CHAPTER 2

INTRODUCTION TO MONITORING AND MODELING

Monitoring and modeling activities are central to implementation of the CSO Control Policy. Thoughtful development and implementation of a monitoring and modeling plan will support the selection and implementation of cost-effective CSO controls and an assessment of their improvements on receiving water quality.

This chapter describes general expectations for monitoring and modeling activities as part of a permittee's CSO control program. It also describes how monitoring and modeling efforts conducted as part of CSO control program implementation can be coordinated with other key EPA and State programs and efforts (e.g., watershed approach, other wet weather programs).

While this chapter will describe general expectations, EPA encourages the permittee to take advantage of the flexibility in the CSO Control Policy by developing a monitoring and modeling program that is cost-effective and tailored to local conditions, providing adequate but not duplicative or unnecessary information.

2.1 MONITORING AND MODELING FOR NINE MINIMUM CONTROLS AND LONG-TERM CONTROL PLAN

The CSO Control Policy urges permittees to develop a thorough understanding of the hydraulic responses of their combined sewer systems (CSSs) to wet weather events. Permittees may also need to estimate pollutant loadings from CSOs and the fate of pollutants in receiving water both for existing conditions and for various CSO control options. The CSO Control Policy states that permittees should immediately undertake a process to characterize their CSSs, demonstrate implementation of the nine minimum controls (NMC), and develop a long-term CSO control plan. Characterizing the CSS and its hydraulic response to wet weather events, implementing the NMC and producing related documentation, and developing a long-term control plan (LTCP) will involve gathering and reviewing existing data, and, in most cases, conducting some field inspections, monitoring, and modeling. Since flexibility is a key principle of the CSO Control Policy, these

activities will be carried out to different degrees based on each permittee's situation. In particular, the type and complexity of necessary modeling will vary from permittee to permittee.

2.1.1 Nine Minimum Controls

The CSO Control Policy recommends that a Phase I permit require the permittee to immediately implement technology-based requirements, which at a minimum include the NMC, as determined on a best professional judgment (BPJ) basis by the NPDES permitting authority. The NMC are:

1. Proper operation and regular maintenance programs for the sewer system
2. Maximum use of the collection system for storage
3. Review and modification of pretreatment requirements to assure CSO impacts are minimized
4. Maximization of flow to the publicly owned treatment works (POTW) for treatment
5. Prohibition of CSOs during dry weather
6. Control of solid and floatable materials in CSOs
7. Pollution prevention
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts
9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.

The NMC are technology-based controls, applied on a site-specific basis, to reduce the magnitude, frequency, and duration of CSOs and their impacts on receiving water bodies. NMC measures typically do not require significant engineering studies or major construction and thus implementation was expected by January 1, 1997. EPA's guidance document Combined Sewer *Overflows - Guidance for Nine Minimum Controls* (U.S. EPA, 1995b) provides a detailed description of the NMC, including example control measures and their advantages and limitations.

Monitoring is specifically included as the ninth minimum control. Implementation of this control would typically involve the following activities:

- Mapping the drainage area for the CSS, including the locations of all CSO outfalls and receiving waters
- Identifying, for each receiving water body, designated and existing uses, applicable water quality criteria, and whether water quality standards (WQS) are currently being attained for both wet weather and dry weather
- Developing a record of overflow occurrences (number, volume, frequency, and duration)
- Compiling existing information on water quality impacts associated with CSOs (e.g., beach closings, evidence of floatables wash-up, fish kills, sediment accumulation, and the frequency, duration, and magnitude of instream WQS violations).

Monitoring as part of the NMC is not intended to be extensive or costly. It should entail collection of existing information from relevant agencies about the CSS, CSOs, the receiving water body, and pollutant sources discharging to the same receiving waters, as well as preliminary investigation activities such as field inspections and simple measurements using chalk boards, bottle boards, and block tests. The collected information and data will be used to establish a baseline of existing conditions for evaluating the efficacy of the technology-based controls and to develop the LTCP (as described in Section 2.1.2).

Data analysis and field inspection activities also support implementation of several other NMC:

- ***Proper operation and regular maintenance programs for the sewer system-*** Characterization of the CSS will support the evaluation of the effectiveness of current operation and maintenance (O&M) programs and help identify areas within the CSS that need repair.
- ***Maximum use of the collection system for*** storage-Information gained during field inspections, such as the system topography (e.g., location of any steep slopes) and the need for regulator or pump adjustments, can assist in identifying locations where minor modifications to the CSS can increase in-system storage.

- ***Review and modification of pretreatment requirements to assure CSO impacts are*** minimized-Pretreatment program information and existing monitoring data will support assessment of the impacts of nondomestic discharges on CSOs and identify opportunities to mitigate the impacts of nondomestic discharges during wet weather.

- ***Control of solid andfloatable materials in*** CSOs-Existing information about receiving water impacts and observations made during field inspections of the CSS will help determine the extent of solid and floatable materials present and the effectiveness of any controls installed.

- ***Dry weather*** overflows-Field inspections will assess the presence of dry weather overflows, the conditions under which they occur, and the effectiveness of any control measures in place.

Because specific NMC implementation requirements will be embodied in a permit or other enforceable mechanism that is developed on a site-specific basis, the permittee should coordinate NMC implementation with the NPDES permitting authority on an ongoing basis.

2.1.2 Long-Term Control Plan Development

The CSO Control Policy recommends that a Phase I permit require the permittee to develop and submit an LTCP that, when implemented, will ultimately result in compliance with CWA requirements. The permittee should use either the presumption approach or the demonstration approach in developing an LTCP that will provide for WQS attainment. The two approaches are discussed in more detail below and in Chapters 7 through 9.

The permittee should evaluate the data and information obtained through the initial system characterization to determine which approach is more appropriate based on site-specific conditions. Generally, the demonstration approach would be selected when sufficient data are available, or can be collected, to “demonstrate” that a proposed LTCP is adequate to meet the water quality-based requirements of the CWA. If sufficient data are not available and cannot be developed to allow use of the demonstration approach, and the permitting authority believes it is likely that implementation of a control program that meets certain performance criteria will result in attainment of CWA requirements, the permittee would use the presumption approach.

Demonstration Approach. Under the demonstration approach, the permittee demonstrates the adequacy of its CSO control program to meet the water quality-based requirements of the CWA. As stated in the CSO Control Policy, the permittee should demonstrate each of the following:

"i. *The planned control program is adequate to meet WQS andprotect designated uses, unless WQS or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs;*

ii. *The CSO discharges remaining after implementation of the planned control program will not preclude the attainment of WQS or the receiving waters ' designated uses or contribute to their impairment. Where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a wasteload allocation and a load allocation, or other means should be used to apportion pollutant loads;*

iii. *The planned control program will provide the maximum pollution reduction benefits reasonably attainable; and*

iv. *The planned control program is designed to allow cost effective expansion or cost effective retrofitting if additional controls are subsequently determined to be necessary to meet WQS or designated uses. "* (Section II.C.4.b of the CSO Control Policy)

Generally, monitoring and modeling activities will be integral to successfully demonstrating that these criteria have been met.

Presumption Approach. This approach is based on the presumption that WQS will be attained with implementation of an LTCP that meets certain performance-based criteria. For the presumption approach, the CSO Control Policy states that:

> *"A program that meets any of the criteria listed below would be presumed to provide an adequate level of control to meet the water quality-based requirements of the CWA, provided the permitting authority determines that such presumption is reasonable in light of the data and analysis conducted in the characterization, monitoring, and modeling of the system and the consideration of sensitive areas described above. These criteria are provided because data and modeling of wet weather events often do not give a clear picture of the level of CSO controls necessary to protect WQS.*

i. *No more than an average of four overflow events per year...*

ii. *The elimination or the capture for treatment of no less than 85% by volume of the combined sewage collected in the CSS during precipitation events on a system-wide annual average basis...*

iii. *The elimination or removal of no less than the mass of pollutants, identified as causing water quality impairment..., for the volumes that would be eliminated or capturedfor treatment under paragraph ii... "* (Section II.C.4.a.)

Monitoring and modeling activities are also likely to be necessary in order to obtain the permitting authority's approval for using the presumption approach. Considerations for using both the presumption approach and the demonstration approach are discussed in *Combined Sewer Overflows - Guidance for Long Term Control Plan* (U.S. EPA, 1995a).

Whether the LTCP ultimately reflects the demonstration approach or the presumption approach, it should contain the same elements, as identified in the CSO Control Policy:

- Characterization, monitoring, and modeling of the CSS
- Public participation
- Consideration of sensitive areas
- Evaluation of alternatives
- Cost/performance considerations
- Operational plan
- Maximization of treatment at the POTW
- Implementation schedule
- Post-construction compliance monitoring program.

Of these elements, the first and last are directly linked to monitoring and modeling and are described below.

Characterization, monitoring, and modeling of the CSS

The first step in developing an LTCP involves characterization, monitoring, and modeling of the CSS. The CSO Control Policy states:

> *"In order to design a CSO control plan adequate to meet the requirements of the CWA, a permittee should have a thorough understanding of its sewer system, the response of the system to various precipitation events, the characteristics of the overflows, and the water quality impacts that result from CSOs. The permittee should adequately characterize through monitoring, modeling, and other means as appropriate, for a range of storm events, the response of its sewer system to wet weather events including the number, location and frequency of CSOs, volume, concentration and mass ofpollutants discharged and the impacts of the CSOs on the receiving waters and their designated uses. The permittee may need to consider information on the contribution and importance of other pollution sources in order to develop a final plan designed to meet water quality standards. The purpose of the system characterization, monitoring and modeling program initially is to assist the permittee in developing appropriate measures to implement the nine minimum controls and, if necessary, to support development of the long-term CSO control plan. The monitoring and modeling data also will be used to evaluate the expected effectiveness of both the nine minimum controls and, if necessary, the long-term CSO controls, to meet WQS. "* (Section II.C.1)

Characterization, monitoring, and modeling of the CSS can be broken into the following elements:

1. Examination of existing data
2. Characterization of the CSS
3. Monitoring of CSOs and receiving water
4. Modeling of the CSS and receiving water.

Analysis of existing data should include an examination of rainfall records and available data on flow, capacity, and water quality for the collection system, treatment plant, and receiving water. This analysis, as well as information from field inspections and simple measurements, provides the basis for the preliminary system characterization. This initial characterization of the system (described in more detail in Chapter 3) should identify the number, location, and frequency of

overflows and clarify their relationship to sensitive areas, pollution sources within the collection system (e.g., indirect discharges from nondomestic sources), other pollution sources discharging to the receiving water (e.g., direct industrial discharges, POTWs, storm water discharges), and background/upstream pollution sources (e.g., agricultural or other nonpoint source runoff).

Since some of these activities are also conducted as part of NMC implementation, the LTCP should be developed in coordination with NMC implementation efforts. Ultimately, because the LTCP is based on more detailed knowledge of the CSS and receiving waters than is necessary to implement the NMC, the extent of monitoring and modeling for LTCP development is expected to be more sophisticated.

Examination of existing data, field inspections and simple measurements, and other preliminary characterization activities will serve as the basis for the development of a cost-effective monitoring and modeling plan (discussed in Chapter 4). The monitoring and modeling plan should be designed to provide the information and data needed to develop and evaluate CSO control alternatives and to select cost-effective CSO controls.

Chapter 4 provides an overview of the development of a monitoring and modeling plan. Chapters 5 and 7 discuss CSS monitoring and modeling, and Chapters 6 and 8 discuss receiving water monitoring and modeling, respectively. It is important to remember that the monitoring and modeling plan should be based on the site-specific conditions of the CSS and receiving water. Therefore the permittee should, on an ongoing basis, consult and coordinate these efforts with the NPDES permitting authority.

Implementation of the monitoring and modeling plan should enable the permittee to predict the CSS's response to various wet weather events and evaluate CSO impacts on receiving waters for alternative control strategies. Evaluation of CSO control alternatives is discussed in *Combined Sewer Overflows - Guidance for Long Term Control Plan* (U.S. EPA, 1995a).

Based on the evaluation of control strategies, the permittee, in coordination with the public, the NPDES permitting authority, and the State WQS authority, should select the cost-effective CSO controls needed to provide for the attainment of WQS. Specific conditions relating to implementation of these CSO controls will be incorporated into the NPDES permit as described in Section 2.1.4.

Post-construction compliance monitoring program

Not only should the LTCP contain a characterization, monitoring, and modeling plan adequate to evaluate CSO controls, but it should also contain a post-construction compliance monitoring plan to ascertain the effectiveness of long-term CSO controls in achieving compliance with CWA requirements. Generally, post-construction compliance monitoring will not occur until after development and at least partial implementation of the LTCP. Nevertheless, the permittee should consider its needs for post-construction monitoring as its monitoring and modeling plan develops. The development of a post-construction compliance monitoring program is discussed in Section 2.1.4 and Chapter 4.

2.1.3 Monitoring and Modeling During Phase I

The CSO Control Policy recommends that the Phase I permit require permittees to:

- Immediately implement BAT/BCT (best available technology economically achievable/best conventional pollutant control technology), which at a minimum should include the NMC, as determined on a BPJ basis by the NPDES permitting authority
- Submit appropriate documentation on NMC implementation activities within two years of permit issuance/modification but no later than January 1, 1997
- Comply with applicable WQS expressed as narrative limitations
- Develop and submit an LTCP as soon as practicable, but generally within two years after permit issuance/modification.

The permittee should not view NMC implementation and LTCP development as independent activities, but rather as related components in the CSO control planning process. Implementation of the NMC establishes the baseline conditions upon which the LTCP will be developed.

In many cases, the LTCP will be developed concurrent with NMC implementation. As described in Sections 2.1.1 and 2.1.2, both efforts require the permittee to develop a thorough understanding of the CSS. For example, monitoring done as part of the NMC to *effectively characterize CSO impacts and the efficacy of CSO controls* should provide a base of information and data that the permittee can use in conducting more thorough characterization, monitoring, and modeling activities for LTCP implementation.

Therefore, the characterization activities needed to implement the NMC and develop the LTCP should be a single coordinated effort.

2.1.4 Monitoring and Modeling During Phase II

The CSO Control Policy recommends that a Phase II permit include:

- Requirements to implement technology-based controls including the NMC on a BPJ basis
- A narrative requirement that selected CSO controls be implemented, operated, and maintained as described in the LTCP
- Water quality-based effluent limits expressed in the form of numeric performance standards
- Requirements to implement the post-construction compliance monitoring program
- Requirements to reassess CSOs to sensitive areas
- Requirements for maximizing the treatment of wet weather flows at the treatment plant
- A reopener clause authorizing permit modifications if CSO controls fail to meet WQS or protect designated uses.

The post-construction compliance monitoring program should provide sufficient data to determine the effectiveness of CSO controls in attaining WQS. The frequency and type of monitoring in the program will be site-specific. In most cases, some monitoring will be conducted during the construction/implementation period to evaluate the effectiveness of the long-term CSO controls. In some cases, however, it may be appropriate to delay implementation of the post-construction monitoring program until construction is well underway or completed.

The post-construction compliance monitoring program may also include other appropriate measures for determining the success of the CSO control program. Measures of success, which are also discussed in Section 2.3, can address both CSO flow and quality issues. For example, flow-related measures could include the number of dry weather overflows or CSO outfalls eliminated, and reductions in the frequency and volume of CSOs. Quality-related measures could include decreases in loadings of conventional and toxic pollutants in CSOs. Environmental measures focus on human and ecosystem health trends such as reduced beach closures or fish kills, improved biological integrity indices, and the full support of designated uses in receiving water bodies.

2.2 MONITORING AND MODELING AND THE WATERSHED APPROACH

The watershed approach represents a holistic approach to understanding and addressing all surface water, ground water, and habitat stressors within a geographically defined area, instead of addressing individual pollutant sources in isolation. It serves as the basis for "place-based" solutions to ecosystem protection.

The watershed approach is based on a few main principles:

- ***Geographic*** Focus-Activities are focused on specific drainage areas
- ***Environmental Objectives and Strong Science/Data-Using*** strong scientific tools and sound data, the priority problems are characterized, environmental objectives are determined, action plans are developed and implemented, and effectiveness is evaluated

- ***Establishment of Partnerships-*** Management teams representing various interests (e.g., regulatory agencies, industry, concerned citizens) are formed to jointly evaluate watershed management decisions

- ***Coordinated Priority Setting and Integrated Solutions-*** Using a coordinated approach across relevant organizations, priorities can be set and integrated actions taken that consider all environmental issues in the context of various water programs and resource limitations.

Point and nonpoint source programs, the drinking water program, and other surface and ground water programs are all integrated into the watershed approach. Under the watershed approach, these programs address watershed problems in an effective and cooperative fashion. The CSO Control Policy encourages NPDES permitting authorities to evaluate CSO control needs on a watershed basis and coordinate CSO control program efforts with the efforts of other point and nonpoint source control activities within the watershed.

The application of the watershed approach to a CSO control program is particularly timely and appropriate since the ultimate goal of the CSO Control Policy is the development of long-term CSO controls that will provide for the attainment of WQS. Since pollution sources other than CSOs are likely to be discharging to the receiving water and affecting whether WQS are attained, the permittee needs to consider and understand these sources in developing its LTCP. The permittee should compile existing information and monitoring data on these sources from the NPDES permitting authority, State watershed personnel, or even other permittees or dischargers within the watershed. If other permittees within the watershed are also developing LTCPs, they may have an opportunity to pursue a coordinated and cooperative approach to CSO control planning.

The sources of watershed pollution and impairment, in addition to CSOs, are varied and include other point source discharges, discharges from storm drains, overland runoff, habitat destruction, land use activities (such as agriculture and construction), erosion, and septic systems and landfills. A watershed-based approach to LTCP development allows for the site-specific determination of the relative impacts of CSOs and other pollution sources. The flows and loads from

the pollutant sources are estimated using available site-specific data and modeling. In addition to locally available data, potential data sources include:

- ***BASINS (Better Assessment Science Integrating Point and Nonpoint Sources)*** - Combines a geographic information system (GIS), national watershed data, and environmental assessment and modeling tools to facilitate watershed and water quality analysis. Additional information is available at http://www.epa.gov/OST/BASINS/. (U.S. EPA, 1997a)

- ***EMAP (Environmental Monitoring and Assessment Program)*** - Contains data on a limited set of estuaries, surface waters, and coastal bays, as well as some information on landscape characteristics and land use. EPA's EMAP Internet site (http://www.epa.gov/emap/) also contains links to additional sources of environmental data.

- ***NAWQA (National Water-Quality Assessment) Program*** - Contains information on the status and trends in the quality of 60 U.S. river basins and aquifers. Information on the NAWQA Program can be obtained from the U.S. Geological Survey (703-648-5716) or from the USGS Internet site (http://wwwrvares.er.usgs.gov/nawqa/).

If the permittee determines during its LTCP development that WQS cannot be met because of other pollution sources within the watershed, a total maximum daily load (TMDL), including wasteload allocations for point sources and load allocations for nonpoint sources, may be necessary to apportion loads among dischargers. Several publications provide TMDL and wasteload allocation guidance (U.S. EPA, 1995g; U.S. EPA, 1991b; Mills et al., 1986; Mancini et al., 1983; Martin et al., 1990; Mills et al., 1985a,b). In many cases, a TMDL may not have been developed for the permittee's watershed. In these cases, the monitoring and modeling conducted as part of the development and implementation of long-term CSO controls will support an assessment of water quality and could support the development of a TMDL. BASINS (U.S. EPA, 1997a) also supports the development of TMDLs.

EPA's Office of Water is committed to supporting States that want to implement a comprehensive statewide watershed management approach. EPA has convened a Watershed Management Policy Committee, consisting of senior managers, to oversee the reorientation of all EPA water programs to support watershed approaches.

Of particular importance to CSO control planning and management is the *NPDES Watershed Strategy* (U.S. EPA, 1994e). This strategy outlines national objectives and implementation activities to integrate the NPDES program into the broader watershed protection approach. The Strategy also supports the development of statewide basin management as part of an overall watershed management approach. Statewide basin management is an overall framework for integrating and coordinating water resource management efforts basin-by-basin throughout an entire State. This will result in development and implementation of basin management plans that meet stated environmental goals.

The *Clean Water Action Plan,* issued jointly by EPA and the U.S. Department of Agriculture, calls for States to issue unified watershed assessments by October, 1998 (U.S. EPA/USDA, 1998). Assessments identify degraded watersheds needing restoration, watersheds needing preventive action to sustain water quality, and pristine or sensitive watersheds on Federal lands needing additional protection. The *Clean Water Action Plan* identifies mechanisms for States and tribes to coordinate with Federal agencies to prioritize watershed restoration and protection efforts. Additional information is available at http://www.cleanwater.gov/.

Use of the comprehensive watershed approach during long-term CSO planning will promote a more cost-effective program for achieving WQS in a watershed. LTCP development using the watershed approach is discussed further in *Combined Sewer Overflows - Guidance for Long-Term Control Plan* (U.S. EPA, 1995a).

2.3 MEASURES OF SUCCESS

Before developing a monitoring plan for characterizing the CSS and determining post-construction compliance, the permittee should identify appropriate measures of success based on site-specific conditions. Measures of success are objective, measurable, and quantifiable indicators that illustrate trends and results over time. Measures of success generally fall into four categories:

- ***Administrative measures*** that track programmatic activities, such as the number of inspections

- ***End-of-pipe measures*** that show trends in the discharge of CSS flows to the receiving water body, such as reduction of pollutant loadings, the frequency of CSOs, and the duration of CSOs

- ***Receiving water body measures*** that show trends of the conditions in the receiving water body, such as trends in dissolved oxygen levels, sediment oxygen demand, and solids and fecal coliform concentrations

- ***Ecological, human health, and use measures*** that show trends in conditions relating to the use of the water body, its effect on the health of the population that uses the water body, and the health of the organisms that reside in the water body, including beach closures, attainment of designated uses, habitat improvements, and fish consumption advisories. Such measures would be coordinated on a watershed basis as appropriate.

Measures of success for a CSO control program should typically include a balanced mix of measures from each of the four categories.

As municipalities begin to collect data and information on CSOs and CSO impacts, they have an important opportunity to establish a solid understanding of the "baseline" conditions and to consider what information and data are necessary to evaluate and demonstrate the results of CSO control. The permittee should choose measures of success that can be used to indicate reductions in the occurrence and effects of CSOs. Municipalities and NPDES permitting authorities should agree early in the planning stages on the data and information that will be used to measure success. These measures of success may need to be adapted as a municipality gains additional information during its system characterization. (Measures of success for the CSO program are discussed in *Combined Sewer Overflows-Guidance for Long-Term Control Plan* (U.S. EPA, 1995a) and *Performance Measures for the National CSO Control Program* (AMSA, 1996)). The permittee should consider these measures of success when determining which parameters to include in its monitoring plan.

2.4 COORDINATION WITH OTHER WET WEATHER MONITORING AND MODELING PROGRAMS

The permittee may be subject to monitoring requirements for other regulated wet weather discharges, such as storm water, in addition to CSOs. Due to the unpredictability of wet weather

discharges, monitoring of such discharges presents challenges similar to those for monitoring CSOs. The permittee should coordinate all wet weather monitoring efforts. Developing one monitoring and modeling program for all wet weather programs will enable the permittee to establish a clear set of priorities for monitoring and modeling activities.

2.5 REVIEW AND REVISION OF WATER QUALITY STANDARDS

Section 301 of the CWA and NPDES regulations at 40 CFR 122.44 require the establishment of both technology-based and water quality-based effluent limitations:

- ***Technology-based requirements.*** Section 301 of the CWA requires effluent reductions based on various degrees of control technology for all discharges of pollutants. NPDES regulations at 40 CFR 122.44(a) require that technology-based effluent limitations be established for pollutants of concern discharged by point sources that will be regulated under an NPDES permit. Under the CSO Control Policy, permittees are expected to implement technology-based controls including, at a minimum, the NMC.

- ***Water quality-based requirements.*** Section 301(b)(1)(C) of the CWA and NPDES regulations at 40 CFR 122.44(d) require that NPDES permits contain water quality-based effluent limitations for all discharges that cause, contribute to, or have the potential to cause an exceedance of a numeric or narrative WQS. As described in the CSO Control Policy, Phase I permits should at least require that the permittee immediately comply with applicable narrative WQS, while sufficient data may not be available at this point to evaluate the need for numeric effluent limits. For Phase II permits, the CSO Control Policy recommends that permits contain water quality-based effluent limits expressed as numeric performance standards (e.g., number of overflow events per year) for the selected CSO controls. If sufficient data are available, numeric water quality-based effluent limitations should be developed and included in Phase II permits.

The development of permit limits and conditions for CSO permittees is described in greater detail in *Combined Sewer Overflows - Guidance for Permit Writers* (U.S. EPA, 1995e).

Since CSO controls must ultimately provide for the attainment of WQS, the analysis of CSO control alternatives should be tailored to the applicable WQS. A key principle of the CSO Control Policy is the review and revision, as appropriate, of WQS and their implementation procedures to reflect the site-specific wet weather impacts of CSOs. In identifying applicable WQS, the permittee

and the permitting and WQS authorities should consider whether revisions to WQS are appropriate for wet weather conditions in the receiving water.

Review of WQS should be conducted concurrent with the development of the LTCP to ensure that the long-term CSO controls will be sufficient to provide for the attainment of applicable WQS. The information gained from LTCP development can then be used to support any efforts to revise WQS. (The identification of applicable WQS and methods for assessing attainment of WQS are discussed in Chapter 9).

The WQS program contains several types of mechanisms that could potentially be used to address site-specific factors such as wet weather conditions. These include the following:

- Adopting partial uses to reflect situations where a significant storm event precludes the use from occurring
- Adopting seasonal uses to reflect that certain uses do not occur during certain seasons (e.g., swimming does not occur in winter)
- Defining a use with greater specificity (e.g., warm-water fishery in place of aquatic life protection)
- Granting a temporary variance to a specific discharger in cases where maintaining existing standards for other dischargers is preferable to downgrading WQS.

These potential revisions are described in detail in the *Water Quality Standards Handbook, Second Edition* (U.S. EPA, 1994).

Reviewing and revising WQS requires the collection of information and data to support the proposed revision. In general, a use attainability analysis (UAA) is required to support a proposed WQS revision. The process for conducting UAAs for receiving waters has been described in various EPA publications (U.S. EPA, 1994; U.S. EPA, 1984a; U.S. EPA, 1984b; U.S. EPA, 1983b).

The information and data collected during LTCP development could potentially be used to support a UAA for a proposed revision to WQS to reflect wet weather conditions. Thus, it is important for the permittee, NPDES permitting authority, State WQS authority, and EPA Regional offices to agree on the data, information, and analyses that are necessary to support the development of long-term CSO controls as well as the review of applicable WQS and implementation procedures, if appropriate.

2.6 OTHER ENTITIES INVOLVED IN DEVELOPING AND IMPLEMENTING THE MONITORING AND MODELING PROGRAM

Development and implementation of a CSO monitoring and modeling program should not be solely the permittee's responsibility. Development of a successful and cost-effective monitoring and modeling program should reflect the coordinated efforts of a team that includes the NPDES permitting authority, State WQS authority, State watershed personnel, EPA or State monitoring personnel, and any other appropriate entities.

NPDES Permitting Authority

The NPDES permitting authority should:

- Develop appropriate system characterization, monitoring, and modeling requirements for NMC implementation and LTCP development (in a Phase I permit) and NMC and LTCP implementation (in a Phase II permit)
- Determine, in coordination with the permittee and appropriate State and Federal agencies, whether the permittee needs to consider any sensitive areas in developing a monitoring and modeling plan
- Coordinate with the permittee to ensure that the monitoring requirements in the permit are appropriately site-specific
- Assist in compiling relevant existing information, monitoring data, and studies at the State and/or EPA Regional level
- Decide if the presumption approach is applicable based on the data and analysis conducted in the characterization, monitoring, and modeling of the system and the consideration of any sensitive areas

- Coordinate the permittee's CSO monitoring and modeling efforts with monitoring and modeling efforts of other permittees within the watershed

- Coordinate the team review of the monitoring and modeling plan, monitoring and modeling data, and other components of the LTCP. To ensure team review of the monitoring and modeling plan, the permitting authority could recommend that the plan include a signature page for endorsement by all the team members after their review.

- Develop appropriate monitoring requirements for post-construction compliance monitoring to assess attainment of WQS and the effectiveness of CSO controls (in a Phase II permit and ongoing).

- Assist in the review and possible revision of WQS.

State WQS Authority

The State WQS authority should:

- Provide input on the review and possible revision of WQS, including conduct of a use attainability analysis where necessary

- Assist in compiling existing State information, monitoring data, and studies for the receiving water body

- Ensure that the permittee's monitoring and modeling efforts are coordinated and integrated with ongoing State monitoring programs

- Evaluate any special monitoring activities such as biological testing, sediment testing, and whole effluent toxicity testing.

State Watershed Personnel

State watershed personnel should:

- Ensure that the permittee's monitoring activities are coordinated with ongoing watershed monitoring programs

- Assist in compiling existing State information, monitoring data, and studies for the receiving water body

- Ensure the permittee's monitoring and modeling efforts are integrated with TMDL application or development.

EPA/State Monitoring Personnel

EPA and State monitoring personnel should:

- Provide technical support and reference material on monitoring techniques and equipment
- Assist in compiling relevant existing monitoring data and studies for the receiving water body
- Provide information on available models and the monitoring data needed as model inputs
- Assist in the evaluation and selection of appropriate models.

The public should also participate in development and implementation of the system characterization activities and the monitoring and modeling program. Throughout the LTCP development process, the public should have the opportunity to review and provide comments on the results of the system characterization, monitoring, and modeling activities that lead to the selection of long-term CSO controls. The public participation effort might involve public meetings at key points during the system characterization phase of LTCP development. Input from the public, obtained during the early phases of the planning process, will enable a municipality to better develop an outreach program that reaches a broad base of citizens. In addition to public meetings, municipalities can obtain input from telephone surveys, community leader interviews, and workshops. Each of these activities can give the municipality a better understanding of the public perspective on local water quality issues and sewer system problems, the amount of public concern about CSOs in particular, and public willingness to participate in efforts to control CSOs.