assessment during 1-2 seasons; spatial coverage usually broad and commensurate with biological sampling; assessment may be regional or site-specific	High precision and sensitivity; professional biologist or hydrologist performs survey and assessment	380

NOTE: Table is based on use in lotic systems. With some modification, these approaches would apply to other waterbody types.

[a] Level of information refers to rigor of habitat assessment, where 1 = lowest and 4 = highest.

[b] Refers to ability of the habitat endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[c] WBS Assessment Type Codes from Table 1-1.

Source: *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* EPA 841-B-97-002B

Table C-3. Hierarchy of Toxicological Approaches and Levels for Evaluation of Aquatic Life Use Attainment

Level of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Any <u>one</u> of the following: • Acute or chronic WET • Acute ambient • Acute sediment	1-2 WET tests/yr or 1 ambient or sediment sample tested in a segment or site	Unknown/low; minimal replication used; laboratory quality or expertise unknown	510, 520, 530, 550
2	Any of the following: • Acute <u>or</u> chronic ambient • Acute sediment • Acute <u>and</u> chronic WET for effluent-dominated system	3-4 WET tests/yr or 2 ambient or sediment samples tested in a segment or site at different times	Low/moderate—little replication used within a site; laboratory quality or expertise unknown or low	510, 520, 530, 540, 550
3	Any of the following: • Acute and chronic WET for effluent-dominated system • Chronic ambient <u>or</u> acute or chronic sediment	Monthly WET tests or total of 3 tests based on samples collected in a segment at 3 different times	Moderate/high—replication used; trained personnel and good laboratory quality	510, 520, 540, 550
4	Both of the following: • Acute and chronic ambient and • Acute <u>or</u> chronic sediment	≥ 4 tests in total based on samples collected in a segment at 4 different times including low flow conditions	High—replication used; trained personnel and good laboratory quality	530, 540, 550

[a] Level of information refers to rigor of toxicity testing, where 1 = lowest and 4 = highest

[b] Refers to ability of the toxicity testing endpoints to detect impairment or to differentiate along a gradient of environmental conditions

[c] WBS Assessment Type Codes from Table 1-1.

Source: *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* EPA 841-B-97-002B

Table C-4. Hierarchy of Physical/Chemical Data Levels for Evaluation of Aquatic Life Use Attainment

Level of Info[a]	Technical Components	Spatial/Temporal Coverage	Data Quality[c]	WBS Codes[d]
1	Any one of the following: • Water quality monitoring using grab water sampling • Water data extrapolated from an upstream or downstream station where homogeneous conditions are expected • Monitoring data >5 years old without further validation • Best professional judgment based on land use data, source locations	Low spatial and temporal coverage: • Quarterly or less frequent sampling with limited period of record (e.g., 1 day) • Limited data during key periods or at high or low flows (critical hydrological regimes)[b].	Unknown/ Low	210, 220, 230, 240, 850, 150, 130
2	Any one of the following: • Water quality monitoring using grab water sampling • Rotating basin surveys involving multiple visits or automatic sampling • Synthesis of existing or historical information on fish contamination levels • Screening models based on loadings data (not calibrated or verified).	Moderate spatial and temporal coverage: • Bimonthly or quarterly sampling during key periods (e.g., spring/ summer months • Fish spawning seasons, including limited water quality data at high and low flows • Short period of record over a period of days or multiple visits during a year or season.	Low/ Moderate	210, 220, 222, 230, 240, 242, 260, 810, 180
3	Any one of the following: • Composite or a series of grab water sampling used (diurnal coverage as appropriate) • Calibrated models (calibration data <5 years old).	Broad spatial and temporal (long-term, e.g., > 3 years) coverage of site with sufficient frequency and coverage to capture acute events: • Typically, monthly sampling during key periods (e.g., spring/ summer months, fish spawning seasons), multiple samples at high and low flows • Lengthy period of record (sampling over a period of months).	Moderate/ High	211, 222, 242, 250, 610
4	All of the following: • Water quality monitoring using composite or series or grab samples (diurnal coverage as appropriate) • Limited sediment quality sampling and fish tissue analyses at sites with high probability of contamination.	Broad spatial (several sites) and temporal (long-term, e.g., > 3 years) coverage of site with sufficient frequency and parametric coverage to capture acute events, chronic conditions, and all other potential P/C impacts • Monthly sampling during key periods (e.g., spring/summer months • Fish spawning seasons) including multiple samples at high and low flows • Continuous monitoring.	High	231, 242, 250

NOTE: Physical refers to physical water parameters (e.g., temperature, pH, dissolved oxygen, turbidity, color, conductivity)

[a] Level of information refers to rigor of physical/chemical sampling and analysis, where 1 = lowest and 4 = highest.

[b] Even a short period of record can indicate a high confidence of *impairment* based on P/C data; 3 years of data are not required to demonstrate impairment. For example, a single visit to a stream with severe acid mine drainage impacts (high metals, low pH) can result in high confidence of nonsupport. However, long-term monitoring may be needed to establish full support.

[c] Refers to ability of the physical/chemical endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[d] WBS Assessment Type Codes from Table 1-1.

Source: *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* EPA 841-B-97-002B

Table C-5. Typical Thresholds Used for Determining Use Support for Aquatic Life

	Not Listed on 303(d)	Listed on 303(d)	
Type of Assessment	**Fully Supporting**	**Partially Supporting**	**Not Supporting**
Bioassessment[1]	Reliable data indicate functioning, sustainable biological assemblages (e.g., fish, macroinvertebrates, or algae) non of which has been modified significantly beyond the natural range of the reference condition.	At least one assemblage (e.g., fish, macroinvertebrates, or algae) indicates moderate modification of the biological community compared to the reference condition.	At least one assemblage indicates nonsupport. Data clearly indicate severe modification of the biological community compared to the reference condition.
Habitat Assessment	Reliable data indicate natural channel morphology, substrate composition, bank/riparian structure, and flow regime of region. Riparian vegetation of natural types and of relatively full standing crop biomass (i.e., minimal grazing of disruptive pressure).	Modification of habitat slight to moderate usually due to road crossings, limited riparian zones because of encroaching land use patterns, and some watershed erosion. Channel modification slight to moderate.	Moderate to severe habitat alteration by channelization and dredging activities, removal of riparian vegetation, bank failure, heavy watershed erosion or alteration of flow regime.
Aquatic and Sediment Toxicity Methods[2]	No toxicity noted in either acute or chronic tests compared to controls or reference conditions.	No toxicity noted in acute tests, but may be present in chronic tests in wither slight amounts and/or infrequently within an annual cycle.	Toxicity noted in many tests and occurs frequently.
Physical/Chemical Methods[3] (Conventionals - dissolved oxygen, pH, temperature)[4]	For any one pollutant or stressor, criteria exceeded in $\leq$ 10 percent of measurements. In case of dissolved oxygen (DO), national ambient water quality criteria specify the recommended acceptable daily average and 7-day average minimums and the acceptable 7-day and 30-day averages. States should document the DO criteria being used for the assessment and should discuss any biases that may be introduced by the sampling program (e.g., grab sampling in waterbodies with considerable diurnal variation).	For any one pollutant, criteria exceeded in 11-25 percent of measurements. For DO, the Fully Supporting considerations apply.	For any one pollutant, criteria exceeded in $>$ 25 percent of measurements. For DO, the Fully Supporting considerations apply.
Physical/Chemical Methods[3] (Toxicants - priority pollutants, metals, chlorine, and ammonia)[4]	For any one pollutant, no more than 1 exceedance of acute criteria (EPA's criteria maximum concentration or applicable State/Tribal criteria) within a 3-year period based on grab or composite samples and no more than 1 exceedance of chronic criteria (EPA's criteria continuous concentration or applicable State/Tribal criteria) within a 3-year period based on grab or composite samples.	For any one pollutant, acute or chronic criteria exceeded more than once within a 3-year period, but in $\leq$ 10 percent of samples.	For any one pollutant, acute or chronic criteria exceeded in $>$ 10 percent of samples.

[1] Additional consideration for lakes: State lake managers should address more than one biological assemblage in making lake ALUS decisions. Regional patterns of lake water quality, morphometry (physical characteristics such as size, shape, and depth), and watershed characteristics should ideally be defined based on comparison to natural conditions using an ecoregion approach.

[2] EPA recommends that information from toxicity tests be separated from the physical/chemical data. Appropriate sample collection is critical to ensure representative and accurate results. Chemical inert sampling equipment must be used and depth and/or width integrated composite samples should be considered for ALUS determination.

[3] States are expected to apply the following guidance to whatever data types are available and to use a "worst case" approach where multiple types of data are available. If, for example, chemical data indicate full support but temperature data indicate impairment, the waterbody is considered impaired.

[4] Special considerations for lakes: States should discuss their interpretation of DO, pH, and temperature standards for both epilimnetic and hypolimnetic waters. In addition, States should consider turbidity and lake bottom siltation.

[5] At least 10 samples over a 3-year period are assumed to be taken. If fewer than 10 samples are available, the State should use discretion and consider other factors such as the number of pollutants having a single violation and the magnitude of the exceedance(s).

Special considerations regarding metals: EPA's policy is for the States to adopt and use the dissolved metal fraction to set and measure compliance with water quality standards, because dissolved metal more closely approximates the bioavailable fraction of metal in the water column than does total recoverable metal. In the absence of dissolved metals data and State criteria, States should continue to apply total recoverable metals criteria to total recoverable metals data because this is more conservative and thus protective of aquatic life. Historical metals data should be used with care. Concern about the reliability of the data are greatest below 5-10 ppb due to the possibility of contamination problems during sample collection and analysis.

Source: *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* EPA 841-B-97-002B

APPENDIX D

Related Federal Programs

Environmental Protection Agency

Water Quality Criteria and Standards Program

Water Quality Standards

Section 303(c) of the CWA establishes the basis for the current water quality standards program. Water quality standards serve as the foundation for the water quality based approach to pollution control and are a fundamental component of watershed management. Water quality standards are Federal, State, Territorial, or authorized Tribal law or regulation that (1) define the water quality goals of a water body or segment by designating the use or uses to be made of the water, (2) set criteria necessary to protect the uses; and (3) protect water quality through antidegradation provisions.

Water quality standards are essential to a wide range of surface water activities, including (1) setting and revising water quality goals for watersheds and/or individual water bodies, (2) monitoring water quality to provide information upon which water quality-based decisions will be made, (3) calculating TMDLs, waste load allocations (WLAs) for point sources of pollution, and load allocations (LAs) for natural background and nonpoint sources of pollution, (4) developing water quality management plans which prescribe the regulatory, construction, and management activities necessary to meet the water body goals, (5) calculating NPDES water quality-based effluent limitations for point sources, in the absence of TMDLs, WLAs, LAs, and/or water quality management plans, (6) preparing various reports and lists that document the condition of the State's, Territory's, or authorized Tribe's water quality, and (7) developing, revising, and implementing an effective section 319 management program which outlines the State's, Territory's or authorized Tribe's control strategy for nonpoint sources of pollution.

The CWA provides that EPA determine appropriate minimum levels of protection and provide national oversight for the criteria and standards program. States, Territories, and authorized Tribes have discretion to design their own programs and to establish levels of protection above national minimums. States, Territories, and authorized Tribes adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the CWA.

Sections 101(a), 101(a)(2), and 303(c) of the CWA provide the authority for water quality standards. Generally, standards are used to:

- restore and maintain chemical, physical, and biological integrity of State, Territorial, and authorized Tribal waters,
- provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water (i.e., fishable/swimmable), and

- consider the use and value of State, Territorial, and authorized Tribal waters for public water supplies, propagation of fish and wildlife, recreation, agricultural and industrial purposes, and navigation (implemented by 40 CFR 131.2).

States, Territories, and authorized Tribes are required to specify appropriate water uses to be achieved and protected, taking into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. The regulation also allows, but does not require, States, Territories, and authorized Tribes to identify more specific sub-categories of these general use categories.

Water Quality Criteria

Water quality criteria are levels of individual pollutants, water quality characteristics, or descriptions of conditions of a water body that, if met, will generally protect the designated use of the water. Water quality criteria guidance is developed by EPA under CWA section 304(a) to protect aquatic life and human health, and in some cases wildlife, from the deleterious effects of pollutants and other effects of pollution. There are three principal categories of water quality criteria: (1) criteria to protect human health, (2) criteria to protect aquatic life, and (3) criteria to protect wildlife. Within these broad categories, there are different types of criteria. For example, there are chemical-specific and microbiological criteria within the human health category while the aquatic life category includes chemical-specific criteria, toxicity criteria, biological criteria, sediment criteria and physical criteria such as habitat and flow balance. Water quality criteria developed under section 304(a) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects.

Criteria are expressed in either narrative or numeric forms and may be developed to apply generally or to apply to site-specific situations. Narrative criteria are descriptions of conditions necessary for the water body to attain its designated use and are often expressed as “free from” certain characteristics. Narrative criteria can be the basis for limiting toxicity in discharges and for controlling nuisance conditions, such as floating debris or other objectionable deposits. Numeric criteria are values expressed as levels, concentrations, toxicity units, or other numbers deemed necessary to protect designated uses.

CWA sections 303(a) through (c) require all States, Territories, and authorized Tribes to evaluate the need for water quality criteria to protect a designated use and then adopt water quality criteria (either EPA’s or its own) sufficient to protect uses designated for State, Territorial, or authorized Tribal waters. When a water body is classified for more than one use, criteria necessary to protect the most sensitive use must be applied to the water body per 40 CFR 131.11(a).

EPA criteria under section 304(a) do not reflect consideration of economic impacts or the technological feasibility of meeting the chemical concentrations in ambient water. As discussed below, section 304(a) criteria are used by States, Territories, and authorized Tribes to establish water quality standards, and ultimately provide a basis for controlling discharges or releases of pollutants.

As part of the water quality standards triennial review process under section 303(c)(1), States, Territories, and authorized Tribes are responsible for maintaining and revising water quality standards. Section 303(c)(1) requires States, Territories, and authorized Tribes to review, and modify if appropriate, their water quality standards at least once every three years. If EPA determines that a new or revised standard is not consistent with the requirements of the CWA, or EPA determines that a revised standard is necessary to

meet the requirements of the Act, section 303(c)(4) authorizes EPA to promulgate replacement water quality standards.

Watershed Programs

Water Quality Assessment Program (Clean Water Act Section 305(b))

CWA section 305(b) establishes a process for reporting information about the quality of the nation's water resources to EPA and Congress. Each State, Territory, authorized Tribe, and Interstate Commission develops a program to monitor the quality of its surface and ground waters and report the current status of water quality biennially to EPA. This information is compiled into a report to Congress. The 305(b) report allows EPA to:

- Determine the status of water quality.
- Identify water quality problems and trends.
- Evaluate the cause of poor water quality and the relative contributions of pollution sources.
- Report on the activities underway to assess and restore water quality.
- Determine the effectiveness of control programs.
- Ensure that pollution control programs are focused on achieving environmental results in an efficient manner.
- Determine the workload remaining in restoring waters with poor quality and protecting threatened waters.
- Use information from the lists of waters developed under sections 304(l) and 319 and continue to maintain and update the statutorily-required lists of waters identified under sections 303(d) and 314.

For each assessed waterbody, information is provided on the status of water quality, including designated uses and causes of nonattainment.

Nonpoint Source Program (Clean Water Act Section 319)

In 1987, Congress added sections 319 and 518 to the CWA to enable States, Territories, and authorized Tribes to address the problems caused by nonpoint source pollution. CWA section 319 established baseline requirements for State and territorial nonpoint source management programs and authorized national funding to support implementation of approved management programs. CWA section 518 authorized EPA to treat federally recognized Tribes in the same manner as States. CWA section 319 established a three-stage program whereby States, Territories, and authorized Tribes (1) conduct statewide (or reservation-wide) assessments of their waters to identify those which are either impaired or threatened because of nonpoint sources; (2) develop nonpoint source management programs to address the impaired or threatened waters identified in their nonpoint source assessments; and (3) implement the EPA approved nonpoint sources management programs.

Section 319(h) of the CWA is the principal source of EPA funding dedicated to nonpoint source control. It authorizes EPA to issue grants to States, Territories, and authorized Tribes to assist them in implementing management programs or portions of management programs which have been approved by EPA. Under section 319(h), Congress appropriates money to EPA for distribution to eligible States, Territories, and authorized Tribes based on an allocation formula. Section 518(f) authorizes EPA to grant up to one-third

of one percent of national 319(h) program funds to Tribes. Since 1990, the United States has spent $100 million annually through the section 319 program.

Section 319(h) grants:

- Emphasize implementation of approved nonpoint source management programs.
- Identify priority actions that will be taken and an explanation of how these actions are related to the priority problems identified in the nonpoint source assessment report.
- Establish a realistic schedule and milestones for completing the priority actions identified.
- Emphasize pollution prevention mechanisms to control nonpoint sources.
- Emphasize watershed-based approaches to solving nonpoint source pollution.
- Provide monitoring and evaluation of program effectiveness.
- Emphasize interagency coordination with federal, State, and local agencies as well as interest groups.
- Describe previous accomplishments in addressing nonpoint source pollution with grant funds (if previous grant funds were received).

Coastal Nonpoint Pollution Control Program

In November 1990, Congress enacted the Coastal Zone Act Reauthorization Amendments (CZARA). To more address the impacts of nonpoint source pollution on coastal water quality, Congress enacted section 6217, *Protecting Coastal Waters* (codified as 16 U.S.C. Section 1455b). Section 6217 requires each State with an approved Coastal Zone Management Program to develop and submit to EPA and the National Oceanic and Atmospheric Administration (NOAA) a Coastal Nonpoint Pollution Control Program for approval. The purpose of the program "shall be to develop and implement management measures for nonpoint source pollution to restore and protect coastal waters, working in close conjunction with other State and local authorities." Coastal Nonpoint Pollution Control Programs are intended to serve as an update and expansion of existing nonpoint source management programs and are to be coordinated closely with existing coastal zone management programs.

Clean Lakes Program

CWA section 314 established the Clean Lakes Program. Historically, the Clean Lakes Program has been active in awarding grants for the study and restoration of publicly-owned lakes. States are encouraged to develop integrated water quality strategies that include lake and reservoir management, restoration, and protection activities. EPA provides financial assistance as available; however, greater emphasis is now on developing technical support material (e.g., a Lake and Reservoir Restoration Guidance Manual). In recent years funding for grants under the Clean Lakes Program has been combined with Section 319(h) (Nonpoint Source Program) funding.

Monitoring Program

Water quality monitoring is essential for an understanding of the condition of water resources and to provide a basis for effective policies that promote wise use and management of those resources. EPA is one of a large number of Federal, Tribal, State, and local agencies and private sector organizations that collect water quality information for purposes that can generally be divided into five categories: (1) status and trends; (2) detection of existing and emerging problems and setting priorities among them; (3)

designing and implementing programs; (4) evaluating program or project success; and (5) emergency response monitoring. Federal agencies alone conduct approximately 141 separate monitoring programs across the country.

EPA also contributes to the national monitoring effort by supporting and cosponsoring (with USGS and other members) the National Monitoring Council. Formed in 1997, the Council is implementing a national strategic plan to achieve effective collection, interpretation, and presentation of water quality data that will improve the availability of existing information for decisionmaking at all levels of government. This integrated nationwide voluntary strategy will meet the nationwide objectives of various monitoring programs, make more efficient use of available resources, distribute information more effectively, and provide comparable data and consistent reporting of water quality status and trends. For more information about monitoring programs operated by EPA and other federal agencies, see the 1996 National Water Quality Inventory & Report to Congress (EPA841-R-97-008).

Section 106 and 319 funds are added to State funds to support State monitoring programs. States are required to describe their monitoring programs in Section 106 work plans and agree to perform the monitoring necessary to comply with EPA/State Performance Partnership Agreements; thus, monitoring requirements are State-specific. States are also required to report the results of their EPA-funded monitoring in their biennial water quality assessment reports under Section 305(b) (see above).

EPA, working with States, has developed an outline for a recommended monitoring program. A comprehensive monitoring program includes general ambient monitoring and targeted monitoring to determine the effectiveness of individual projects and programs designed to protect waterbodies or control sources of pollution. Recommended elements of a State monitoring program include monitoring program objectives; a monitoring design description; written protocols; analytical laboratory support; quality assurance quality control procedures; data storage, management, and sharing; water resource assessment and reporting; training; and integration of work partners, including volunteer monitoring groups. Copies of the outline for effective State monitoring programs can be obtained by contacting the Monitoring Branch at: U.S. EPA (4503F), Office of Water, 401 M Street, SW, Washington, DC 20460.

National Estuary Program

Authorized by Congress in 1985, and formally established in 1987 by amendments to the CWA section 320, the National Estuary Program (NEP) builds upon the lessons of the Chesapeake Bay, Great Lakes, and other earlier programs and stresses a geographic, basin-wide approach to environmental management. The EPA Administrator selects estuaries for NEP participation following nomination by governors. NEP estuaries address the loss of aquatic habitats, toxic contamination of estuarine sediments, increases in nutrient levels, bacterial contamination, and hypoxia. As methods for assessing and successfully managing these estuaries are developed, lessons learned are communicated to the more than 150 estuaries nationally.

For approved estuaries, the Administrator convenes management conferences, a grouping of interested Federal, Regional, State, and local governments, affected industries, scientific and academic institutions, and citizen organizations. Management conferences strive for an open, consensus-building approach to defining program goals and objectives, identifying problems to address, and designing pollution prevention/control and resource management strategies to meet each objective. Management conferences are required to create and begin implementation of a Comprehensive Conservation and Management Plan (CCMP) designed to protect and restore the estuary.

Wetlands Program

Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. No discharge of dredged or fill material is permitted if there is a practicable alternative that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. When individuals apply for a permit, they must show that they have taken steps to avoid wetland impacts where practicable, minimized potential impacts to wetlands, and provided compensation for any unavoidable impacts through activities to restore or create wetlands.

EPA and the Corps jointly administer the 404 program. In addition, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and State resource agencies have important advisory roles. A Federal permit is required to discharge dredged or fill material into wetlands and other waters of the United States. Permit application and comments are reviewed by the Corps and other interested Federal and State agencies, organizations, and individuals. The Corps determines whether an Environmental Impact Statement is necessary (see NEPA compliance issues elsewhere in this document). Citizens may request that the Corps conduct a public hearing however, public hearings are not normally held. The Corps evaluates the permit application based on the comments received, as well as its own evaluation. The Corps prepares a Statement of Finding document to explain how the permit decision was made, which is made available to the public.

Approval of a section 404 permit to discharge dredged or fill material into wetlands or other waters of the United States is contingent on compliance with section 401 State Water Certification requirements. CWA §401 requires that the Corps obtain certification from the State or interstate water control agencies that the proposed discharge will not lead to a violation of water quality standards. Section 404(r) waives the requirement to obtain a section 404 permit for Federal projects if the information on the effects of the discharge are included in an Environmental Impact Statement on the proposed project and it is submitted to Congress prior to authorization of the project.

Municipal Wastewater Treatment

State Revolving Fund

To help address the growing need for water pollution control funding, Congress created the Clean Water State Revolving Fund (CWSRF) as part of the Clean Water Act Amendments of 1987. The CWSRF succeeded the Construction Grants Program, a direct grant program for funding wastewater treatment projects. Under the CWSRF, EPA provides grants or “seed money” to states to capitalize individual State revolving funds. The program is managed by the states, and loans or other types of assistance for water quality projects are disbursed according to each states’ programs and priorities. As the loans are repaid, the money is reused (revolved) by the CWSRF to provide assistance for future projects. Although in many cases, assistance is in the form of low interest loans, the CWSRF is a flexible source of financing that can also provide loan guarantees, bond insurance, and refinancing of existing debt. Both point source and nonpoint source water pollution control programs can be financed by the CWSRF. For more information, see the OWM WEB page on the INTERNET at WWW.epa.gov/owm.

National Pollutant Discharge Elimination System Permit Program

The CWA prohibits point source discharges into waters of the United States unless in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Point sources are, in general, discrete conveyances such as pipes or man-made ditches. The National Pollutant Discharge Elimination System (NPDES) permit program is authorized by Section 402 of the CWA. These permits must include limits based either on technology or water quality standards, whichever is more stringent. Requirements for effluent limitations are derived from Section 301(b) of the Clean Water Act (CWA) and refer to various levels of treatment which apply to particular categories of pollutants. The NPDES permit program is intended to protect public health and the nation's waters by eliminating or reducing the discharges that pose the most threat to public health and the aquatic environment. These discharges include human wastes, toxic chemicals, oil and grease, pesticides, and metals which when discharged into the nation's waters, threaten both the health of humans and life forms in the water.

NPDES permits regulate household and industrial wastes that are collected in sewers and treated at municipal wastewater treatment plants. NPDES permits also regulate industrial point sources and concentrated animal feeding operations that discharge directly into receiving waters.

Regulatory agencies use a variety of techniques to monitor permittees' compliance status, including on-site inspections and review of data submitted by permittees.

Permitting and Nationally Applicable Technology Based Effluent Limitations

To support the minimum threshold for substantial pollutant controls, EPA develop technology-based effluent limitations, guidelines and standards, which are limitations based on the performance of treatment and control technologies applicable to specific industrial categories, rather than on the risk or impact to receiving waters. Effluent guidelines are national standards for wastewater discharges directly to surface waters and indirectly (through sanitary sewer systems) to publicly owned treatment works (POTWs). NPDES permit writers use the guidelines as the numeric effluent limitations in permits for categorical industries after evaluating whether water quality standards will be maintained if the technology-based limitations are applied.

In developing effluent guidelines, EPA considers the category of industry which produces the pollutant. The Agency takes into account the specific factors unique to a particular type of industry (manufacturing process, type and quantity of pollutants generated, types of treatment facilities available to treat the pollutants, etc.). In using this approach, the regulations attempt to "level the economic playing field" by imposing maximum standards based on demonstrated pollution control for discharging facilities within an industry. In theory, for example, a certain type of facility on the west coast of the U.S. would be required to meet the same pollution controls for BOD as an identical plant located on the east coast (unless there were special site-specific water quality concerns which had to be addressed).

Industrial Pretreatment

Industries in many communities pretreat their wastewater before discharging it to sanitary sewer systems, where it mixes with domestic sources of wastewater. These facilities are "indirect dischargers" because their wastewater is delivered to a publicly owned treatment works (POTW) for further treatment and is then, after pretreatment, discharged to receiving waters through the POTW. The National Pretreatment Program, a cooperative effort of federal, State, and local officials, is fostering this practice nationwide. By

reducing pollutants discharged by industries into municipal sewage systems, the pretreatment program ensures POTW infrastructure protection and that industrial development vital to the economic well-being of a community will be compatible with a healthy environment.

Most sewage collection and treatment systems are not designed to transport and treat harmful industrial wastes. Such wastes can damage the collection system, interfere with plant operations, pass through the plants to contaminate receiving waters, threaten worker safety and increase the cost and risks of sludge treatment and disposal. These types of problems are prevented using proven pollution control technologies and practices that promote reuse and recycling of material, industrial plants can remove or eliminate pollutants from their wastewaters before discharging them into the municipal sewage treatment system.

Pretreatment standards for existing sources (PSES) and pretreatment standards for new sources (PSNS) are established during the effluent guidelines process (described above) for certain categories of industry. In addition to these categorical standards, local limits are developed and enforced by various POTWs when necessary for the POTW to assure compliance with its water quality based effluent limits, as well as to protect treatment processes, worker health and safety, and equipment.

NPDES Storm Water Program

The 1987 CWA amendments established a two-phased approach to storm water discharges. The first phase required permits for separate storm sewer systems (MS4s) serving large- and medium-size communities (i.e., those with populations over 100,000 served by the MS4) and for storm water discharges associated with industrial activities, including construction sites disturbing at least five acres. Municipal stormwater permits require a reduction of pollutants to the maximum extent practicable through implementation of a variety of measures. Municipal permit applications required sampling to characterize the discharges from MS4s and many municipal permits require ongoing monitoring of storm water quality to assess program effectiveness and to ensure compliance.

To address the more than 100,000 industrial dischargers of storm water, EPA developed a tiered framework to manage the administrative burden while emphasizing reduction in risk to human health and ecosystems. The second phase of the storm water regulations is designed to address remaining storm water discharges. Additional permittees would be covered, including municipal storm water from urbanized areas with populations under 100,000 and smaller construction sites. EPA proposed a regulation in 1998 and the final rule is anticipated in 1999. At this time, however, in all areas that are not subject to the first phase of regulations, control of urban runoff is voluntary (except urban coastal areas subject to the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Therefore, smaller, noncoastal urban areas not currently do not implement urban runoff BMPs at the same level as larger and coastal urban areas.

Combined Sewer Overflows

In many older cities, sewers were designed to carry storm water runoff along with sewage, and to overflow if a heavy rain exceeded the capacity of the system. These combined sewer overflows or "CSOs" occur in about 1,100 cities around the country. In addition to spilling raw sewage, CSOs can also release untreated industrial wastewater and street debris. Therefore, industrial pretreatment is an important component of a CSO control program because CSOs discharge directly from the collection systems to waters of the U.S. The result of such discharges can be a menace to public health, recreational uses, and commercial fishing. In fact, CSOs are a leading cause of beach closures and shellfishing restrictions around the country.

Working closely with the States, affected cities, and environmental groups, EPA helped develop a consensus policy to guide action on CSOs. The Policy encourages cities to pursue certain minimum, low-cost controls and to develop a full understanding of local CSO occurrences and impacts before making longer-term investments in additional wastewater treatment, temporary storage capacity, and sewer rehabilitation. Measures specified in the Policy include proper operation and regular maintenance of sewer systems and CSOs, as well as the public notice in the event of overflows, to ensure that the public receives adequate notification of the impacts of this health and environmental hazard. With significant input from key stakeholders, EPA is currently developing guidances to assist communities to implement measures for the control of CSOs as effectively as possible.

Sanitary Sewer Overflows

EPA has also begun developing a national policy to reduce sanitary sewer overflows (SSOs) and the public health threats these overflows cause. The Agency is currently evaluating the extent of the SSO problem across the country by working with the public and with constituent groups to identify and evaluate issues associated with these overflows to protect human health, property, and water quality. Implementation of the NPDES Watershed Strategy is underway, and will include the assessment of State watershed protection activities and needs. EPA is coordinating this effort with States to ensure that ongoing program activities take watershed planning into consideration. The watershed approach is ideally suited to address one of the chief NPDES program responsibilities, the effective implementation of EPA's wet weather strategies, including storm water management and the control of combined sewer and sanitary sewer overflows.

Groundwater Program

Groundwater protection and management is primarily a state-level activity with minimal EPA involvement. This program was authorized under the Safe Drinking Water Act Amendments (SDWA) of 1996, and the Federal Clean Water Act. In addition, the Resource Conservation and Recovery Act (RCRA), and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) all contain groundwater protection provisions.

Section 1429 of the Safe Drinking Water Act Amendments (SDWA) of 1996 authorizes the Administrator of EPA to make grants to States to develop and implement programs to ensure the coordinated and comprehensive protection of ground water resources within the State. While Congress has not yet appropriated funds for these grants, the EPA has developed guidance to identify the key elements of State ground water protection programs and to establish grant application procedures should funds become available in the future.

The Final Comprehensive State Ground Water Protection Program (CSGWPP) Guidance document (EPA 100-R-93-001) encourages States to develop and implement CSGWPPs, as an integral part of watershed protection. In that guidance, EPA identifies six strategic activities to ensure CSGWPPs are designed to focus source control programs on preventing contamination of higher priority ground water, facilitate coordination among the many intrastate programs that protect ground water, and build a comprehensive approach to protection of ground water that includes all stakeholders. In addition, CSGWPPs strengthen State watershed approaches by providing an essential linkage between the State's ground water and surface water protection programs. Many States use funding under section 106 of the Clean Water Act to support their efforts to develop State groundwater programs and plans.

Drinking Water Program

The 1996 Amendments to the Safe Drinking Water Act (SDWA, P.L. 104-182) emphasize preventing contamination problems through source water protection and enhanced water system management. The act promotes sound science and risk-based standard setting, small water supply system flexibility and technical assistance, community-empowered source water protection, consumer awareness/right-to-know, and water system infrastructure assistance through a multi-billion-dollar Drinking Water State Revolving Fund.

Source Water Protection

SDWA section 1453 requires States with PWSS primacy to develop source water quality assessments program and submit it for EPA approval. State assessment programs are required to: (1) delineate the boundaries of the areas providing source waters for public water systems, and (2) identify (to the extent practicable) the origins of regulated and certain unregulated contaminants in the delineated area to determine the susceptibility of public water systems to such contaminants. [1453] Sec. 132(a). EPA published guidance to States on August 6, 1997. States must submit their program to EPA no later than February 6,1999. States must also make the results of the source water assessments available to the public. States may use SRF set-aside funds to pay for their source water protection and implementation efforts. Statutory Reference (§1428, 1429, 1453, 1454)

Capacity Development - Revolving Funds

The 1996 SDWA Amendments created a program to strengthen the technical, managerial, and financial capacity of water systems to deliver safe drinking water by authorizing States to develop programs to support capacity development. States may use SRF set-aside funds to pay for their capacity development and implementation efforts. Statutory Reference (§ 1420, 1415).

Drinking Water State Revolving Fund

The SDWA Amendments of 1996 authorized a Drinking Water State Revolving Fund (DWSRF) program to assist public water systems finance the costs of drinking water infrastructure to achieve or maintain compliance with DWSRF requirements and to protect public health. The DWSRF program will help ensure that the nation's drinking water supplies remain safe and affordable, and that systems that receive funding will be properly operated and maintained.

The 1996 SDWA amendments emphasize preventing contamination problems. Central to this emphasis is the development of State prevention programs, including source water protection, capacity development and operator certification. States have the option to use a portion of its DWSRF capitalization grant to help develop these programs. The DWSRF appropriation for FY97 was $1.275 billion, and $725 million in FY98. Statutory Reference (§1452).

Risk-based Contaminant Selection

Maximum contaminant levels (MCLs) for drinking water supplies are established by EPA by a regulation. Prior to the reauthorization in 1996, EPA was required to regulate an additional 25 contaminants every three years. EPA now has the flexibility to decide whether to regulate a contaminant after reviewing at least five contaminants every five years. To regulate a contaminant, EPA must use the following criteria: the contaminant adversely affects human health; it is known or substantially likely to occur in public water

system with a frequency and at levels of public health concern; and the regulation of the contaminant presents a meaningful opportunity for health risk reduction.

Wellhead Protection

The 1986 SDWA Amendments established the Wellhead Protection Program to protect ground waters that supply drinking water to public supply systems. The wellhead protection program protects all or part of the area surrounding a well from which the ground water is drawn (i.e., the "wellhead protection area"). Wellhead protection requires State and local coordination to delineate the wellhead protection area, identify actual and potential sources of contamination, and execute protection strategies. Contingency plans, provisions for siting new wells, and public participation are important elements of the wellhead protection programs. EPA supported State program development through grants under §106, §205(j) and §319 of the Clean Water Act. States can use set-asides from their DWSRF funds to conduct wellhead protection programs.

Underground Injection Control

Mandated by the Safe Drinking Water Act, the Underground Injection Control (UIC) Program works with State and local governments to regulate injection wells to prevent them from contaminating drinking water resources. EPA defines the five classes of wells according to the type of waste they inject and where the waste is injected. EPA also provides States with technical support, including program guidance and data management.

The Sole Source Aquifer (SSA) Protection Program

The SSA Protection Program is authorized by SDWA section 1424 (Public Law 93-523, 42 U.S.C. 300 et. seq). Under the SSA program, the EPA Administrator can designate an area that has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health. Designations are published in the Federal Register. After the publication, no commitment for federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate an aquifer and create a significant hazard to public health. Federal assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

Pesticide Program

Another program administered by EPA that controls some forms of nonpoint source pollution is the pesticides program under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Among other things, this program authorizes EPA to control pesticides that may threaten ground and surface water. FIFRA provides for the registration of pesticides and enforceable label requirements, which may include maximum rates of application, restrictions on use practices, and classification of pesticides as “restricted use” pesticides (which restricts use to certified applicators trained to handle toxic chemicals).

CERCLA/SARA

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or "Superfund" provides broad federal authority to respond to releases or threatened releases of hazardous substances. This

law provides for the cleanup of inactive or abandoned hazardous waste sites. Under CERCLA, EPA assesses the nature and extent of contamination at a site, determines the public health and environmental threats posed by a site, analyzes the potential cleanup alternatives, and takes action to clean up the site. In instances where a CERCLA site has impact on a nearby waterbody, the level of cleanup needed to maintain water quality standards of surface waters may have a direct relationship to the TMDL. As part of the CERCLA process, all "applicable or relevant and appropriate requirements" of statutes such as the CWA must be followed. Load allocations developed pursuant to section 303(d) may, in appropriate circumstances, be "applicable or relevant and appropriate."

POTWs that discharge CERCLA hazardous substances in effluent at levels that equal or exceed NPDES permit limitations, or for which no specific limitations exist, or in spills or other releases, may be subject to the notification requirements and liability provisions under CERCLA. In addition, POTWs that disposed of sludge in impoundments or landfills that are Superfund sites may be required to pay for cleanup of those sites. At times, POTWs may be requested to accept wastewaters from Superfund cleanup activities. If discharge of CERCLA wastewaters to an off-site POTW is deemed appropriate, the discharger must ensure compliance with the national pretreatment program and all local pretreatment regulations.

The provisions of CERCLA extend well beyond the regulation of POTW discharges and include abandoned hazardous waste sites and inactive mines.

The Superfund Amendments and Reauthorization Act (SARA), which amended CERCLA, also established in Title III a new program to increase the public's knowledge of and access to information on the presence of hazardous chemicals in their communities and releases of these chemicals into the environment. Title III (Community Right to Know Program) requires facilities to notify State and local officials if they have extremely hazardous substances present at their facilities in amounts exceeding certain "threshold planning quantities." If appropriate, the facility must also provide material safety data sheets on hazardous chemicals stored at their facilities, or lists of chemicals for which these data sheets are maintained, and report annually on the inventory of these chemicals used at their facility. The law may also require facilities to submit information each year on the amount of toxic chemicals released by the facilities to all media (air, water, and land), if they fall within Standards Industrial Classification Codes 20 to 39 and meet certain threshold limits.

Other Federal Activities

U.S. Department of Agriculture Natural Resource Conservation Agency

Farm Bill Conservation Provisions

Technical and financial assistance for landowners seeking to preserve soil and other natural resources is authorized by the Federal government under provisions of the Food Security Act (Farm Bill). Approximately $163 million is available annually through the Farm Bill. 1996 provisions relating directly to installation and maintenance of BMPs are summarized in the following sections.

Environmental Conservation Acreage Reserve Program (ECARP)

ECARP is an umbrella program established by the 1996 Farm Bill which contains the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), and Environmental Quality Incentives Program (EQIP). It authorizes the Secretary of Agriculture to designate watersheds, multi-state areas, or

regions of special environmental sensitivity as conservation priority areas which are eligible for enhanced Federal assistance. Assistance in priority areas is to be used to help agricultural producers comply with nonpoint source pollution requirements of the Clean Water Act and other State or Federal environmental laws. The ECARP is authorized through 2002.

Conservation Reserve Program (CRP) — First authorized by the Food Security Act of 1985 (Farm Bill), this voluntary program offers annual rental payments, incentive payments, and cost-share assistance for establishing long-term, resource-conserving cover crops on highly erodible land. Conservation Reserve Program contracts are issued for 10 to 15 years for up to 36.4 million acres of cropland and marginal pasture. Land can be accepted into the CRP through a competitive bidding process where all offers are ranked using an environmental benefits index, or through continuous sign-up for eligible lands where certain special conservation practices will be implemented. Annually, $2 million dollars is available through CRP.

Wetlands Reserve Program (WRP) — The WRP is a voluntary program to restore and protect wetlands and associated lands. Participants may sell a permanent or 30-year conservation easement or enter into a 10-year cost-share agreement with USDA to restore and protect wetlands. The landowner voluntarily limits future use of the land, yet retains private ownership. The NRCS provides technical assistance in developing a plan for restoration and maintenance of the land. The landowner retains the right to control access to the land and may lease the land for hunting, fishing, and other undeveloped recreational activities.

Environmental Quality Incentives Program (EQIP) — The EQIP was established by the 1996 Farm Bill to provide a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. EQIP offers financial, technical, and educational help to install or implement structural, vegetative, and management practices designed to conserve soil and other natural resources. Current priorities for these funds dictate that one half of the available monies be directed to livestock-related concerns. Cost-sharing may pay up to 75 percent of the costs for certain conservation practices. Incentive payments may be made to encourage producers to perform land management practices such as nutrient management, manure management, integrated pest management, irrigation water management, and wildlife habitat management. Cost-share for construction of animal waste management facilities is prohibited for livestock operations over 1,000 animal units or as otherwise approved by the Chief of NRCS, but such units are eligible for incentive payments and technical and educational assistance. Annually, $200 million is available through EQIP.

Wildlife Habitat Incentives Program (WHIP)

This program is designed for people who want to develop and improve wildlife habitat on private lands. Plans are developed in consultation with the NRCS and local Conservation District. USDA provides technical assistance and cost-share up to 75 percent of the cost of installing the wildlife practices. Participants generally must sign a 5- to 10-year contract with USDA which requires that they maintain the practices. Annually, $200,000 is available through WHIP.

Conservation of Private Grazing Land

This program was authorized by the 1996 Farm Bill to provide technical and educational assistance to owners of private grazing lands. It offers opportunities for better land management, erosion reduction, water conservation, wildlife habitat, and improving soil structure.

USDA Forest Service

Forestry Incentives Program (FIP)

Originally authorized in 1978, the FIP allows cost sharing up to 65 percent (up to a maximum of $10,000 per person per year) for tree planting, timber stand improvement, and related practices on nonindustrial private forest land. The FIP is administered by the NRCS and the U.S. Forest Service. Cost share funds are restricted to individuals who own no more than 1,000 acres of eligible forest land.

DOI Bureau of Land Management

The Bureau of Land Management (BLM) is the agency of the Department of the Interior that manages about 272 million acres of land. The BLM program areas most relevant to the TMDL program fall under BLM's Lands and Renewable Resources Program area, which includes recreation, forestry, wilderness, range, cultural resources, and wildlife. For example, BLM manages about 2,000 miles of the Wild and Scenic River System and manages the riparian areas along about 85,000 miles of streams containing trout, salmon, and other sport fish. More than 4 million acres of lakes and reservoirs are managed by BLM. BLM also manages 25 wilderness areas in eight states, covering more than 450,000 acres and manages livestock grazing on 165 million acres of public lands serving about 18,000 ranchers and farmers.

DOI Bureau of Reclamation

The Bureau of Reclamation is an agency of the U.S. Department of the Interior which stores and supplies water for irrigation and for use in homes and in industry. The Bureau also generates hydroelectric power, provides flood control, and helps meet fish and wildlife needs and compliance with water quality standards. The Bureau's mission includes a water resources management focus and the development of technical expertise and the transfer of more environmentally sensitive solutions to water users and water managers.

Army Corps of Engineers

The Army Corps of Engineers (Corps) is involved in numerous activities that support environmental planning and analysis, which play a pivotal role in Corps civil works, military, and other programs. In addition to support for Corps programs, these water quality activities support EPA and U.S. Fish and Wildlife program and a host of State and local environmental efforts.

- Monitoring of hundreds of projects
- Flow augmentation for fisheries monitoring and resolution of dissolved gas problems
- Modeling to better understand project functions
- Management of releases to resolve temperature and dissolved oxygen problems
- Monitoring and resolving groundwater contamination
- Quantifying saltwater intrusion problems
- Dealing with toxic algal blooms
- Monitoring bacterial problems
- Working to protect threatened and endangered species
- Supporting dredging activities
- Working with off-shore disposal problems
- Working with contaminated sediments
- Identifying toxics in fish flesh and working to resolve fishkill problems

- Working to improve and create wetland, river corridor and other important habitats
- Working with ecology of such diverse organisms as bacteria, fish, zooplankton, birds, insects, and mammals in addition to dealing with the physical environment

Federal Emergency Management Agency

Founded in 1979, the Federal Emergency Management Agency (FEMA) is an independent executive agency of the federal government. FEMA's mission is to reduce loss of life and property and to protect the nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response, and recovery.

The range of activities undertaken by the Federal Emergency Management Agency (FEMA) is broad. FEMA advises local governments on building codes and flood plain management, i.e., teaching people how to get through a disaster and helping equip local and State emergency preparedness. FEMA also coordinates the federal response to disasters, making disaster assistance available to States, communities, businesses and individuals. The agency trains emergency managers, supports the nation's fire service, administers the national flood and crime insurance programs. Floodplain management aspects are the most relevant to the TMDL program.