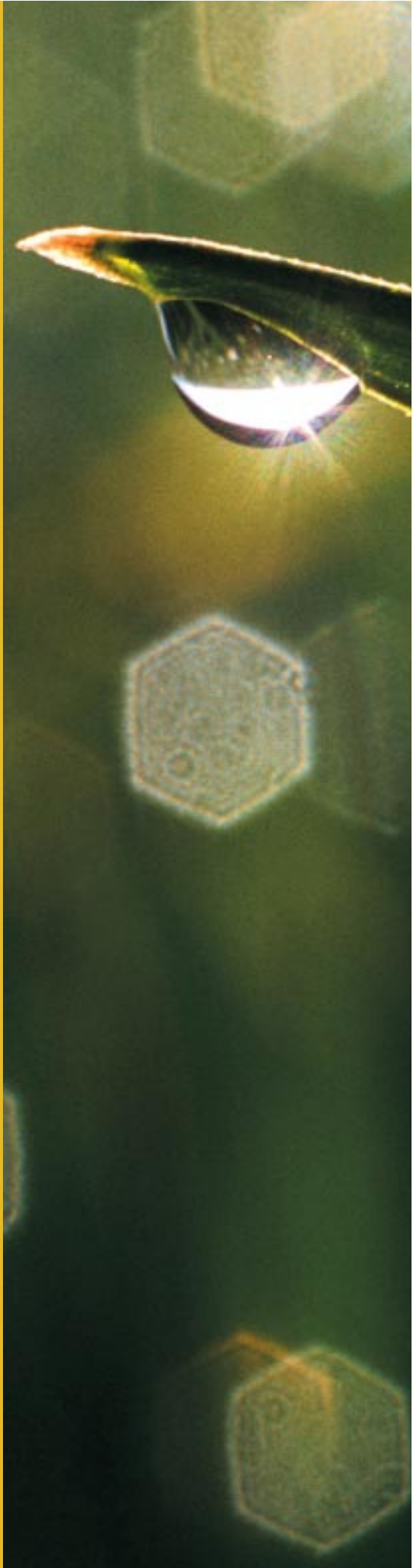
Understanding What States Need to Protect Water Quality



December 2002

National Academy of Public Administration

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A Report by a Panel of the

NATIONAL ACADEMY OF PUBLIC ADMINISTRATION

For the United States Environmental Protection Agency

December 2002

UNDERSTANDING WHAT STATES NEED TO PROTECT WATER QUALITY

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ACKNOWLEDGEMENTS

The Academy Panel would like to acknowledge the subcontractor's staff whose dedicated and gracious work contributed to the research and writing of the report.

The Panel offers its warmest thanks and appreciation to:

John Pendergrass, Turner Odell, Nicholas Gayeski, and Jeramy Shays of the Environmental Law Institute.

The views expressed in this report are those of the Panel.
They do not necessarily reflect the views of the Academy as an institution.

This document was funded by the U.S. Environmental Protection Agency under contract number 68-C-02-070.

Academy Project Number 2001-001

FOREWORD

Since passage of the Clean Water Act in 1972, the scope of programs to protect water quality has expanded to address literally hundreds of thousands of pollution sources. As a result, state agencies that manage most of the day-to-day aspects of water quality programs are in a difficult bind: Their responsibilities are expanding while they face increasingly severe funding constraints.

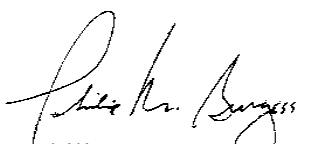
In 1998, EPA and its state partners began a systematic effort to collect information on what states now spend to manage water quality programs, what resources they would need to fully implement the Clean Water Act, and the gap between them. The study established reached a disquieting finding: The annual gap between state expenditures and state resource needs for managing water programs ranges between $735 million and $960 million. On the bright side, the project identified new approaches that hold promise for making state water programs both more efficient and more effective in achieving environmental goals. These include watershed-based management, improved data management systems, and technology advances—e.g., in monitoring and other functions.

In August 2002, EPA and state leaders asked the Academy to conduct an independent review of their Water Quality Management Resource Analysis project to determine whether their national estimate of the resource gap is reasonable and to recommend ways to increase the reliability of future estimates of resource needs. To direct this evaluation, the Academy selected a Panel comprised of experts in environmental policy, state finance, and water program management.

The Panel commends the states and EPA for undertaking this quite difficult and daunting task. After carefully reviewing the tools, methodologies, and interim results of the Resource Analysis project, the Panel finds that the estimated resource gap is based on a reasonable and defensible assessment process. Further, they find the comprehensive workload model can be used to project future resource needs on a nationwide basis, helping states plan and manage their own programs and helping them identify and share ways to make state water programs more efficient and cost-effective.

The Panel also observed that this process has been a valuable source of shared learning among the states and EPA and is worth repeating in the future. Thus, the Panel has identified ways that methods to estimate state resource needs can be improved and fine-tuned in subsequent phases.

The Panel's work was greatly aided by the excellent cooperation and background information provided by state officials and managers from EPA's Office of Water. We thank them all for their assistance and support. I also want to thank the Academy Panel and project staff for efforts beyond the call of duty to complete their research and publish this report under a very short deadline. This project illustrates quite well how the Academy can respond to pressing issues in a timely way with studies that are insightful, dependable and actionable.



Philip M. Burgess
President

UNDERSTANDING WHAT STATES NEED TO IMPROVE WATER QUALITY

ACRONYMNS

AFOs	Animal Feeding Operations
AWWA	American Water Works Association
ASDWA	Association of State Drinking Water Administrators
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
BEACH	Beaches Environmental Assessment and Coastal Health Act
BMPs	Best Management Practices
CAFOs	Concentrated Animal Feeding Operations
CBO	Congressional Budget Office
CALM	Consolidated Assessment and Listing Methodology
CPP	Continuing Planning Process
CSO	Combined Sewer Overflows
CWA	Clean Water Act (Federal Water Pollution Control Act)
CWNS	Clean Water Needs Survey
CWSRF	Clean Water State Revolving Fund
CWSS	Community Water Systems Survey
CZMA	Coastal Zone Management Act
DOI	United States Department of the Interior
DWINS	Drinking Water Infrastructure Needs Survey
ECOS	Environmental Council of the States
EPA	United States Environmental Protection Agency
FTE	Full Time Equivalent employee
GIS	Geographic Information Systems
FWPCA	Federal Water Pollution Control Act
NADN	National Air Deposition Network
NASBO	National Association of State Budget Officers
NCMA	National Coastal Monitoring Act
NGA	National Governors Association
NGOs	Non-governmental Organizations
NOV	Notice of Violation
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NRI	National Resource Inventory
PCS	Permit Compliance Systems
POTWs	Publicly Owned Treatment Works
PPA	Performance Partnership Agreement
PPG	Performance Partnership Grant
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan
QMP	Quality Management Plan
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SPGP	State Programmatic General Permit
SSOs	Storm Sewer Overflows
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
WIN	Water Infrastructure Network
WQMP	Water Quality Management Plan

EXECUTIVE SUMMARY

The scope of water quality programs has grown tremendously since the Clean Water Act (CWA) was first enacted in 1972. But federal funding to the states—which are responsible for most of the day-to-day implementation of these programs—has not kept pace. While it has been widely recognized that state water programs lacked sufficient resources to carry out their responsibilities, the size of the funding gap has been unknown.

In 1998, experienced water program officials formed a State Task Force and began collaborating with the U.S. Environmental Protection Agency (EPA) on the Water Quality Management Resource Analysis (Resource Analysis) project. They designed the Resource Analysis project to develop a common framework for collecting information about state water programs that would produce a reasonable estimate of the gap between the resources states need and the resources currently available to them for implementing water quality programs under the Clean Water Act.

Through a survey of state expenditures, the State Task Force collected information from states on what they are currently spending for water quality programs. To enable states to estimate the resources they would need to implement the various elements of the Clean Water Act, the Task Force developed an extensive workload model (Needs Model). Using this new tool, states made systematic projections of their workloads and costs for fully implementing water programs. Because not all states submitted data, the Task Force used various estimation techniques to calculate estimates for the missing states, then combined these estimates with the submitted state data to develop the national estimates. Based on these data, the Task Force concluded that the gap between the funding states now have and what they need to fully implement Clean Water Act programs is between $735 million to $960 million.

EPA has asked the National Academy of Public Administration (the Academy) to review the methodologies and techniques used in the Resource Analysis project and determine whether they produced a reasonable estimate of the national funding gap for state water programs. Based on its examination of the State Expenditures Survey, the Needs Model, and the estimation techniques used by the Task Force, the Panel concludes that between $0.7 billion and $1.0 billion (after rounding to significant digits) is a sound national estimate of the gap between the resources states now have and what they would need to fully implement water programs. The Panel further concludes that this national estimate is probably low because it does not include the costs of new and expanding water programs and may also underestimate the costs of state employees.

The Panel commends the states and EPA for undertaking the challenge of creating the Needs Model to produce more reliable estimates of state workloads for implementing water programs and their associated costs. This new workload model can be used to project future resource needs on a nationwide basis, help states plan and manage their water programs, and facilitate state sharing of practices to make their water programs more efficient and cost-effective. The success of this effort demonstrates the value of collaboration and constructive communication between EPA and the states.

The Panel's findings and recommendations in this report fall into three general categories.

1. Fostering Collaboration and a Culture of Learning

Through the Resource Analysis project, EPA and the states have created an atmosphere of collaboration and shared learning that can lead to more effective protection of water quality. EPA and the states should build on this success and continue working together to develop joint strategies for filling the gaps in water program funding, as well as to collect information about the workloads and resource needs of state water programs on a routine basis.

2. Fine-Tuning Tools and Methodologies for Estimating Resource Needs

The Resource Analysis project has produced a reasonable national estimate of the gap between the resources states now have and what they need to implement their water programs. This project calculated that the national resource gap for managing state water ranges between $0.7 billion and $1.0 billion.

The states and EPA can use these estimates from the Resource Analysis project without hesitation. To improve the reliability of future estimates, the Panel recommends fine-tuning the project's data collection tools and estimation methodologies. In particular, using actual state data for just two items -- the fully-loaded cost of a state employee and the number of hours in a state's work year -- would greatly increase the accuracy of the Needs Model. These and other changes also would make it easier for more states to fill out the workload model and calculate their current program expenditures. However, all of these technical changes together will probably produce only minor changes in the estimate of national water program resource needs.

3. Improving the Effectiveness of Water Programs

State and EPA investments in obtaining better information about the conditions of water bodies, sources of water pollution, and the results of water programs will build a more persuasive case for Congress and state legislatures to appropriate additional resources or enact program reforms. They will also help states to identify and share the most effective practices for managing water quality programs.

COMPLETE FINDINGS AND RECOMMENDATIONS

Findings on Fostering Collaboration and a Culture of Learning

Finding 1-1: The Resource Analysis project represents an important step in building a constructive working relationship between EPA and the states. It has set the stage for greater collaboration and a culture of continued learning that can produce more effective water quality programs.

Finding 1-2: The Resource Analysis project has produced a reasonable estimate of the national funding gap between the resources that states need to implement adequate water quality programs and what they currently spend. If anything, the Panel believes it understates the actual funding gap.

Finding 1-3: The Resource Analysis project provided a neutral ground for collaboration between EPA and states and has launched a constructive dialogue on improving state water quality programs.

Finding 1-4: The State Task Force has developed a tool that can be used nationally to develop an estimate of resources needed for water quality programs, as well as by individual states for their own planning, budgeting, management, and other purposes.

Finding 1-5: In conducting the Resource Analysis project, the State Task Force had to adjust for some data limitations and strike a balance between the desire to obtain precise data versus the desire to achieve maximum state participation.

Finding 1-6: States that chose not to participate in the Resource Analysis project did so due to concerns about confidentiality or because they perceived the data requests to be too burdensome.

Finding 1-7: With the Resource Analysis project, states and EPA have a powerful new tool that can help them to explain and build support for water quality programs. But to be persuasive, their analysis must show how meeting their additional funding needs will lead to improvements in environmental results.

Recommendations on Fostering Collaboration and a Culture of Learning

Recommendation 1-1: The Panel commends the states and EPA for working together to develop procedures and tools to:

- Identify what levels of state staffing and other program costs are involved in implementing the Clean Water Act;
- Determine what resources are needed to fund these activities at both the national and state levels;
- Devise approaches that encourage shared learning about how to increase EPA and state program effectiveness and use resources more efficiently; and
- Create incentives and a culture of continued EPA and state collaboration and learning on how to improve water program implementation.

Recommendation 1-2: States and EPA should carry out a joint educational effort to explain to Congress, state legislatures, and other stakeholders about the national resource gap and its implications for achieving water quality goals. In addition, each state should consider developing a strategy to educate its local constituencies about the impacts of the resource gap in each state.

Recommendation 1-3: States and EPA should continue to collect and analyze information on state resource needs on a routine basis. They should make improvements over time in their Expenditures Survey and Needs Model so they can increase the reliability and usefulness of the data they collect.

Recommendation 1-4: The states and EPA should simplify the Needs Model and address concerns about confidentiality so more states will use the Model, thereby increasing its value and the reliability of its estimates.

Findings on Fine-Tuning Resource Analysis Tools and Methodologies

Finding 2-1: The State Task Force met its dual goals for analyzing water resource needs:

- Producing a reasonable national estimate of the gap between current state expenditures and what states need to adequately implement the Clean Water Act; and

- Developing a tool for estimating resource needs that individual states would find useful for their own planning, budgeting, and other purposes.

Finding 2-2: States and EPA can build on this first effort to fine-tune the data collection tools, increase state participation, and make future estimates even more reliable.

Specific Findings on the State Expenditures Survey

Finding 2-3: Based on data provided by state budget and water program officials, the State Expenditures Survey produced a reasonable estimate of current state funding levels for water quality management programs.

Finding 2-4: Beyond the information provided by state agency and budget officials for the survey, the Panel found no other reliable sources of data on state expenditures for managing water quality programs.

Finding 2-5: Because the activity and program categories in the State Expenditures Survey and Needs Model are not the same, it is not possible to make direct comparisons between current state expenditures and resource needs below the aggregate level.

Finding 2-6: Nationally aggregated data mask the wide variability among states in the relative shares that state general revenues, federal grants, state permit fees, and other state sources contribute to each state's total funding.

Specific Findings on the Needs Model

Finding 2-7: The Needs Model provides a comprehensive and systematic tool for estimating the workloads and costs involved in implementing state water quality programs and can be modified easily as program elements change or expand.

Finding 2-8: The conceptual framework of the Needs Model is simple, and its modular structure accommodates variations in how state water programs are organized.

Finding 2-9: Future refinements to the Needs Model could make it clearer, easier to complete, and more accurate. However, most of these refinements would have virtually no impact on the total estimate of state or national resource needs.

Finding 2-10: The primary drivers for the Needs Model are the fully-loaded cost of a state employee and the number of work hours in a state's work year. Increasing the accuracy of these data would increase the accuracy of the national resource needs estimate.

Finding 2-11: In the Needs Model, the number of point sources of water pollution drives about one-fourth of the workload for implementing water programs. If actual state inventory data were used for all states rather than default values, the accuracy of the national needs estimate would be slightly improved.

Finding 2-12: Future changes in the Needs Model should focus on modules that cover newer programs, such as Total Maximum Daily Loads (TMDLs), nonpoint sources, and some aspects of the wetlands program, because that is where resource needs are most likely to grow.

Finding 2-13: Fine-tuning some of the defaults in the Needs Model could help states develop more accurate estimates of their own resource needs, as well as improve the national estimates.

Finding 2-14: It is not clear to what extent the Clean Water Act implementation costs for state agencies other than environmental departments were included in the estimates of state expenditures and resource needs for water quality programs. Not including information from other agencies would provide an incomplete picture of state expenditures and costs for water quality programs.

Specific Findings on Estimation Methodologies

Finding 2-15: To appreciate the methodologies in their proper context, it is important to understand the overall data quality objective of the Resource Analysis project was to develop a reasonable estimate of -- not a precise number for -- the national resource gap.

Finding 2-16: The State Task Force considered it reasonable to assume that the average values derived from the data submitted by states were representative of a "typical" state and could be used to calculate the numbers for missing states.

Finding 2-17: The national estimate of resource needs lies somewhere between $1.3 billion and $1.7 billion, and a reasonable single value to use is $1.5 billion; the estimated gap between current expenditures and resource needs ranges from $0.7 billion to $1 billion.

Finding 2-18: Task Force methodologies and the reasons behind them should be clearly presented in future reports and other documentation for the Resource Analysis project.

Finding 2-19: While not directly comparable, the methodologies used in other studies on water infrastructure may provide information useful to the State Task Force in refining the Needs Model for use in future estimates of resources needed to manage water programs.

Finding 2-20: The presentation and technical problems in the *Interim Report* short-change the extraordinary effort and potential value of the Resource Analysis project.

Recommendations on Fine-Tuning Resource Analysis Tools and Methodologies

Recommendation 2-1: The State Task Force has developed and used data collection tools and methodologies that produce reasonable estimates of state expenditures, resource needs, and the gap between them and, although some refinements are possible, they would not significantly affect the ultimate calculation of the resource gap for managing state water programs.

Recommendation 2-2: Categories in the State Expenditures Survey and Needs Model should be refined so they match each other, and states should be encouraged to complete the two data collection tools at the same time.

Recommendation 2-3: Nationally aggregated estimates tend to mask some important information that could help decision-makers, so the Task Force should consider summarizing and reporting selected data for various elements of state water programs and provide contextual information for key state data, such as employee salaries and number of regulated facilities.

Recommendation 2-4: The State Task Force could enhance the reliability of the estimated national resource gap by using the same methods for non-reporting states in estimating both resource needs and current expenditures.

Recommendation 2-5: Although the Needs Model already produces sound estimates of national and state resource needs, the State Task Force should consider refining the Model to increase its accuracy for future estimates, encourage more states to participate, and streamline data collection.

Recommendation 2-6: The State Task Force should try to acquire more accurate data on the fully-loaded costs of state water program employees and the number of hours in a state's work year. These values are drivers for the entire Needs Model, and the default values probably underestimate states' employee costs.

Recommendation 2-7: The State Task Force should consider making other technical refinements to the Needs Model that would result in incremental improvements in the accuracy of its estimates, such as:

a. Revising specific default values in light of information obtained from states in the initial round of the Resource Analysis project,

b. Revising default values to align with actual state adoption of particular programs, and

c. Revising the Needs Model on an ongoing basis as state workloads increase for rapidly developing programs.

Recommendation 2-8: The Task Force should consider collecting information regarding the coverage of each state's water quality programs as well as the agencies involved in completing the Needs Model.

Recommendation 2-9: Because the credibility of the Task Force could be questioned due to minor technical problems in its *Interim Report*, EPA and the states should consider preparing a revised summary of the Task Force's conclusions.

Findings on Improving the Effectiveness of Water Programs

Finding 3-1: By moving forward to address the gap between resource needs and current expenditures for state water programs, the states and EPA have an important opportunity to improve the effectiveness of these programs.

Finding 3-2: There are opportunities for states to accomplish their water program workloads by adopting strategies that will produce greater efficiencies and, at the same time, enhance water quality.

Finding 3-3: A lack of information about actual environmental conditions -- including information about water quality and sources of water pollution -- has been a major obstacle to improving the effectiveness of state water quality programs. Investments in better environmental information, even though difficult given states' current financial conditions, can produce future benefits by helping states make more effective use of the limited resources they have.

Finding 3-4: The growing emphasis on performance-based management by government agencies at all levels gives added importance to building better state-EPA partnerships that are based on a common understanding of current environmental conditions. With improved data on the environment and sources of pollution, EPA and states can set priorities together and target shared resources to address major water pollution problems.

Finding 3-5: There are wide variations in the sources and levels of funding for state water programs, so no single approach to solving state funding problems can be applied nationally. There are opportunities for states to tap other sources of funding or support through sharing their workloads with other agencies, cooperating to achieve economies of scale among states, or working with EPA to provide federal services that will enhance water quality nationwide.

Recommendations on Improving the Effectiveness of Water Programs

Recommendation 3-1: All states should look for opportunities to adopt more cost-effective and efficient practices that will accomplish the goals of their water programs by reducing redundancies, eliminating duplication of efforts, promoting resource sharing, and enhancing collaboration.

Recommendation 3-2: EPA should actively help states learn from one another about ways they can improve their environmental data systems. Specifically, EPA should share information about cost-effective methods for collecting information; conduct or fund research on emerging technologies that may help states to monitor environmental conditions more easily; and deploy new methods for measuring environmental results that can be used by many states.

Recommendation 3-3: States should work through national associations, such as the Environmental Council of the States (ECOS) and Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), to establish effective mechanisms for sharing best practices and techniques for managing water programs more efficiently.

Recommendation 3-4: States should also be prepared to make substantial investments in improving their environmental data systems and installing advanced information technologies, such as remote sensing and geographic information systems (GIS), that will enhance the collection and analysis of water quality data so they can ultimately reduce the costs of managing their water programs by focusing their efforts on the most important water pollution problems.

Recommendation 3-5: States and EPA should work in partnership to implement performance-based management and build their collective capacity to prioritize water pollution problems, target shared strategies to address those problems, use better data to evaluate their progress, and modify their joint initiatives, where needed, to produce more effective results as measured by water quality outcomes.

Recommendation 3-6: The State Task Force should work with EPA to involve additional state and federal agencies in developing a comprehensive strategy for coordinating any additional sources of state, federal, or local funding for water programs and to ensure that all investments of currently available funding are focused on activities that will improve the states' ability to enhance and protect water quality.

PART I

INTRODUCTION

BACKGROUND

The scope and complexity of our nation's programs to protect water quality have grown tremendously since the Clean Water Act (CWA)[1] was passed in 1972. What began 30 years ago as essentially a permitting system to control water pollution from a few thousand facilities, or "point sources," has expanded into a multi-faceted endeavor now addressing pollution from hundreds of thousands of sources, both point and "nonpoint." Examples of today's water pollution challenges are agricultural runoff, combined sewer overflows, and animal feedlots.

Not surprisingly, with increasing scope and complexity have come concerns about the adequacy of funding for managing the nation's water quality programs. This concern is the greatest among the states -- which under the Clean Water Act have been delegated primary responsibility for the day-to-day operation of programs to protect water quality.

Past studies and anecdotal information suggested that states have significant unmet resource needs, but the actual size of the funding gap was unknown. In 1998, the states and EPA launched the State Water Quality Management Resource Analysis (Resource Analysis) project to develop a reliable estimate of the gap between the total resources states now have and what they need to manage adequate water quality programs. This was the first project to focus on the costs state governments face in carrying out their water program *management* responsibilities, as distinguished from the more often studied costs of *infrastructure* for drinking water and wastewater treatment. (In 1998, EPA also launched a separate effort to develop updated estimates of the gap in infrastructure funding -- the Clean Water and Drinking Water Infrastructure Gap Analysis.[2])

To conduct their Resource Analysis project for water program management, states and EPA developed new tools for determining current state expenditures and for estimating staff workloads and costs for implementing adequate water quality programs under the Clean Water Act. With these tools, they have estimated for the first time what states are spending, what they need to spend, and the gap between the two.

Their comprehensive study using these tools resulted in the following estimates:

- Total current state expenditures for water quality programs are somewhere between $722 million and $805 million.

- Projected state resource needs are between $1.5 billion and $1.7 billion.

- The national funding gap is between $735 million and $960 million.[3]

The Purpose of this Report

Would potential users of this information deem these estimates credible? EPA and states brought this important question to the National Academy of Public Administration (the Academy) in 2002 when they asked for an independent review of their Resource Analysis project. Specifically, they asked the Academy to:

- Conduct an independent, critical review of the development and execution of the State Expenditures Survey and Needs Model,

- Assess the validity of the Resource Analysis and conclusions presented in the *Interim Report* on the results of the project,

- Make recommendations for improving the overall implementation and execution of future state expenditures surveys and resource need assessments, and

- Suggest possible alternative methodologies that could improve the reliability of state need estimates and calculations of state expenditures and resource needs.

The results from the Academy's review of the State Water Quality Management Resource Analysis project is the subject of this report.

AN OVERVIEW OF THE RESOURCE ANALYSIS

A State Task Force comprised of experienced state water officials led the Resource Analysis project. Its goals were to answer three questions:

- What are states currently spending to manage water quality programs?
- What resources would states need to manage these programs adequately?
- If there is a funding gap, how can it be reduced?

The project had two phases. The first phase could be characterized as a "quick and dirty" effort to collect information about the resource gap by conducting site visits and interviews with water program and budget officials in 14 states. Using common definitions and assumptions, the Task Force asked these state officials to estimate the funding gap for their water quality management programs in each of their states. Based on data from these states, the Task Force then extrapolated a value for the remaining 36 states using a linear regression methodology. These calculations produced an estimated national funding gap of about $600 million.

After these preliminary findings, the Task Force undertook a second phase to collect information more systematically from all 50 states. They developed two new tools for collecting the second round of data:

- A **State Expenditures Survey** to collect information about each state's actual expenditures for water quality programs, and

- A **Water Quality Management Resource Analysis Model** (Needs Model) to estimate the resources needed by each state to manage an adequate water quality program.

Individual states submitted data for the State Expenditures Survey and Needs Model. The Task Force compiled the data and used statistical techniques to extrapolate values for the states that did not provide data. The actual state data and extrapolated values were added together to develop national estimates for total state expenditures and total state resource needs. The national estimate of the state funding gap is the difference between total state expenditures and total state resource needs.

As part of this data collection effort, the Task Force also asked states to provide information about successful efforts to streamline or otherwise improve the efficiency of their water quality programs.

Project Organization

The Task Force of state water program experts led the design and implementation of the Resource Analysis project. EPA's Office of Water arranged for the Cadmus Group to provide logistical and analytic support, while EPA's Headquarters and Regional offices provided technical assistance. Several national and regional organizations participated in the project as well, including the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA),[4] the Environmental Council of the States (ECOS),[5] the Association of State Wetlands Managers,[6] the Coastal States Organization,[7] the Water Environmental Federation,[8] the Northeast Interstate Water Pollution Control Commission,[9] and the National Association of State Budget Officials (NASBO).[10]

Interim Results

The Task Force presented the results of its second round of data collection in an April 2002 report entitled *State Water Quality Management Resource Analysis - Interim Report on Results (Interim Report)*. In addition to describing the methodologies used to develop the estimates of state expenditures, resource needs, and the gap between them, the *Interim Report* also contained Task Force recommendations for various approaches to reduce the resource gap.

EPA and state officials view this *Interim Report* as a first step towards preparing more definitive estimates of state resource needs and the funding gap for managing water programs. They plan to continue refining both the State Expenditures Survey and the Needs Model and hope to increase the number of states that participate in future efforts.

SCOPE AND METHODOLOGY OF THE ACADEMY REVIEW

The Academy appointed a three-member Panel to direct and oversee the independent review of the Resource Analysis project. The Panel included Academy Fellows and state officials with long experience in designing, managing, and evaluating environmental programs. Brief biographies of the Panel and project staff are provided in Appendix H.

In carrying out this review, the Panel actively directed the work of the Academy research team, reviewed the research results, participated in the analysis, and developed the findings and recommendations of this report. The Panel met twice, heard presentations by members of the State Task Force, and held several conference calls between August and December 2002.

Study Methodology

For this project, Academy researchers have:

- Reviewed the *Interim Report* and its documentation of estimates and other project results;
- Examined the methodologies and calculations of the State Task Force to produce national estimates;
- Carefully examined the Needs Model by reviewing the coverage, assumptions, basis for default values and how these values were used, as well as reviewing the documentation to accompany each component of the Needs Model;
- Analyzed the actual data submitted for the Needs Model by 19 states, with state names omitted so researchers could not tie data to any specific state;
- Reviewed the State Expenditures Survey instrument and summary of state responses;
- Conducted meetings and in-depth interviews with members of the State Task Force, other state water program managers, and others who had principal roles in the development of the Needs Model and Expenditures Survey; and
- Researched other government reports and documents related to the costs and expenditures for state water quality program and state environmental programs, including the future costs of water infrastructure.

During this review, the Academy researchers maintained contact with leaders of the State Task Force, EPA managers in the Office of Water, and key officials of the Cadmus Group who provided logistical and statistical support for the Resource Analysis project. On October 15, 2002, the Academy provided an informal report to EPA's Office of Water containing the Panel's preliminary findings and recommendations about the estimates produced by the Needs Model.

This final report by the Panel analyzes the State Expenditures Survey and Needs Model and contains the Panel's complete findings and recommendations on all aspects of the Resource Analysis project.

Appendices A through G contain the detailed results of the Academy research team's examination of the Resource Analysis project and provide the technical basis for the Panel's final findings and recommendations.

ENDNOTES

[1] *Federal Water Pollution Control Act* (commonly known as the Clean Water Act) 33 U.S.C. Section 1251 et seq. (1977).

[2] U.S. EPA Office of Water*, The Clean Water and Drinking Water Infrastructure Gap Analysis* EPA-816-R-02-020 (Washington D.C.: September 2002). Available at http://www.epa.gov/owm/gapreport.pdf.

[3] State Water Quality Management Resource Analysis Task Force, *State Water Quality Management Resource Analysis--Interim Report on Results* (Washington D.C.: April 1, 2002).

[4] The Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) is an independent, nonpartisan organization of state and interstate water program managers. ASIWPCA members implement surface and groundwater quality management programs. For more information, go to: http://www.asiwpca.org.

[5] The Environmental Council of the States (ECOS) is the national non-profit, non-partisan association of state and territorial environmental commissioners. For more information go to: http://www.sso.org/ecos/.

[6] The Association of State Wetland Managers is a nonprofit membership organization established to promote and enhance protection and management of wetland resources, promote application of sound science to wetland management efforts, and provide training and education. For more information go to: http://www.aswm.org.

[7] The Coastal States Organization (CSO) represents the governors of United States coastal states, territories, and commonwealths as an advocate for improved management of the nation's coasts, oceans, and Great Lakes. For more information go to: http://www.sso.org/cso/.

[8]The Water Environment Federation (WEF) is a not-for-profit technical and educational organization that includes water quality professionals from 79 member associations in 32 countries. For more information go to: http:///www.wef.org.

[9] The New England Interstate Water Pollution Control Commission (NEIWPCC) was established to create water quality standards and classifications for interstate waters in the New England-New York area. Compact-member states are Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island, and Vermont. For more information go to: http://neiwpcc.org.

[10] The National Association of State Budget Officers (NASBO) is professional membership organization for state finance officers. Through NASBO, states collectively advance state budget practices. For more information go to: http://www.nasbo.org.

PART II

FINDINGS AND RECOMMENDATIONS

1. FOSTERING COLLABORATION AND A CULTURE OF LEARNING

Finding 1-1:

The Resource Analysis project represents an important step in building a constructive working relationship between EPA and the states. It has set the stage for greater collaboration and a culture of continued learning that can produce more effective water quality programs.

For the foreseeable future, federal and state budgets for environmental programs are likely to remain seriously constrained. Many states are already experiencing budget cuts, and more cuts are anticipated. Meanwhile, the level of federal funding is becoming less certain as demands on national resources increase due to concerns about homeland security and national defense. This reality provides the backdrop for the Panel's consideration of the Resource Analysis project, and makes it all the more important for EPA and states to continue working together to make the best possible investments in activities that will improve and protect water quality.

There has been a general concern for many years that state resources for managing water quality programs are insufficient to meet all of the requirements of the Clean Water Act (CWA). However, the size of the funding gap has been unknown. Through a systematic approach to collecting and analyzing state data, the State Task Force has produced a reasonable national estimate of the gap between the resources states need to implement adequate water quality programs and the funds they currently have for these purposes. With this information, states, EPA, Congress, state legislatures, and other interested parties can now begin discussions about how to reduce the gap and find ways to make the most effective use of limited resources to protect water quality.

The groundbreaking effort of the Task Force to build a detailed workload model -- the Water Quality Management Resource Analysis Model (Needs Model) -- has already had positive benefits by increasing state and EPA understanding about the scope and complexity of water quality programs and the actual work involved in their implementation. In addition to providing a basis for estimating resource needs at the national level, the Needs Model can be used by individual states to plan and manage their own water programs, support budget requests, calculate the impact of proposed changes in state budgets, and assess any additional workloads associated with new regulatory requirements. One of the most promising potential uses for data collected through the Needs Model will be benchmarking and identifying best practices so states can share information about how to make their programs more efficient and effective.

Finding 1-2:

The Resource Analysis project has produced a reasonable estimate of the national funding gap between the resources that states need to implement adequate water quality programs and what they currently spend. If anything, the Panel believes it understates the actual funding gap.

Using the first round of data collected by the Task Force, the national estimate of the current funding gap between state resource needs and current expenditures is between $735 and $960 million. After analyzing the states' methodologies and data, the Panel finds that this estimate is reasonable. If anything, it probably underestimates actual needs. The Panel believes this for two major reasons. First, the Needs Model most likely underestimates the amount of state work involved in implementing newer and expanding water programs such as controlling nonpoint sources, establishing Total Maximum Daily Loads (TMDLs), and managing storm water runoff. Second, other studies suggest that the Needs Model's estimates of fully-loaded state employee costs -- which drive the Model's costs -- are too low.

The Panel does have questions about some aspects of some choices connected with calculating the national estimates for state expenditures, resource needs, and the gap between them. These are discussed in detail in Part II, Section 2 below, along with specific recommendations for how to remedy these problems. However -- and this is an important however -- the Panel believes correcting these problems will not have a significant effect on the estimated range of the national funding gap, presently on the order of $0.7 billion to $1.0 billion, after rounding to significant digits. Having said this, though, the Panel does believe that by correcting the estimation methodology, EPA and states can more easily explain and defend their results.

Finding 1-3:

The Resource Analysis project has provided a neutral ground for collaboration between EPA and states and has launched a constructive dialogue on improving state water quality programs.

While EPA and the states have worked together on water quality programs for several decades now, relationships have sometimes been strained. Concerns about increasing national program requirements, limited federal funding, and EPA oversight have created tensions on both sides. The issue of adequate federal government funding for states has been particularly prickly, often making it difficult for EPA and states to discuss state water program needs constructively.

While conducting the Resource Analysis project, State Task Force members set aside the question of "who should pay" to focus on preparing an unbiased estimate of how much it would cost to implement an adequate state water program. By doing so, they established a neutral ground for discussing states' actual workloads for managing their water quality programs. Separating the question of who pays from what the costs are was essential to the success of the Resource Analysis project. By creating a common vocabulary and understanding of what it actually takes in staff and other resources to implement the Clean Water Act, the Needs Model

provides states and EPA with a neutral basis for discussing how to improve water quality programs.

An extensive collaborative process was used to develop the Needs Model. This process ensured the Model represented the best professional judgment of water officials in state agencies and EPA. It also allowed the Task Force to draw on more than 20 years of field experience in implementing Clean Water Act programs. A series of focus groups and working sessions, held over a period of many months, drew participants from 38 states, while EPA experts for each element of the water program provided technical information and advice. EPA's contractor, the Cadmus Group, provided logistical and analytic support for the project. To ensure that the Needs Model reflected the perspectives of all states, the Task Force circulated drafts of the Model, along with its assumptions and default values, to all 50 states for review and comment.

The cooperative spirit evidenced during the Resource Analysis project sets a positive precedent for future state-EPA relations. By working together to understand the workloads and tasks involved in protecting water quality, as well as their related costs, states and EPA have succeeded in opening a constructive dialogue that can produce more efficient and effective water programs.

Finding 1-4:

The State Task Force has developed a tool that can be used nationally to develop an estimate of resources needed for water quality programs, as well as by individual states for their own planning, budgeting, management, and other purposes.

The Task Force recognized that more states would be likely to contribute data if they could see some potential value for themselves. They wanted to create a tool that would not only calculate an estimate of the national resource gap, but would also be useful to individual states for developing budgets, planning future work, and other purposes.

Some states that participated in the Resource Analysis project have already made effective use of the project's results at the state level. One state has successfully used its Needs Model data on the actual costs of issuing a water permit to persuade its state legislature to raise permit fees. Another state reallocated its staff after it found greater resource gaps in some program areas than in others. Other states have used the Needs Model to estimate the impacts of anticipated budget reductions, and still others used the results to educate public interest groups about the water program and its resource needs.

Finding 1-5:

In conducting the Resource Analysis project, the State Task Force had to adjust for some data limitations and strike a balance between the desire to obtain precise data versus the desire to achieve maximum state participation.

From the outset, the Task Force recognized there would be problems in terms of the availability and quality of state data. They deliberately set a modest goal of developing an estimated range

for the size of the resource gap rather than trying to develop a precise number. They also attempted to find a balance between satisfying the need for detailed data and minimizing the burden on states to provide data, striking a compromise between participation and precision. They assumed that, if more information were required from states, fewer states would participate and, with fewer states providing data, the national estimates would be less reliable.

Several key considerations affected the design of the Needs Model, the major new tool developed by the Task Force. They especially wanted to develop a tool that would provide information for two purposes: (1) estimating any resource gap at the national level and (2) estimating workload and resource needs at the state level that an individual state can use for their own planning and budgeting purposes.

The Needs Model focuses on the workload and costs associated with implementing the Clean Water Act in order to calculate a national estimate of resource needs. However, many states have water quality programs that extend beyond what is required by the Clean Water Act, and the Task Force wanted to develop estimates for total state program resource needs. The Needs Model allows states to include information about elements beyond the Clean Water Act, but these state-specific costs are excluded from the national estimates of resource needs.

The modular design of the Needs Model accommodates different state program structures. It does this by dividing water program activities into 14 "modules" that represent typical categories of state functions, including cross-cutting activities such as monitoring and data management. While the modules do not line up exactly with CWA programs or with state budgeting and accounting systems, the approach provides a common frame of reference that all states can use and that is applicable to most state water quality programs.

It is important to note that the Needs Model is prospective; it asks states to *project* what it would cost if they were to fully implement an adequate water quality program. The Task Force chose the standard of "adequate" for the states to use in projecting their resource needs, recognizing that any standard would necessarily be somewhat subjective. The Model's guidance on what constitutes an adequate program varies with each module. Generally, however, modules covering program elements that have been operating the longest or have more clearly defined requirements have the most specific instructions.

Having only limited information on many aspects of the Needs Model, the Task Force solicited expert judgments from experienced state and EPA program managers to help them develop the 14 modules, default values, and other workload elements of the Model. They considered using national information sources as the basis for default values on the size of the regulated universe (such as the EPA database for major water permits) but ended up rejecting them because they were considered to be too unreliable.[1]

The Needs Model focuses on the costs of managing and implementing water quality programs at the state level. For the most part, these costs are borne by the state water quality divisions, which are usually part of each state's environmental agency or equivalent. In some cases, however, program responsibilities reside in other state agencies as well, such as agriculture or natural resources, or are carried out by local governments. The Needs Model is designed to

include costs of all involved state agencies, but does not capture the costs of water quality management borne by local governments.

The Task Force erred on the conservative side in constructing the Needs Model. To do so, they took care to minimize the potential for double-counting of activities and costs that could fall under more than one of the 14 modules. They also based the default values on information from states that have solidly adequate -- but not necessarily the best -- water quality programs.

Finding 1-6:

States that chose not to participate in the Resource Analysis project did so due to concerns about confidentiality or because they perceived the data requests to be too burdensome.

Despite the Task Force's best efforts to inform states about the project and provide training and technical assistance, less than half of the states (22) completed the Needs Model, while three-quarters of the states (37) provided data for the State Expenditures Survey.

According to Task Force leaders, many state officials were reluctant to participate in the project for fear of having their workloads and needs estimates made public. Some worried EPA would use the data for oversight purposes; others were concerned that public release of information about the gap between needs and resources could be used for political purposes. [2] To address these concerns, the Task Force agreed to report only aggregated data and took steps to ensure each state's data would be kept confidential unless a state specifically authorized their release.

Higher state participation in the Expenditures Survey can be explained in several ways. State budgets and expenditures are public information, and state officials are accustomed to providing such information to their legislatures and governors. While the categories of expenditures in the Survey were not necessarily aligned with how individual states keep their records, state staff who completed the Survey told Academy researchers they had no difficulty in pulling together the necessary information. In addition, there had been several earlier national efforts to collect information about state environmental spending, so states were not breaking new ground by making these data public.[3]

The Needs Model, in contrast, was something entirely new for states. Completing it was lengthy and complex, and some states may have decided they could not devote staff time to filling it out. Confidentiality concerns were also significant. In fact, some states that were leaders in the Resource Analysis project initially completed the Model, but did not submit their data for inclusion in the national estimates because of their concerns about confidentiality.

The Panel heard anecdotal evidence that the Task Force's outreach efforts to solicit state participation in the project did not always reach the top executives in state environmental agencies, or at least not in a way that caught their interest. [4] Some correspondence was addressed to the state environmental commissioners, and some commissioners were directly involved in the decision about whether to submit data. When the Task Force made follow-up contacts at lower levels in state agencies, these staff were sometimes reluctant to participate.

One former state commissioner, who normally supports participation in national efforts of this kind, expressed surprise that his state had not provided data for the Needs Model.

It is understandable that some states were unwilling to have their data made public or reported in a way that would allow comparisons between states. However, not having data below the national level may create a barrier to realizing one of the most promising benefits of the Needs Model: allowing states to benchmark and learn from each other about how to manage their water quality programs more effectively. Further, nationally aggregated data may not present the most compelling case for additional CWA funding because there is no way to determine where the resource gaps are greatest, either by specific program areas or by individual states.

Finding 1-7:

With the Resource Analysis project, states and EPA have a powerful new tool that can help them to explain and build support for water quality programs. But, to be persuasive, their analysis must show how meeting their additional funding needs will lead to improvements in environmental results.

Using the information generated through this project, states and EPA are now positioned to work as a team with Congress, the Executive Branch, state legislatures, the regulated community, and the public to seek additional funding for water quality programs. The Needs Model provides a tool to explain the amounts and kinds of work involved in issuing permits, taking enforcement actions, monitoring water quality, and performing a host of other activities associated with implementing water quality programs. Better public understanding of what is involved in implementing water quality programs may foster more realistic expectations of what can be accomplished with the resources available, encourage greater stakeholder involvement in setting priorities, and lead to better environmental results.

The Needs Model may be especially useful for states in working with Congress, state legislatures, and EPA to project the implications of changes in resources or program requirements. While states often provide comments on proposed national requirements, using the Needs Model as the basis for workload and cost estimates could help them to be especially persuasive. Further, as states learn more from each other about program efficiencies, they can apply these lessons when they design their approaches for implementing new requirements.

Armed with information about their actual workloads, states and EPA can set more realistic expectations about what can be accomplished, and focus limited resources where they are most needed to meet water quality goals. The information gathered through this project, including the Task Force's anecdotes and examples in the appendices to the Interim Report, also can help to identify state program elements that can be used for benchmarking or other efforts to improve efficiency in managing water quality programs.

However, the Panel believes that cost and workload information alone will not be enough for states and EPA to make the case for additional resources or program reforms. To be persuasive, states also will need to explain how their current efforts are affecting water quality and what impacts they would expect under different funding scenarios.

RECOMMENDATIONS ON
FOSTERING COLLATORATION AND A CULTURE OF LEARNING

Recommendation 1-1:

The Panel commends the states and EPA for working together to develop procedures and tools to:

- **Identify what levels of state staffing and other program costs are involved in implementing the Clean Water Act;**

- **Determine what resources are needed to fund these activities at both the national and state levels;**

- **Devise approaches that encourage shared learning about how to increase EPA and state program effectiveness and use resources more efficiently; and**

- **Create incentives and a culture of continued EPA and state collaboration and learning on how to improve water program implementation.**

Recommendation 1-2:

States and EPA should carry out a joint educational effort to explain to Congress, state legislatures, and other stakeholders about the national resource gap and its implications for achieving water quality goals. In addition, each state should consider developing a strategy to educate its local constituencies about the impacts of a resource gap in each state.

Recommendation 1-3:

States and EPA should continue to collect and analyze information on state resource needs on a routine basis, and they should make improvements over time in their Expenditures Survey and Needs Model so they can increase the reliability and usefulness of the data they collect.

They should improve the data collection tools to accomplish the following:

- Align the categories in the Expenditures Survey with the categories in the Needs Model;

- Focus refinements of the Needs Model on the limited number of newer program areas where substantial workload changes are likely;

- Modify default values where actual data submitted by states suggests that the defaults are significantly different from states' actual workload estimates; and

- Streamline the Needs Model to eliminate some levels of detail that add only marginal improvements in national or state estimates.

***Note**: Part II, Section 2 contains the Panel's specific findings and recommendations for refining the State Expenditures Survey, Needs Model, and estimation methodologies.*

Recommendation 1-4:

The states and EPA should simplify the Needs Model and address concerns about confidentiality so more states will use the Model, thereby increasing its value and the reliability of its estimates.

To encourage more state participation in the next round of data collection, the Panel recommends the following steps:

- Contact state environmental commissioners directly with information about the project, its potential benefits, and reasons why each state should participate. To persuade senior leaders that their states should submit data for the next round, the Task Force should develop a marketing package designed specifically for state commissioners. These materials should be brief, explaining why it is important for states to participate in developing the national estimates but really focusing on how the data can be useful to states for their own purposes. The materials should include testimonials from state commissioners or deputy commissioners in states that participated in the first round, explaining how they have used the information within their states for budgeting, workload planning, management, and other purposes.

- While still continuing to protect state identities, consider preparing detailed reports showing the range of data provided by states on topics such as total state expenditures, total state needs estimates, and fully-loaded employee costs, along with median values. This analysis would help to explain the national estimates and make the project more informative about the variety of state situations.

- Report some information in work hours. The work hours associated with the many activities in the Needs Model are critical for state benchmarking. Unlike state salaries, which vary widely, an hour is a common unit across all states. Reporting specific activity "costs" in work hours, rather than in dollars, actually may be less controversial and yet more useful for identifying states with the most efficient practices.

  For national estimates, use a sensitivity analysis to identify a few data points that predict overall costs and rely on those elements to simplify the Needs Model. The Model can also be simplified by reducing the detail in some modules (e.g., Permitting, Compliance and Assistance, and Enforcement).

- In the case of states that do not wish to provide data for the Needs Model, EPA staff or consultants can fill in many gaps through a combination of using existing data (e.g., number of permitted facilities), relying on knowledge of basic facts (e.g., is a state coastal or not), and contacting state officials directly. For these states, the Model can then be run using a combination of actual state data and default values for the remaining data points. This should result in a more accurate estimate of each state's resource needs than an estimate based entirely on default values or on the average of reported state resource needs.

- Explore the possibility of collecting data electronically for one or both parts of the Resource Analysis project, using the new state-EPA Central Data Exchange Network.

2. FINE-TUNING RESOURCE ANALYSIS TOOLS AND METHODOLOGIES

Finding 2-1:

The State Task Force met its dual goals for the Water Resource Analysis project of:

- **Producing a reasonable national estimate of the gap between current state expenditures and what states need to adequately implement the Clean Water Act and**

- **Developing a tool for estimating resource needs that individual states would find useful for their own planning, budgeting, and other purposes.**

The Panel reviewed the stated goals and objectives of the Resources Analysis project, the two tools used to collect state data (State Expenditures Survey and Needs Model), and the methodologies adopted by the State Task Force to calculate their national estimates of current state expenditures, projected resource needs, and the gap between them.

The Panel concludes that a range of $0.7 billion to $1.0 billion per year is a reasonable estimate of the national funding gap between what states now spend and the resources they need to implement water quality programs -- but the estimate is probably low. The national estimates of state resource needs derived from the Needs Model are a sound starting point for understanding the size of the funding gap. The estimates are conservative, however, because the actual costs of state employees is likely to have been underestimated. Further, because the Task Force deliberately focused the Needs Model on existing water programs and requirements, the funding gap does not reflect the costs of new and developing programs.

Moreover, several states have already used the calculations from the Needs Model to support funding requests, secure increases in permit fees, reallocate workloads, prepare budgets, or educate the public about water quality needs. Thus, the Panel concludes that the State Task Force has succeeded in developing a new tool that is useful to individual states as well.

Finding 2-2:

States and EPA can build on this first effort to fine-tune the data collection tools, increase state participation, and make future estimates even more reliable.

EPA requested the Panel and its research team to conduct a critical analysis of the State Expenditures Survey, Needs Model, and the methodologies used to develop the national estimates. Before presenting the detailed findings from its review, the Panel wishes to

underscore its fundamental conclusion -- the states and EPA have developed valuable new tools and initiated a constructive learning process that can lead to more effective water quality programs. The results can, and should be, used now without hesitation.

The findings and recommendations here -- and in the more thorough analysis in the Appendices -- are intended to build on this achievement by highlighting where the states and EPA can fine-tune their data collection tools and methodologies to make the estimates even more reliable, as well as to foster greater state participation in the future.

State Expenditures Survey

Finding 2-3:

Based on data provided by state budget and water program officials, the State Expenditures Survey produced a reasonable estimate of current state expenditures for water quality management programs.

The State Expenditures Survey asked states to provide data on state appropriations for water quality programs, estimates of the percentage of these funds coming from different funding sources, and estimates of the percentage of funds spent on various categories of activities.

The State Task Force, working through the Environmental Council of the States (ECOS) and the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), asked states to complete the State Expenditures Survey and to provide information about current state appropriations for water quality program management and implementation. They were also asked to provide estimates of the percentage of their state's total water program expenditures that came from general state revenues, federal (EPA) contributions, permit fees, and other sources such as bonds or special taxes. In addition, they were asked to estimate the percentage of state funds used for 13 categories of water program activities.

The survey's instructions[5] clearly explained that states should only report expenditures related to *managing* water quality management programs designed to restore and protect surface water as envisioned under the Clean Water Act. To be excluded were infrastructure improvements; State Revolving Fund and Section 319 grants; and activities of local entities or nongovernmental organizations, such as implementation of best management practices.

Finding 2-4:

Beyond the information provided by state agency and budget officials for the survey, the Panel found no other reliable sources of data on state expenditures for managing water quality programs.

The Expenditures Survey was completed by state water quality agency officials and budget officers, using data from state appropriations documents, past agency budgets, agency finance systems, agency timesheets, and activity reports. In ten states contacted by Academy researchers about their participation in the project, officials who completed the Survey reported no major

difficulties in compiling the requested information, even though the Survey's categories did not necessarily align with how their states keep records.

Academy researchers attempted to find other sources of information about state environmental expenditures, including the National Governors' Association,[6] *Governing* magazine, the U.S. Census Bureau,[7] the National Association of Budget Officers (NASBO),[8],ECOS,[9] and the General Accounting Office.[10] They found that the state budget data collected by these organizations were highly aggregated or combined in ways that were unrelated to the narrow scope of the State Expenditures Survey. As a result, the funding data collected by the Expenditures Survey are the only data that can be used to calculate the resource gap.

Finding 2-5:

Because the activity and program categories in the State Expenditures Survey and Needs Model are not the same, it is not possible to make direct comparisons between current state expenditures and resource needs below the aggregate level.

The Expenditures Survey was conducted while the Needs Model for assessing the workload and resource needs was still being developed, so program and activity categories in the two tools are not the same. Therefore, at this juncture it is not possible to make a direct comparison between expenditures and resource needs for all water program areas on either national or state levels.

One state's experience already shows the advantages of using the same categories for both tools, and for completing them at the same time. After the Needs Model was developed, this state went back and completed it simultaneously with the State Expenditures Survey. The state was able to cross-check its data, identify where resource needs and program activities had been improperly assessed, and to re-evaluate assumptions about both water quality program needs and expenditures. Because the categories were the same, the state was further able to see where the resource gaps were greatest and make appropriate adjustments in staffing and resources.

Using the same categories in both data collection tools would have comparable advantages at the national level. Currently, the resource gap can only be estimated for the costs of managing a state's entire water quality program. This aggregate estimate does not provide any guidance to decision-makers about which components of state water quality programs are in the greatest need or come closest to having sufficient funds.

Finding 2-6:

Nationally aggregated data mask the wide variability among states in the relative shares that state general revenues, federal grants, state permit fees, and other state sources contribute to each state's total funding.

As part of the Expenditures Survey, states were asked to provide estimates of the percentage of their total water quality program funds contributed by various funding sources. The funding source categories were state general revenues, the federal (EPA) contribution, permit fees, and other state sources such as bonds or special taxes.

Based on data received from 36 states, the *Interim Report* provides aggregated national information about the percentage of funding provided by state revenues (40 percent), EPA (31 percent), permit fees (19 percent), and other sources (10 percent). The Task Force recommends moving toward the goal of parity between state and federal funding of water quality programs within the next ten years.

Academy researchers were able to review updated expenditures and revenue source data from 37 states. With the additional state included, the national average for the federal share is 37 percent, slightly higher than the percentage in the *Interim Report*. Moreover, examination of the detailed state data reveals considerable variation in the relative share of state funding provided by each funding source.[11] The ranges are large:

	Lowest	Average	Median	Highest
State general revenues	0%	37%	39%	79%
Federal contribution	8%	37%	37%	85%
Fee revenues	0%	19%	17%	86%
Other sources (bonds, etc.)	0%	6%	0%	81%

For example, the federal government's contribution is less than 20 percent in six states, between 20 and 40 percent in 17 states, between 60 and 80 percent in two states, and over 80 percent in one state. State funding sources, which make up the remainder, include general revenues, permit fees, or other sources. Of the 37 states reporting, 32 states collect permit fees to help fund their water quality programs, and 12 states get some of their funds from other revenue sources such as bonds or special taxes.

Based on these wide variations, the Panel believes there needs to be careful consideration of the policy implications of these differences among the states in the relative shares provided by the various funding sources.

Water Qualtiy Management Resource Analysis Model (Needs Model)

Finding 2-7:

The Needs Model provides a comprehensive and systematic tool for estimating the workloads and costs involved in implementing state water quality programs and can be modified easily as program elements change or expand.

The detailed Needs Model is the first comprehensive workload model covering the management of water quality programs. It is viewed by states and EPA as a major advance towards gaining a systematic understanding of the work involved in implementing water quality programs and what it would cost states to implement water quality programs adequately.

Both states and EPA have invested considerable time and resources to develop the Needs Model. In seeking an independent review of the Resource Analysis project, they have requested the Panel's specific suggestions about how the Needs Model can be improved for the future. In order to make substantive recommendations, the Panel and Academy researchers have carefully

examined the contents of the Needs Model, analyzed its underlying assumptions and default values, and reviewed actual data submitted by states.

As noted earlier, the Panel believes that by creating the Needs Model, the Task Force has successfully developed a common framework for understanding the actual work involved in implementing water quality programs and what it takes in staff and other resources. The Model's comprehensive coverage of the components of water quality programs provides a tool that is useful not only for estimating the resources needed, but also for benchmarking and sharing information on best practices.

The state and EPA water program experts who developed the default values and other assumptions built into the Needs Model based them on actual data when they were available and best professional judgment when they were not. All states were invited to participate in the development of the Needs Model and to review and comment on draft components to ensure the defaults and assumptions would represent the experience of every state.

The default values made it possible to develop needs estimates for states that did not have precise information for every data point as well as for states that did not submit any data at all. However, instructions for the Model strongly urged states to enter their own data rather than use the defaults, and most of the participating states did use their own values for key data points, adding accuracy to the resource need projections.

The Academy's review found no apparent overlaps or duplications in the Needs Model. Moreover, the modular design of the Model allows for easy modification to reflect changes or expansions of water programs.

Finding 2-8:

The conceptual framework of the Needs Model is simple, and its modular structure accommodates variations in how state water programs are organized.

The basic conceptual framework for the Needs Model is simple. It identifies all the activities associated with implementing the various Clean Water Act programs, estimates the number of hours state staff devotes to completing each activity, and multiplies the number of hours by salary cost per hour. A useful frame of reference for thinking about the size and scope of the model is the total number of hours of work it represents. Based on just the default values for the staff hours needed to complete all water program tasks, the Model encompasses more than 600,000 work hours.

The workload model is divided into 14 modules, which are functional categories of state work. In addition, there are two worksheets for entering data about assumptions that drive calculations in some or all of the modules. While the modules do not always correspond with the organization of the Clean Water Act or state programs, this approach does accommodate a variety of state structures as well as cross-cutting activities, such as monitoring and data management.

The Panel's key findings related to the Needs Model are set forth in Findings 2-9 through 2-14 below. More detailed analyses of the Model are contained in Appendices B through E:

Appendix B -- General Assumptions: Fully-Loaded FTE Cost, FTE Hours per Work Year

Appendix C -- Point Source Modules: Point Source Assumptions Worksheet, Permitting, Compliance and Assistance, Enforcement, Septage

Appendix D -- Other Program Modules: Nonpoint Source and Coastal Nonpoint Source, Total Maximum Daily Loads, Wetlands, Coastal and Marine Waters

Appendix E -- Cross-Cutting Modules: Monitoring, Data Management, Water Quality Standards, CWSRF and other CWA Grant Management, Reporting and Planning, Regional Initiatives

Finding 2-9:

Future refinements to the Needs Model could make it clearer, easier to complete, and more accurate. However, most of these refinements would have virtually no impact on the total estimate of state or national resource needs.

There is room for refining the Needs Model to make it more accurate for future applications. However, all but one of these refinements would affect only a tiny portion of the Needs Model. If all of the refinements suggested in Appendices B through E were added together, they would have negligible impact on the national or state level resource needs estimates.

As discussed next in Finding 2-10, only changes in state employee costs -- because of their multiplier effect throughout the Needs Model -- would have a discernable impact on the resulting needs estimates.

Finding 2-10:

The primary drivers for the Needs Model are the fully-loaded cost of a state employee and the number of work hours in a state's work year. Increasing the accuracy of these data would increase the accuracy of the national resource needs estimate.

Increased participation by states would substantially improve the accuracy and credibility of the Needs Model. For purposes of the national estimate, however, states would not necessarily need to submit data for the entire Needs Model. Two data elements -- the annual cost of a fully-loaded state employee, or Full Time Equivalent (FTE), and the number of actual work hours available per FTE work year -- are multipliers for nearly everything else in the Needs Model. With actual state values for just these two data points, the Needs Model could calculate a reasonable estimate of every state's resource needs using default values for the rest of the data points.

Academy researchers tested how sensitive the national and state estimates are to variations in FTE costs and hours worked per year. They developed a simple formula for calculating a "cost per work hour" that would allow for costs to be compared across states. Using the model's built-in default values for the number of work hours (approximately 600,000) as a constant, they compared the total state resource needs based on the default cost per FTE hour against the total resource needs based on the median of reported state FTE cost per hour.

Using the median reported FTE per-hour cost produces a six percent increase in a state's total resource needs -- $1.6 million higher than the result from using the default. This is a large number when viewed within the context of an individual state's water program budget. At the national level, though, the significance diminishes: the difference between the total cost of the model for 50 states using the default value instead of using the median value is less than $100 million.

In reviewing actual data submitted by 16 states, Academy researchers found that most states provided actual data for FTE costs and hours per work year, which suggests may be able to produce this information easily. However, there was considerable variation among the 16 states in both FTE cost and hours per work year. Fully-loaded FTE costs ranged from a low of $55,000 to a high of $90,000, while hours per work year ranged from 1,500 to 1,950 hours. (The defaults are $70,000 and 1,800 hours, respectively.) Thus, given the number of work hours in the Model, using default values instead of actual state data can significantly under- or over-estimate an individual state's resource need. See Appendix B for more a detailed discussion of this analysis.

Because data on state employee costs and work hours per year have a major impact on the total resource needs estimate, both the State Task Force and Academy researchers sought other sources of data. They were not successful in finding anything appropriate. The Task Force settled on a default value for a fully-loaded FTE cost of $70,000, based on data submitted by 14 states and best professional judgment; but project leaders acknowledged their concern about whether this figure is really appropriate. Further complicating matters, Model instructions are complex as to what should and should not be included in the costs of a fully-loaded FTE. Neither the Task Force nor Academy researchers could determine whether states have records that allowing them to make employee cost calculations in accord with the Model's instructions.

As the Academy's sensitivity analysis shows, FTE costs and work hours are the primary drivers of the Needs Model. Additional efforts to obtain accurate data from all states on these two data points alone would be a wise investment that could lead to more reliable national resource needs estimates. The State Task Force should also consider simplifying how fully-loaded costs are defined. One possibility is adopting the overhead rates states use in their applications for federal grants as a standard approach that would be relatively consistent across states.

Finding 2-11:

In the Needs Model, the number of point sources of water pollution drives about one-fourth of the workload for implementing water programs. If actual state inventory data were used for all states rather than default values, the accuracy of the national needs estimate would be slightly improved.

Activities covered by the four Point Source Modules account for more than 23 percent of a typical state's resource needs (based on default values).[12] The workload and needs estimates for these modules are largely determined by how many regulated sources the state has, i.e., how many major and minor National Pollutant Discharge Elimination System (NPDES) permits, Publicly Owned Treatment Works (POTWs), combined sewer overflows (CSOs), and storm sewer overflows (SSOs).

The Point Source Modules take the numbers of regulated sources and translates them into activities that must be undertaken, such as permit renewals, inspections, and enforcement actions. The Model then determines resource needs based on how many hours each one of these activities takes to complete. While the accuracy of point source numbers is not significant for the national estimate of resource needs, it is for states that want to use the Model for their own purposes.

In reviewing actual data from 16 states, Academy researchers found wide ranges in the numbers of sources reported by states, as well as fairly large differences between state-reported numbers and the default values. For example, the default value for the number of minor facilities with NPDES permits is 800, whereas actual state data ranged from below 100 to above 1,800 permits. The default value for CSOs was 15, but the average state value for the 16 states was 99, more than six times higher than the default. Similarly, the default value for SSOs was 2, compared to an average actual state value of 40.

The Panel notes that databases exist for some of these sources, particularly facilities that currently have permits. As evidenced by the fact that most of the states completing the Needs Model did provide their own data for the Worksheet, at least some of these data are readily available. An effort to collect accurate information about numbers of point source facilities for each state could be used to improve the accuracy of the national estimates.

Nevertheless, the Panel emphasizes again that collecting information about the number of sources by itself would have a minor impact on the national estimates. When accurate data are coupled with better information about actual state employee costs, however, the national estimates could be greatly improved with a relatively small investment of time and resources. This approach could be used to streamline data collection as well as reduce the use of assumptions about "typical" or "average" states, as the Task Force did in the first round to calculate estimates for states that did not submit data.

Finding 2-12:

Future changes in the Needs Model should focus on modules that cover newer programs, such as TMDLs, nonpoint sources, and some aspects of the wetlands program, because that is where resource needs are most likely to grow.

The State Task Force recognized that some elements of state water programs are still developing and will likely grow in the future. They decided to focus the Needs Model on what states currently are required to implement under the Clean Water Act, while anticipating future revisions to the Needs Model to reflect changes as newer program requirements come into place. Given the uncertainties of future program requirements, the Panel understands why the Task Force chose this approach. To help the Task Force plan for future revisions, the Panel offers the following suggestions on possible future modifications of the Model to address new or changing requirements.

Many states have yet to monitor all of their water bodies to determine if they are impaired and whether they are subject to TMDL requirements. The TMDL Module now focuses on "all-known" TMDLs, which probably underestimates the number of TMDLs the state will eventually determine are required. Future iterations of the Resource Analysis project should encourage states to consider the potential expansion of the universe of water bodies that will require TMDLs.

The potential effects of EPA's proposed storm water phase II rule are not yet reflected in either the Nonpoint Source or the Point Source Modules. Clearly, the Needs Model cannot incorporate workloads and costs associated with proposed rules that have not yet been adopted, but the Task Force should be prepared to revise the Needs Model to incorporate new requirements when it is clear what those requirements will be. Although the largest share of additional costs associated with this proposed rule will fall on local governments, states are likely to face additional costs associated with planning and coordination with local governments as a result of the new rule. Similarly, the Needs Model will need to reflect the decision, now in flux, about which sources should be regulated as concentrated animal feeding operations (CAFOs) and be required to obtain NPDES permits.

In *SWANCC v. Corps of Engineers*,[13] the U.S. Supreme Court held that the Clean Water Act did not apply to certain wetlands that are not adjacent to navigable waters. This decision has created substantial uncertainty concerning which wetlands continue to be regulated under the CWA and which wetlands are now subject to regulation only by states. Since the *SWANCC* decision, many states have begun to consider whether they need to establish new laws, regulations, and programs to protect wetlands no longer covered by the federal law. The workload associated with planning and developing these programs does not appear to have been considered in the Wetlands Module, probably because the Model was largely developed before the Supreme Court issued its decision. It is possible, however, the Task Force will determine these activities should be treated as state-specific activities only.

Instructions for the Monitoring Module acknowledge that default values are not adequate to cover emerging monitoring needs, such as those necessary to support the nonpoint source,

wetlands, and TMDL programs. The additional costs of these unaccounted monitoring needs could be substantial. For example, in an August 2001 study, "The National Costs of the Total Maximum Daily Load Program," EPA estimated that the additional costs for all states in total water quality monitoring costs to support TMDLs alone would be approximately $17 million annually.[14]

Finding 2-13:

Fine-tuning some of the defaults in the Needs Model could help states develop more accurate estimates of their own resource needs, as well as improve the national estimates.

- Some of the default values in the Needs Model are much lower than the average state values and may be misleading to individual states that may want to rely on them. For example, inventories of several categories of pollution sources are six to 20 times lower than the average state values, which raises the possibility that heavy use of defaults will result in estimates substantially lower than the actual workload. On the other hand, the Model's default value for the number of Publicly-Owned Treatment Workds (POTWs) was extremely close to the average value reported by states. However, data from the Clean Water Needs Survey (CWNS)[15] indicates that the average number of POTWs per state is 22 percent higher than the Needs Model default. The Task Force might want to investigate the reason for these differences.

  About half of the estimated resource need for the Nonpoint Source Module, based on the default values, is determined by the effort associated with locally-based program/project coordination. However, the default value for this activity is less than half the average state value (1,800 hours compared to 3,781 hours), indicating that reliance on the default value substantially underestimates this aspect of NPS programs.

- In some instances, the Needs Model could be improved by changing default values to reflect the fact that many states do not implement some programs. For example, the Wetlands Module assumes a state has a wetlands permitting program under Section 404 of the Clean Water Act, although only two states have such a program. Using the default values, the costs associated with permitting for Section 404 of the CWA make up over one-third of the costs of the Wetlands Module.[16] But this default value does not accurately reflect the needs of a typical state program because only New Jersey and Michigan have formally assumed responsibility for Section 404 permitting.

  In this case, the default value should be changed to zero to reflect the limited number of states that issue Section 404 permits. The Coastal and Marine Module also assumes that every state has such a program, yet the program applies to only 29 states. In this case, it is appropriate for the default to assume a state has a coastal and marine program, but the Needs Model should not use the default value in calculating the national needs estimate.

Finding 2-14:

It is not clear to what extent the Clean Water Act implementation costs for state agencies other than environmental departments were included in the estimates of state expenditures and resource needs for water quality programs. Not including information from other agencies would provide an incomplete picture of state expenditures and costs for water quality programs.

State water quality agencies are typically housed in state environmental protection agencies (or equivalent). However, in some states, the water quality agencies share responsibility for implementing some aspects of the Clean Water Act -- particularly for nonpoint sources -- with other departments such as agriculture, forestry, and fish and wildlife.

Instructions for both the Expenditures Survey and the Needs Model ask state water officials to consult with their counterparts in the other agencies to get expenditure and resource needs information. Anecdotal evidence from interviews suggest that at least some states did consult with other agencies to develop complete state data. However, there is no way to tell from the data which state environmental agencies share water quality program responsibilities with other agencies and, for those that do, whether these costs and needs are reflected in the states' totals.

This uncertainty about whether agency costs and needs are fully reflected in the national expenditures and needs estimates suggests an important caution in how the estimates are explained and used. Further, the Task Force made a deliberate decision not to include in the estimates the costs borne by local governments with respect to Clean Water Act programs. Consequently, in discussing the national estimates, it should be made clear that they do not represent the full costs of implementing water quality programs by state and local governments.

Estimation Methodologies

Finding 2-15:

To appreciate the methodologies in their proper context, it is important to understand that the overall data quality objective of the Resource Analysis project was to develop a reasonable estimate of -- not a precise number for -- the national resource gap.

About one-quarter of the states did not submit information for the State Expenditures Survey, and more than half did not submit information for the State Water Quality Management Resource Needs Model. Of those states that did provide data, some provided only partial data.

As a consequence, the State Task Force had to develop methodologies that could be used to calculate estimates for states with partial or no data. Cadmus Group, which served as consultants and provided analytic support to the Resource Analysis project, worked with the State Task Force to develop the estimation techniques that were used.

While Cadmus analysts did use statistical techniques to help develop and support the national estimates of state expenditures and needs, the intent of the Task Force from the very outset was

to develop a reasonable estimate of the national resource gap, not a precise number. The Panel notes, however, that the *Interim Report* uses statistical terminology in ways that could lead readers to infer the data have a stronger statistical basis than is appropriate. The number of significant digits used in reporting national estimates may also imply an unwarranted level of precision.

Finding 2-16:

The State Task Force considered it reasonable to assume that the average values derived from the data submitted by states were representative of a "typical" state and could be used to calculate the numbers for missing states.

The Task Force did not attempt to ensure that the reporting states truly were representative of all states. Rather, they relied on a consensus among project leaders that participating states adequately represented a cross-section of demographic characteristics, geographic locations, water resources, and water quality issues. Based on this assessment, they considered it reasonable to assume that averages derived from the submitted data would represent a "typical" state and could be used to calculate numbers for the missing states. Under this assumption, they believed that the estimated level of states' needs and the real level would be reasonably close to each other.

However, the Task Force's application of this assumption was not consistent. On the needs side, the average of actual state values from 19 reporting states was used to calculate estimates for the resource needs of non-reporting states. (Data from two large states were dropped because they were considered to be outliers.) Whereas on the expenditures side, the Task Force rejected using an average of actual state values from all reporting states (in this case, 36) because they were concerned that the average would not be representative.

The approaches used to address missing data in developing national estimates are described and analyzed in more detail below.

A note: Academy researchers were unable to replicate exactly Task Force calculations using the data and methodologies in the *Interim Report*. This was due to confusion about how many states submitted data and how partial state data was used to calculate national estimates.

National Estimate of State Expenditures

Current water quality expenditures data were submitted by 36 states; data for the missing 14 states were extrapolated using a regression model. After testing several possible variables, Cadmus analysts found a strong positive correlation between state water quality expenditures and the total of all state expenditures for the 36 reporting states as reported in NASBO's 1999 State Expenditure Report.[17] These variables were then used in a regression model to extrapolate the water quality expenditures for the 14 states that did not submit data.

Using the data submitted by 36 states and the results of the regression model for the remaining 14 states, the estimate for total state expenditures is $722 to $805 million. According to Task

Force materials, the upper and lower bounds of this estimate represent a 95 percent confidence interval for total state expenditures.

National Estimate of State Resource Needs

Complete data for the Needs Model were submitted by 21 states. For purposes of calculating average state values, data from two outlier states were omitted. The Task Force assumed the wide range of demographic characteristics, geographic locations, water resources, and water quality issues represented by the remaining 19 states were representative of a "typical" state.

Two approaches were used to calculate an "average" state resource needs value for each of the non-reporting states:

Approach 1
State value = the average state resource need based on the data submitted by 19 states

Approach 2
State value = the total of default values in the Needs Model

These surrogate state values were then multiplied by 29 to arrive at a total value for the non-reporting states. These totals were then added to the totals from the reporting states to arrive at national estimates of the resource need. The results are shown below:

Approach 1
21 States Reported Needs + (19 States Average X 29 States) = $1.7 Billion

Approach 2
21 States Reported Needs + (Model Default X 29 States) = $1.5 Billion

Finding 2-17:

The national estimate of resource needs lies somewhere between $1.3 billion and $1.7 billion, and a reasonable single value to use is $1.5 billion; the estimated gap between current expenditures and resource needs ranges from $0.7 billion to $1 billion.

From a statistical standpoint, it would be preferable to use the median of state reported resource needs rather than the mean (average) in estimating resource needs for the non-reporting states. Academy researchers found high dispersion (78 percent) in the resource needs results of the 21 states that submitted data because there were several outliers among the 21 submitters. In such cases, it is preferable to use a mean in order to avoid skewing the results.

Calculating a range of estimates based on several alternative methods can help to overcome concerns about bias. The results of several different need calculations are presented below:

		Needs Model Default Values	X	50 States	= $1.3 billion
21 States Reported Needs	+	(Model Default	X	29 States)	= $1.5 billion
21 States Reported Needs	+	(21 States Median	X	29 States)	= $1.6 billion
21 States Reported Needs	+	(19 States Average	X	29 States)	= $1.7 billion

To settle on a single resource needs estimate, $1.5 billion is a reasonable figure because it is based on the median value of the states' reported data, and it falls in the middle of the range produced by these four calculation methods.

Estimate of the National Resource Gap

The resource gap for funding state water quality programs was calculated by subtracting estimated state water quality resource needs from estimated current state water quality expenditures. The *Interim Report* calculated this gap.

Resource Needs	***minus***	**Current Expenditures**	***equals***	**Resource Gap**
$1.54 - $1.69 billion	*minus*	$722 - $805 million	*equals*	$735 - $960 million

Finding 2-18:

Task Force methodologies and the reasons behind them should be clearly presented in future reports and other documentation for the Resource Analysis project.

Academy researchers found the *Interim Report* did not contain some information vital to understanding the methodologies used by the Task Force to calculate national estimates. Using the data and methodologies in the *Interim Report*, they were unable to replicate the results. After investigation, they learned some of the information in the *Interim Report* -- such as the number of states that submitted data and the equation for how missing states were included when calculating national estimates -- were incorrect.

Comparison to Other Methodologies

Finding 2-19:

While not directly comparable, the methodologies used in other studies on water infrastructure may provide information useful to the State Task Force in refining the Needs Model for future estimates of resources needed to manage water programs.

Academy researches found no studies or other sources of information on workload to manage state water quality management programs. However, many organizations, including EPA, the Congressional Budget Office (CBO), the American Water Works Association (AWWA), and the Water Infrastructure Network (WIN) have estimated the future needs for clean water and/or drinking water infrastructure. Many of these studies are based on EPA's 1996 Clean Water

Needs Survey (CWNS) and its 1999 Drinking Water Infrastructure Needs Survey (DWINS). Academy researchers reviewed the methodologies in six infrastructure studies, which are discussed in Appendix G.

The infrastructure studies are based on the projected costs of physical capital, whereas the management needs must reflect the workload to support evolving elements of water quality management programs. Nonetheless, observations from these studies may be useful in considering ways to improve the reliability of future data collection for program needs.

- Both the Clean Water Needs Survey (CWNS) and the Drinking Water Infrastructure Needs Survey (DWINS) had a high level of state participation, reducing the need to model the costs for non-reporting states.

- Follow-up visits to a sample of large and medium-sized water systems were used to determine that both the CWNS and the DWINS under-reported infrastructure needs.

- Both the CWNS and the DWINS required respondents to provide documentation of the source of their need estimates.

- Many of the water infrastructure studies used national statistics to determine drinking water infrastructure needs.

- Many of the infrastructure studies used multiple methods to estimate total water infrastructure needs.

- The availability of multiple infrastructure studies allows for comparisons, but there are no other workload studies that can be compared with the Resource Analysis project.

The *Interim Report*

Finding 2-20:

The presentation and technical problems in the *Interim Report* short-change the extraordinary effort and potential value of the Resource Analysis project.

In April 2002, the State Task Force issued its *Interim Report* on the results of the Resource Analysis project. The *Interim Report* was the starting point for the Panel's review and analysis of the Resource Analysis project. As the principal way for many potential users to learn about the gap in state water quality program resources, the *Interim Report* (and any future reports) have a vital role in gaining wider understanding and acceptance of the Resource Analysis project and its results. For this reason, the Panel reviewed the contents, presentation, and organization of the *Interim Report.*

The Panel and Academy researchers had difficulty following the structure of the report, and some information crucial to understanding the project is buried in the text or not included at all.

The *Interim Report* does not fully convey the dual objectives of the project, nor how and why it was developed and conducted. From reading the *Interim Report*, Panel members and Academy researchers were left with the impression of a statistically-oriented project that had serious flaws when viewed from that perspective. Once they met with leaders of the State Task Force and discussed technical issues with Cadmus Group consultants, the Panel and researchers understood the broader purpose and context for the effort.

A basic test for a study's reliability is whether the results can be replicated by independent analysts using the same data and same methods. Unfortunately, as discussed earlier in this report, when Academy researchers tried to duplicate the figures in the report, they found discrepancies that, while small, called into question how the Task Force had calculated the numbers in the *Interim Report.* They learned that the methods actually used to estimate the national resource needs were indeed more complex than the equation shown in the *Interim Report*, and that information about the number of states that participated in the project was inaccurate. The impact on the national estimates of these discrepancies is practically nil, but even small errors in the public report can affect a study's overall credibility.

RECOMMENDATIONS ON FINE-TUNING RESOURCE ANALYSIS TOOLS AND METHODOLOGIES

Recommendation 2-1:

The State Task Force has developed and used data collection tools and methodologies that produce reasonable estimates of state expenditures, resource needs, and the gap between them; and although some refinements are possible, they would not significantly affect the ultimate calculation of the resource gap for managing state water programs.

The Resource Analysis project is a successful beginning in an effort to gain a better understanding of resources needed to implement state water quality programs, what state resources are now available, and the gap between them. While the Panel has identified ways the project can be refined in the future, they are all minor adjustments to a solid foundation. The project already represents great progress in building more cooperative working relationships between EPA and states. It also has improved understanding about the actual work involved in implementing water quality programs and has led to productive discussions about reducing the resource gap, both for individual states and at the national level.

Recommendation 2-2:

Categories in the State Expenditures Survey and Needs Model should be refined so they match each other, and states should be encouraged to complete the two data collection tools at the same time.

The results of the State Expenditures Survey and the Needs Model cannot now be compared directly because the two data collection tools define the categories of work differently. If the categories are the same, states could see more clearly which program areas and activities have the greatest funding gaps; and they could project where resource needs are likely to grow, stay

the same, or decrease. These insights would be helpful at the national and state levels for planning and other purposes, and would be especially useful to states in making staffing allocations.

Recommendation 2-3:

Nationally aggregated estimates tend to mask some important information that could help decision-makers, so the Task Force should consider summarizing and reporting selected data for various elements of state water programs and provide contextual information for key state data, such as employee salaries and number of regulated facilities.

The national funding gap estimate is between $0.7 and $1.0 billion for all state water quality programs under the Clean Water Act. While this figure is impressive and is a useful starting point for discussion about the size of the resource gap, it does not provide much insight as to which program elements or which state programs most need additional resources. While showing the relative size of the gap among water programs is clearly a sensitive issue for all program managers, it will be difficult for the states and EPA to make a persuasive case for additional resources without being able to explain more specifically where the greatest resource needs occur and why.

Even so, it is important to keep individual state information confidential so more states will participate in future estimates. Consequently, the State Task Force should consider ways of reporting state information in summary form. At a minimum, reporting the high and low values as well as the averages and the means for key data elements -- such as state expenditures, state resource needs information, and funding gaps -- would provide useful insights to understand better the national estimates.

Recommendation 2-4:

The Task Force could enhance the reliability of the estimated national resource gap by using the same methods for non-reporting states in estimating both resource needs and current expenditures.

In this initial effort, the Task Force used two different approaches to estimate data for non-participating states in the State Expenditures Survey and Needs Model. In the first case, a regression model was used and in the second, an average state value was used. The reliability of the total national funding gap would be increased if comparable estimation techniques are used for both parts of the equation.

Ideally, all states will participate in future data collection. For the Needs Model, it may be possible to obtain state data on just a few data points that would allow for the development of a better estimate of state needs for each of the non-participating states, as described in Recommendations 2-5 and 2-6.

Recommendation 2-5:

Although the Needs Model already produces sound estimates of national and state resource needs, the State Task Force should consider refining the Model to increase its accuracy for future estimates, encourage more states to participate, and streamline data collection.

The Panel commends the Task Force for taking on the complex challenge of developing the Needs Model. Their commitment to developing a tool that would produce a good estimate of the resources needed to carry out water quality programs is evidenced by the care they took in breaking out all of the activities associated with implementing water quality programs, developing the assumptions and default values, and training state officials in how to submit data. As a result, there is now a sound national estimate of state resource needs for water quality programs, as well as a tool that states are finding useful to plan for and manage their own programs.

As is often true for the first iteration of any data collection tool, particularly one containing as much detail as the Needs Model, there are some items that could be improved in future versions. The Panel wishes to emphasize, however, these refinements -- both individually and collectively -- have virtually no impact on the national estimate of state resource needs. They also will have either no, or only minor, impacts on individual state estimates. The only data that may have a major impact are state employee costs. Obtaining more accurate data on state employee costs could have a sizable impact on individual state resource estimates and a lesser impact on the national totals.

Recommendation 2-6:

The State Task Force should try to acquire more accurate data on the fully-loaded costs of state water program employees and the number of hours in a state's work year. These are drivers for the entire Needs Model, and the default values probably underestimate states' employee costs.

The Panel acknowledges the effort the Task Force has already invested in trying to determine the fully-loaded costs of state water program employees and their work hours per year. Not finding a useful source for this information, the Task Force ultimately chose to base the default values of $70,000 and 1,800 hours, respectively, primarily on the best professional judgment of Task Force members.

However, the Panel's analysis of the actual state submissions, as well as its limited review of other information on state salaries, suggests the defaults which are used in calculating state and national resource needs estimates are too low, especially if they are intended to include fringe benefits and other indirect costs.

In addition to obtaining more accurate information about state salaries, the Task Force should seek a simpler way to determine indirect costs. One possible approach would be to use the indirect cost rates states use in their grant applications for federal funds. Grant applications might also be a reliable source for information about state salaries.

Given that state employee costs and the number of hours per work year are multipliers for the approximately 600,000 hours of work in the Needs Model, better precision on just these two items could greatly increase the accuracy of the needs estimates. These values are so important that the Panel urges the Task Force to solicit this data from all states, even those states that choose not to participate in the project. This information could be used along with default values for other data elements to derive a better estimate of resource needs for each non-participating state. Such estimates for non-participating states would be even more improved if key data about their source inventories, as discussed below, were used as well.

Recommendation 2-7:

The State Task Force should consider making other technical refinements to the Needs Model that would result in incremental improvements in the accuracy of its estimates.

The Panel has identified some refinements that could improve the Needs Model. These are primarily technical improvements to improve clarity, adjust default values, or streamline the Needs Model.

a. Revise specific default values in light of information obtained from states in the initial round of the Resource Analysis project.

The State Task Force intended the default values to be conservative yet appropriate approximations of state experience. Information gained from the initial round of the Resource Analysis project allows the Task Force to improve the precision of the default values to better approximate actual state experiences. The Task Force should adjust the default values where the average state values or other information provides a better approximation of a typical state.

The Task Force should consider reducing the default values for the following defaults because the average state values from submitted data are substantially higher than the default values:

- NPDES Majors (Point Source Assumptions Worksheet)
- NPDES Minors (Point Source Assumptions Worksheet)

The Task Force should consider increasing the default values for the following defaults because the average state values from submitted data are substantially lower than the default values:

- Wet weather permits (CSOs) (Point Source Assumptions Worksheet)
- Wet weather permits (SSOs) (Point Source Assumptions Worksheet)
- POTWs (Point Source Assumptions Worksheet) (CWNS data vary from default and average state value)
- Locally-based programs required effort (NPS Module)
- Technical assistance for NPS project management (NPS Module)
- Value of contracts (TMDL Module)
- Number of contracts (TMDL Module)
- Number of TMDLs (TMDL Module)

b. Revise default values to align with actual state adoption of particular programs.

The Resource Analysis project is intended to collect data about states' actual workloads in managing adequate water quality programs. In a few instances, the Needs Model uses default values that assume states manage a program when a large number of states do not.

The Wetlands Module assumes every state has assumed responsibility for issuing permits under Section 404 of the Clean Water Act, but only two states have actually adopted this program. The default for issuance of section 404 permits would more accurately reflect actual state experiences if it were set at zero.

The entire Coastal and Marine Module covers a program that applies only to 29 states. This module would better reflect reality if it were designed so it automatically resulted in a default of zero for the 21 states to which it does not apply. The average state value should be adjusted for this module so it includes only the states subject to the program.

Of less significance due to the relatively small size of the program is the fact that few states implement a septage program. The default value for this program would be more accurate if it assumed a state did not have a septage program.

c. Revise the Needs Model on an ongoing basis as state workloads increase for rapidly developing programs.

The Total Maximum Daily Load (TMDL), nonpoint source, and wetlands programs are in the process of changing, and future versions of the Needs Model should incorporate new aspects of these programs as the workloads associated with them become clear. In addition to the modules directly describing these programs, the Monitoring Module is also affected by the increasing workloads from these programs. The instructions for the Monitoring Module, in contrast to other modules, note that its default values are not adequate to cover the costs and workload associated with providing monitoring support for these new programs. The default values for the Monitoring Module should therefore be revised to account for additional monitoring known to be needed to support new programs.

Recommendation 2-8:

The Task Force should consider collecting basic information about the coverage of each state's water quality programs as well as about the agencies involved in completing the Needs Model.

Some states do not implement all elements of the water quality programs covered in the Needs Model. For example, most states do not currently implement septage or Section 404 wetlands permit programs; only 29 states have Coastal and Marine programs. Some modules have built-in default values for these "optional" programs that assume states do implement the program; in other modules, the default values assume the opposite. In either case, individual states must actively change any inaccurate default assumptions. The Panel suggests the Needs Model could be made more accurate by adding a few questions to the General Assumptions that would

determine whether or not a state implements these "optional" programs; the Needs Model could then automatically tailor the default values and assumptions based on the state's answers.

In some states, several agencies share responsibility for implementing water quality programs. The state water quality agency is likely to complete the Needs Model, but the instructions ask them to consult with the other agencies in making resource needs estimates. Currently, there is no way to tell whether other agencies share implementation responsibilities, and if so, whether their resource needs are included in the state's resource needs estimates. The Panel suggests amending the General Assumptions to ask which agencies have responsibility for implementing water quality programs, and if more than one agency is involved, which agencies provided data for the Needs Model. This refinement would reinforce the instructions to consult with other agencies as well clarify the scope of the state's estimates.

Recommendation 2-9:

Because the credibility of the Task Force could be questioned due to minor technical problems in the *Interim Report*, EPA and the states should consider preparing a revised summary of the Task Force conclusions.

For the immediate term, EPA and states need materials explaining the Resource Analysis project and the funding gap so they can educate federal and state legislators, agency leaders and staff, the regulated community, and the public. The Panel recommends preparing a corrected, short summary of the results of the first round of data collection that can be used until the next round of data is collected and analyzed.

3. IMPROVING THE EFFECTIVENESS OF WATER PROGRAMS

Finding 3-1:

By moving forward to address the gap between resource needs and current expenditures for state water programs, the states and EPA have an important opportunity to improve the effectiveness of these programs.

Recent constraints on public resources highlight the need for the states and EPA to target their investments on efforts that will enhance program performance and produce demonstrable improvements in water quality. Some of those investments may be sizeable at first, but in the long run, the Panel believes they will produce greater program efficiencies and save money for states.

In the Needs Model, the states have already developed a tool that can help water program managers gain a better, more complete understanding of the work needed to improve water quality, such as how many staff hours are needed to devote to specific program tasks. The results of the Needs Model can help states identify best practices to protect and improve water quality in more efficient, less time-consuming, and less costly ways.

In Appendix D of the *Interim Report*, the State Task Force discussed operating practices that states can adopt to achieve greater efficiencies and reduce program management workloads, while still protecting and improving water quality. Based on prior Academy studies on watershed protection,[18] the Panel strongly urges all states to give serious consideration to adopting many of these more efficient approaches in order to help reduce the estimated funding gap for state water programs.

Finding 3-2:

There are opportunities for states to accomplish their water program workloads by adopting strategies that will produce greater efficiencies and, at the same time, enhance water quality.

As the Academy's prior research has demonstrated and as the Task Force has pointed out, more efficient strategies are available for managing many elements of the states' water programs. Among the most promising:

Focus management of water quality problems on a watershed-by-watershed basis. This means developing a comprehensive management plan for each watershed that integrates and coordinates TMDLs, NPDES permits, public hearings, monitoring, and non-point source strategies.

Involve other state agencies -- such as agriculture, forestry, natural resources, fish and wildlife, health, and transportation departments -- in developing a single resource protection plan covering all activities affecting water quality in particular regions or watersheds.

Develop partnerships and cost-sharing arrangements with other federal agencies and local universities to fund or conduct research, planning, monitoring, and other work needed to control water pollution.

Use volunteers from nearby communities to collect data on local water quality, participate in advisory councils, recommend priorities for the work of the states' water programs, and help disseminate information on water program results and funding needs.

Finding 3-3:

A lack of information about actual environmental conditions -- including information about water quality and sources of water pollution -- has been a major obstacle to improving the effectiveness of state water quality programs. Investments in better environmental information, even though difficult given states' current financial conditions, can produce future benefits by helping states make more effective use of the limited resources they have.

Recent General Accounting Office[19] and Academy [20] studies have highlighted inadequacies in state and EPA data on water quality conditions and sources of pollution problems, especially

nonpoint sources. All have concluded that better data systems and higher data quality are needed so that states can make sound water quality management decisions.

While improvements to state information systems for collecting and analyzing water data are likely to be expensive, the Panel believes they will produce important cost savings in the long term. Expected benefits include: increased efficiencies within state agencies, improved coordination among water program staff and between various levels of government, reduced reporting burdens for regulated facilities, and greater transparency for the public.

Better information technology: EPA can help states make cost-effective investments in better information technology by keeping them informed about model state data systems that can be replicated less expensively by other states and by taking the lead in developing cutting-edge methods for data collection, such as geographic information systems (GIS) and remote sensing. With improved data systems -- ones that can facilitate permitting, monitoring, record-keeping, and reporting -- states can determine whether, and to what extent, water quality is improving and where remaining problems need attention.

Better data on water quality and pollution sources: Better information technology should in turn produce better data, thus enabling both states and EPA to manage the performance of their water quality programs more efficiently and effectively. With more consistent, reliable nationwide water quality data, state water managers will be able to target their efforts on major sources of pollution; monitor the results of program activities; analyze whether results are translating into improvements in water conditions; and redirect staff and other efforts, as necessary, to ensure they are focusing on the most important problems.

Finding 3-4:

The growing emphasis on performance-based management by government agencies at all levels gives added importance to building better state-EPA partnerships that are based on common understanding of current environmental conditions. With improved data on the environment and sources of pollution, EPA and states can set priorities together and target shared resources to address major water pollution problems.

In the past few years, many state legislatures and Congress have passed new laws requiring public agencies to develop strategic plans, define goals, prioritize their tasks, and measure performance toward meeting those goals. Most recently, the Bush administration has adopted the President's Management Agenda as a way to ensure that all federal agencies are following a performance-based approach to managing their programs and can document the improved results and progress that Congress and the President are expecting.[21]

What would help states and EPA adopt a performance-based approach with regard to water programs? The pressing need is for better information on sources of water pollution and current water conditions. More complete, reliable data would enable states and EPA to make better decisions about how to deploy their current resources and evaluate whether their expenditures are producing expected water quality outcomes. Then they could prioritize and, if necessary

adjust, the workloads of water program staff to focus on remaining sources of pollution that have not been addressed effectively in the past.

Moreover, once problem areas are identified, better data should help states present compelling reasons for why additional funding is needed from state legislatures or Congress to cover gaps in fulfilling the requirements of the Clean Water Act. Likewise, where data demonstrate state programs are producing progress in reducing water pollution, state agencies would be able to build public support, as well as greater understanding by state legislatures, about the levels of effort and funding needed to protect water quality.

Finding 3-5:

There are wide variations in the sources and levels of funding for state water programs, so no single approach to solving state funding problems can be applied nationally. There are opportunities for states to tap other sources of funding or support through sharing their workloads with other agencies, cooperating to achieve economies of scale among states, or working with EPA to provide federal services that will enhance water quality nationwide.

State funding for water quality programs currently comes from federal grants, state general funds, permit fees, and other sources such as bonds and special taxes. The breakdown of these funding sources varies greatly from state to state. In one state, its own general funds provide almost 80 percent of total program funding; in another state. permit fees are the source of over 80 percent of what it spends. The federal share of states' water program funding ranges from less than 10 percent to more than 80 percent.

These differences suggest the Task Force should devote effort to identifying various options for ensuring there is sufficient funding for state water programs. States also need to gain a better understanding of what criteria EPA uses to allocate the federal share of each state's funding and how they might work toward greater parity in the percentage of state water program costs paid by EPA. Again, with better data about funding sources and the extent of water pollution in each state, EPA and state agencies will be better equipped to demonstrate to Congress, state legislatures, the regulated community, and the public why certain states or certain water program elements within some states may need additional funding.

The range in state permit fees makes this point clearer. The State Expenditures Survey shows that a few states obtain little or no water program funding from permit fees; this implies that some additional funding could be derived by assessing fees to cover state workloads in preparing permits for facilities' discharges into water bodies in those states. In contrast, in states that already obtain a sizeable portion of their water funding from permit fees, it may not be possible to increase fees further without the risk of political backlash or decreasing the state's attractiveness when it comes to recruiting new business. Further, states may not be able to use permit fees to fund components of water programs that are not directly related to issuing permits.

In exploring possible sources of adequate and stable funding for water quality programs, the Task Force and EPA should also investigate opportunities to collaborate with other state and federal agencies that share the same concerns about improving water quality and reducing

pollution. In the new Farm Bill, for example, Congress has recently approved major amounts of new funding for monitoring, evaluation, education, and technical assistance to expand agricultural conservation programs.[22] Because state water programs face significant new workloads to control pollution from non-point sources and because many of those sources are agricultural operations, water programs in states with large farming areas may be able to qualify for some of these funds. At the same time, they may also be able to form new partnerships with their sister state agriculture agencies and local conservation districts to work on conserving soil and preventing run-off in ways that will also, of necessity, improve water quality.

RECOMMENDATIONS ON IMPROVING THE EFFECTIVENESS OF WATER PROGRAMS

Recommendation 3-1:

All states should look for opportunities to adopt more cost-effective and efficient practices that will accomplish the goals of their water programs by reducing redundancies, eliminating duplication of efforts, promoting resource sharing, and enhancing collaboration.

Recommendation 3-2:

EPA should actively help states learn from one another about ways they can improve their environmental data systems. Specifically, EPA should share information about cost-effective methods for collecting information, conduct or fund research on emerging technologies that may help states to monitor environmental conditions more easily, and deploy new methods for measuring environmental results that can be used by many states.

Recommendation 3-3

States should work through national associations, such as the Environmental Council of the States (ECOS) and Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), to establish effective mechanisms for sharing best practices and techniques for managing water programs more efficiently.

Recommendation 3-4:

States should also be prepared to make substantial investments in improving their environmental data systems and installing advanced information technologies, such as remote sensing and geographic information systems (GIS), that will enhance the collection and analysis of water quality data, so they can ultimately reduce the costs of managing their water programs by focusing their efforts on the most important water pollution problems.

Recommendation 3-5:

States and EPA should work in partnership to implement performance-based management and build their joint capacity to prioritize water pollution problems, target shared strategies to address those problems, use better data to evaluate their progress, and modify their joint initiatives, where needed, to produce more effective results as measured by water quality outcomes.

Recommendation 3-6:

The State Task Force should work with EPA to involve additional state and federal agencies in developing a comprehensive strategy for coordinating any additional sources of state, federal, or local funding for water programs and to ensure that all investments of currently available federal, state, and local funding are focused on activities that will improve the states' ability to enhance and protect water quality.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), Briefing presented to Academy Panel (Washington, D.C.: September 20,2002).
[2] Ibid.
[3] Ibid.
[4] R. Steven Brown, *States Put Their Money Where Their Environment Is—State Environmental Spending*, ECOStates (Washington, D.C.: Spring 2001). Available at http://www.sso.org/ecos/ECOStatesArticles/rsbrown.pdf. See also National Association of State Budget Officers (NASBO), *State Expenditures Report—2001* (Summer 2002). Available at http://www.nasbo.org/Publications/PDFs/nasbo2001exrep.pdf.
[5] Correspondence with attachments from Susan L. Sylvester, Administrator, Division of Water, Wisconsin Department of Natural Resources to State Water Quality Directors, "Water Program Gap Analysis*"* (November 8, 2002).
[6] see http://www.nga.org.
[7] U.S. Census Bureau, webpage "Federal State and Local Governments: State and Local Government Finances" (December 12, 2002). Available at http://landview.census.gov/govs/www/estimate.html.
[8] See http://www.nasbo.org.
[9] Brown, *States Put Their Money Where Their Environment Is.*
[10] U.S. General Accounting Office, *Environmental Protection: Grants Awarded for Continuing Environmental Programs and Projects* GAO-01-860R (Washington, D.C.: June 29, 2001). Available at http://www.gao.gov/new.items/d01860r.pdf.
[11] State Task Force, 19 state data summary provided to the Academy.
[12] State Task Force, *State Water Quality Management Resource Analysis Needs Model (Needs Model), Five-Year Summary of Needs.* (Washington, D.C.: April 1, 2002). The "Current Need" column of the Five Year Summary shows all the resource needs totals, module by module, as calculated using the Model's default values. The resource needs for the four point source modules is subtotaled ($6,119,873), which is 23 percent of the total resource needs for all modules ($26,125,980).
[13] *Solid Waste Agency of N. Cook County v. Corps of Engineers*, 121 S.Ct. 675 (2001).
[14] U.S. Environmental Protection Agency (EPA), *The National Costs of the Total Maximum Daily Load Program.* (Washington, D.C.: August 2001).
[15] EPA, *1996 Clean Water Needs Survey*. Available at http://www.epa.gov/owm/mtb/cwns/1996report1/index.htm.
[16] State Task Force, *Needs Model, Wetlands Module.*
[17] NASBO, *1999 State Expenditure Report* (June 2000). Available at http://www.nasbo.org/Publications/PDFs/exprpt99.pdf.
[18] National Academy of Public Administration (NAPA), *Environment.gov: Transforming Environmental Protection for the 21st Century*," (Washington, D.C.: 2000), 93-133, and accompanying research papers 7 through 10 on Governance in *Watershed Vol. II* (November 2000).
[19] U.S. General Accounting Office (GAO), *Water Quality: Key EPA and State Decisions Limited by Inconsistent and Incomplete Data* RCED-00-54 (Washington, D.C.: March 15, 2000); GAO, *Water Quality: Identification and Remediation of Polluted Waters Impeded by Data Gaps* T-RCED-00-131 (Washington, D.C.: March 23, 2000); GAO, *Water Quality: Inconsistent State Approaches Complicate Nation's Efforts to Identify its Most Polluted Waters* GAO-02-186 (Washington, D.C.: January 11, 2002); GAO, *Water Quality: Better Data and Evaluation of Urban Runoff Programs needed to Assess Effectiveness* GAO-01-679 (Washington, D.C.: June 29, 2001).
[20] NAPA, *Evaluating Environmental Progress: How EPA and the States Can Improve the Quality of Enforcement and Compliance Information* (Washington, D.C.: June 2001).
[21] See http://www.whitehouse.gov/omb and http://www.results.gov .
[22] P.L. 107-171, *Farm Security and Rural Investment Act of 2002*.

LIST OF APPENDICES

APPENDIX A

STATE EXPENDITURES SURVEY

Overview

The purpose of the State Expenditures Survey was to determine how much states are currently spending on the management of water quality programs. The State Task Force decided to survey the states directly to collect data on water management expenditures after concluding there were no national databases containing accurate information on state expenditures for managing water quality programs.[1]

Survey Instrument. The Task Force developed a survey instrument, which was distributed to all 50 states by the Environmental Council of the States (ECOS) in December of 1999. The states were directed to use a team of water quality program managers and budget/financial staff to complete the survey. In the survey, each state was asked to provide:

- The state's total current appropriation for management and implementation of water quality programs;
- An estimate of the percentages of state expenditures that came from state general purpose funds, the federal government, fee revenues, and other sources such as bond revenues; and
- An estimate of the percentages of total expenditures for each of the activity or program categories (modules or sub-modules in the survey instructions) listed below:

	Module	Sub-Module
1	Point Source Controls	Permitting Compliance Enforcement Septage
2	TMDLs, Standards, Reporting, Monitoring	TMDLs Reporting Water Quality Standards
3	NPS, Lakes, Wetlands	Nonpoint Sources Clean Lakes Wetlands
4	Coastal, SRF, Planning, Data, Regional	Coastal and Marine Clean Water SRF Data Management

The Task Force's instructions on how to complete the Expenditures Survey provided detailed directions on what was to be included and excluded from the states' expenditures estimates.

Items to be included: Expenditures related to the management of state water quality programs, or those activities that constitute each state's water quality program to restore and protect surface water as envisioned in the federal Clean Water Act (CWA).

Items to be excluded: Expenditures related to infrastructure improvements or the activities of local entities or non-governmental organizations (NGOs)), such as the implementation of best management practices. Also excluded were appropriations for the following:

- Drinking water, underground injection control, and most activities related to ground water (except for permitting of ground water discharges);
- Grants or loans to publicly-owned treatment works, local governments, and NGOs;
- SRF loans and Section 319 grants (except planning for and managing those loans and grants; and
- Ground-water clean-up, underground storage tanks, and review of plans and specifications for septic systems.

The Task Force believed these detailed instructions were sufficient for accurate reporting by the states because the Survey was similar to prior surveys by ECOS, ASIWPCA, and other state associations. As a result, no additional training was provided. A Task Force member and a consultant were listed as contacts for anyone having questions or needing assistance.

Survey Results. The Expenditures Survey was completed in full by 36 states.[2] The Task Force extrapolated data for the remaining 14 states using a regression analysis which is described in Appendix F. Combining the state-submitted data and extrapolated data, the Task Force estimated the national expenditures for managing state water quality programs fell within the range of $722 to $805 million per year.

The Expenditures Survey also yielded other important information. For example, Figure 1 below illustrates how state expenditures were reported by program area. The percentages shown are based on an average of the percentages reported by 36 states.

The Expenditures Survey also yielded information on the sources of state funding, which is illustrated in Figure 2 below. The majority of water program funding came from state tax revenues (40 percent) and federal funding (31 percent). The remaining funds came from state revenue fees (19 percent) and "other" funding sources (10 percent) such as bond funds, restricted trusts, special funds, and special taxes.

Figure 1 **State Expenditures on Water Quality Management Programs (by Program Area)**[3]

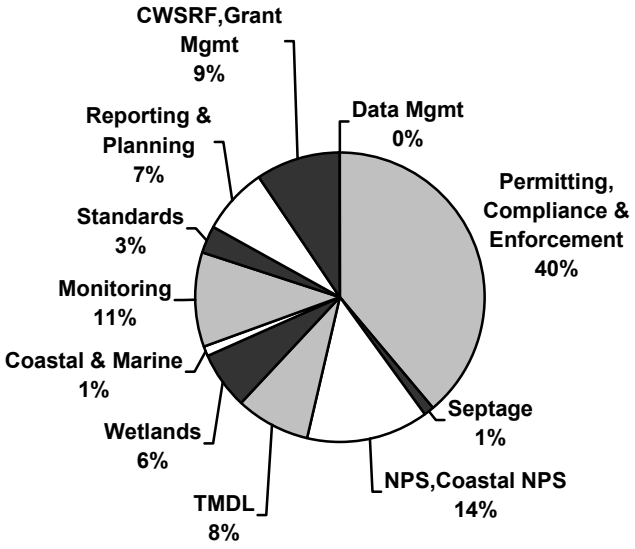
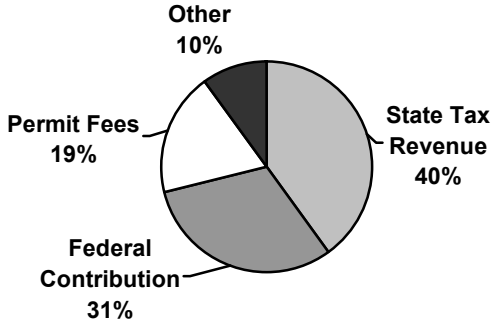


Figure 2 **Sources of Funding for State Water Quality Programs**[4]



Observations and Analysis

States used a variety of approaches to collect information for the State Expenditures Survey. Academy researchers contacted the individuals from ten states who had personally submitted the data to ask them how they approaches and completed the Survey. Of the tend states where interviews were conducted, five states were actively involved in the Task Force's work, and the other five were not.

Academy researchers asked several basic questions:

- Who gathered the data? What personnel were involved?
- What was the source of the data? What agencies were involved?
- How detailed were the data? Did the state use appropriations, agency budgets, activity reports, timesheets, or other kinds of data?
- How long did the survey take to complete?
- What fiscal year did the state report, either federal or state fiscal year?

From the interviews, researchers learned:

- Those who gathered the data ranged from agency staff and managers to state budget officers.
- Among the organizations participating in data submission were state water quality agencies, state legislatures, state agricultural agencies, and state fish and wildlife agencies.
- The sources of the data included state appropriations documents, past agency budgets, agency financial data systems, timesheets, and activity reports.
- The length of time to complete the Survey ranged from a few hours to one or two days, depending on the state.

Most states reported using the July 1 to June 30 fiscal year.

Situations where more than one state agency is responsible for implementing and managing the water quality program can make data collection more difficult. Where an appropriation is shared by more than one agency, it was left to the state to determine how much of that appropriation had been spent on management and implementation. For example, water agencies in two states said they share funds with agricultural agencies. In one of these states, the water agency receives the full appropriation and subcontracts with the agricultural agency. In the other state, the agricultural agency provided the water agency with a gross estimate of its expenditures for the nonpoint source program. The second state also had to estimate expenditures with the state fish

and wildlife agency to determine an estimate for implementing its water quality monitoring program. Based on these interviews, it appears that the states are aware of overlapping duties, and that water agencies consulted other agencies when necessary to complete the Expenditures Survey.

Alternative sources of state information about environmental expenditures are aggregated at too high a level to serve as a source of information about specific state water programs. Sources investigated by Academy researchers include the National Governors' Association, the U.S. Census Bureau, the National Association of Budget Officers (NASBO), ECOS, and the General Accounting Office (GAO). In most cases, the data collected by these organizations are either highly aggregated or presented in conjunction with other expenditures that are unrelated to the narrow scope of the State Expenditures Survey.

NASBO: NASBO's *State Expenditures Report* aggregates expenditures by major category: Medicaid, transportation, public assistance, higher education, elementary and secondary education, and all other programs (including environmental projects, housing, etc.). State capital expenditures separate environmental expenditures from the "all other" category, but the aggregate number cannot be used to identify program expenses.[5]

Census Bureau: The U.S. Census Bureau's FY 1999 *Summary of State and Local Government Finances* lumps together many environmental program areas: conservation, promotion and development of natural resources, provision of sanitary and storm sewers and sewage disposal facilities as well as services and payments to other governments for such purposes, solid waste collection and disposal, and provision of sanitary landfills and resource recovery facilities.[6]

GAO: In April 2001, GAO analyzed grants from EPA to states, local governments, NGOs, and universities over the five-year period from 1996 to 2000. As part of its research, GAO used EPA's electronic database of grants to determine the amount of funds that had been distributed to states for continuing environmental program grants (excluding infrastructure) for each of these years. In 1999, the amount EPA provided to states for managing water quality programs was $549.3 million; in 2000, the amount was $594.5 million.[7] However, these totals cannot be compared directly to estimates of the federal share of state funds in the State Expenditures Survey because they are not based on all of the same water programs and activities.

Nationally aggregated data on the sources of funding for state water programs masks wide variability among the states in the relative contribution made by state general revenues, federal grants, permit fees, and other sources.

The *Interim Report* of the State Task Force includes nationally aggregated information about the percentage of state funding for water quality programs derived from state revenues (40 percent), EPA (31 percent), permit fees (19 percent), and other sources (10 percent).

Academy researchers later obtained updated expenditures and revenue source data from 37 states, although the *Interim Report* is based on data from 36 states. After adding one state, the national average for the federal share is slightly higher: 37 percent. Examining the data on all

37 states reveals considerable variation in the relative share of state funding provided by each funding source.[8]

	Lowest	Average	Median	Highest
State general revenues	0%	37%	39%	79%
Federal contribution	8%	37%	37%	85%
Fee revenues	0%	19%	17%	86%
Other sources (bonds, etc.)	0%	0%	0%	81%

For example, the federal government's contribution is less than 20 percent in 6 states, between 20 percent and 40 percent in 17 states, between 60 percent and 80 percent in two states, and over 80 percent in one state. There are similar variations in the extent to which state programs are supported by state general revenues and fees.

One of the recommendations in the *Interim Report* is to work toward a goal of "parity" in 10 years between state and federal shares of funding for water quality programs.[9] It is unclear from this statement whether the Task Force intended for each state eventually to receive about the same share of funds from EPA.

The activity and program categories in the State Expenditures Survey and Needs Model are not the same, so it is not possible to make direct comparisons between current expenditures and resource needs below the aggregate.

The Task Force conducted the State Expenditures Survey while still developing the Needs Model for assessing the states' workload and resource needs, so program and activity categories in the two tools are not the same. Therefore, at this juncture it is not possible to directly compare water quality expenditures to resource needs for all program areas at either national or state levels.

One state's experience already shows the advantages of using the same categories for both tools, and for completing them at the same time. Once the Needs Model was ready, the state went back and completed it simultaneously with the State Expenditures Survey. As a result, the state was able to cross-check its data, identify where resource needs or program activities had been improperly assessed, and re-evaluate assumptions about both water program needs and expenditures. Because it used the same categories, this state was further able to see where the resource gaps were greatest, and make appropriate adjustments in staffing and resources.

Using the same categories in both data collection tools would have comparable advantages at the national level. Currently, the resource gap can only be estimated for the costs of managing the entire water program. This aggregate estimate does not provide any guidance to decision-makers about which components of water programs have the greatest resource needs or are closest to having sufficient funds.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), Briefing presented to Academy Panel (Washington, D.C.: September 20,2002).
[2] States reporting full data include: AL, AK, CA, CO, DE, FL, HI, ID, IL, IN, KA, LA, MD, MS, MN, MI, MO, NH, NJ, NY, NC, OH, OK OR, RI, SC, SD, TN, UT, VT, WA, WV, WI, and WY. Texas reported partial data.
[3] State Task Force, *State Water Quality Management Resource Analysis -- Interim Report on Results* (Washington, D.C.: April 1, 2002).
[4] Ibid.
[5] The National Association of State Budget Officers, *State Expenditure Report—2001* (NASBO, Summer 2002). Available at http://www.nasbo.org/Publications/PDFs/nasbo2001exrep.pdf.
[6] U.S. Census, *Federal, State, and Local Governments, State and Local Government Finances, State Summary Tables – 1999* (1999). Available at http://landview.census.gov/govs/www/estimate99nslist.html.
[7] U.S. General Accounting Office, *Environmental Protection: Grants Awarded for Continuing Environmental Programs and Projects* GAO-01-860R (Washington D.C.: June 29, 2001). Available at http://www.gao.gov/new.items/d01860r.pdf.
[8] State Task Force, 19 state data summary provided to the Academy.
[9] State Task Force, *Interim Report*.

APPENDIX B

NEEDS MODEL: OVERVIEW AND GENERAL ASSUMPTIONS

Development of the Needs Model

In meetings and interviews, State Task Force members told Academy researchers they wanted to develop a common framework and language for estimating state resource needs. Reasoning that more states would participate in a data collection effort if they could see tangible benefits for themselves in pulling together the information, Task Force members envisioned a tool that would:

- provide a systematic way for estimating the resources states need to implement water quality programs and develop a national estimate of the resource gap, and also

- be useful to individual states for budget development, planning, and other state purposes.

Task Force members decided that a detailed workload model would meet these dual goals. To develop the model, they began an extensive collaborative process designed to tap into the more than 20 years of field experience in implementing water quality programs under the Clean Water Act (CWA). A series of focus groups and working sessions drew participants from 38 states.[1]

Based on their own direct experience in water quality program management, and often supported by state records, the state participants:

- determined the overall design criteria for the model
- developed the assumptions underlying the model
- defined the model's components
- broke out in detail the actual work activities associated with each component
- developed default values for each of the individual activities (with the expectation that individual states would change them based on their own programs)

To help ensure that the model would reflect the perspectives of all states, draft products were also circulated to all 50 states for review and comment. EPA experts in each of the water program areas provided technical information and advice.

Conceptual Framework

The basic conceptual framework for the Needs Model is simple:

1. Identify all of the activities associated with implementing the various CWA programs (e.g., issuing permits, conducting inspections, developing rules).

2. Estimate the number of work hours it takes to complete one unit of each activity.

3. Multiply the estimated number of work hours required to complete one unit of each activity by the estimated number of such activities to be completed during a year.

4. Multiply the total number of hours per activity by the salary costs per hour.

5. Add the cost totals for all activities together to arrive at the state's total resource needs.

The Needs Model also provides opportunities for states to include the direct costs of contractors that provide support services, such as for sample analysis or data system development, in their needs estimates.

Structure of the Needs Model

States can download the Needs Model in an automated spreadsheet format at the website of the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA): www.ASIWPCA.org/programs/docs/WQModel18.xlt. Footnotes give detailed instructions, explanations of assumptions, and other information to help state officials fill in the requested data.

A useful frame of reference for thinking about the size and scope of the model is the total number of person-hours of work it represents. It takes about 600,000 person-hours to complete all of the water program tasks when the model's variables are set to their default values.

The workload model divides the activities associated with managing water programs into 14 modules, as shown below. A General Assumptions section requests information about state employee costs as well as the number of hours in a work year; these assumptions affect calculations for the entire model. A Point Source Worksheet requests information on state inventories of various categories of point sources of water pollution; the inventory data affect calculations for the four modules dealing with point sources.

Most of the modules are aligned with relatively discreet components of water quality programs, but several modules cover activities that cut across multiple program areas. The modules are listed below; each is explained in detail in Appendices C through E.

Point Source Modules -- Point Source Assumptions Worksheet, Permitting, Compliance and Assistance, Enforcement, Septage (see Appendix C)

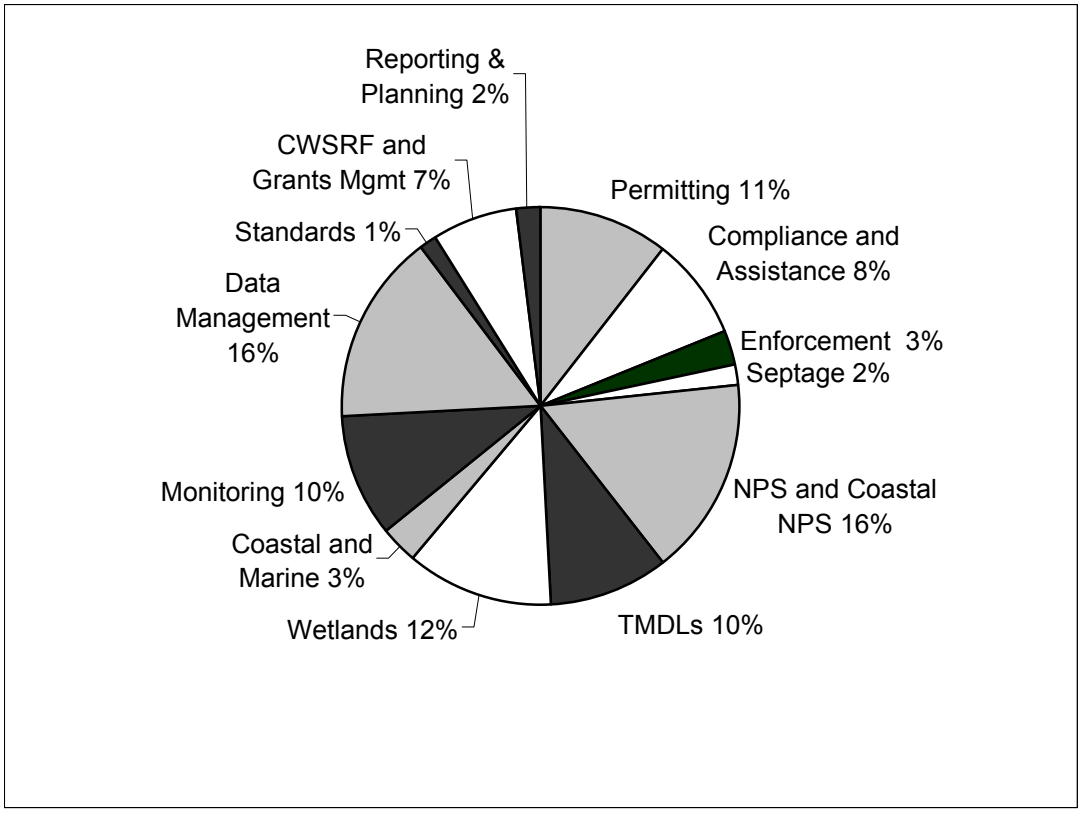
Other Program Modules -- Nonpoint Source and Coastal Nonpoint Source, Total Maximum Daily Loads, Wetlands, Coastal and Marine Waters (see Appendix D)

Cross-Cutting Modules -- Monitoring, Data Management, Water Quality Standards, CWSRF and other CWA Grant Management, Reporting and Planning, Regional Initiatives (see Appendix E)

The total costs associated with implementing the water quality management activities in each of these modules vary. Figure 1 shows the relative contribution of each module to the total estimated costs of managing state water quality programs. These percentages are based on the

current needs of a typical state, using the default values developed by the focus groups for the Needs Model.

Figure 1: Percent Contribution of Each Module to Total State Resource Needs[2]



Each of the data cells in the modules contains a default value, but the instructions strongly urge states to change these values to their own numbers. Once state data have been entered into all of the cells for a module (or the pre-entered default values have been left in place), the model makes automatic calculations of total work hours and costs for that module; it also calculates state totals for all completed modules. At their option, states can complete all or just some of the modules.

The modules typically contain these elements:

- Instructions for completing the module,
- The work activities covered by the module,
- Assumptions underlying the module, such as assumptions about what constitutes an adequate program,
- Explanation of where potentially overlapping topics are covered in other modules,
- Default values for every "cell" in the model (which states are urged to modify) ,
- A place to record direct costs, such as costs of contracts or lab analysis, anf
- Optional data field for recording state-specific program costs.

NEEDS MODEL: GENERAL ASSUMPTIONS

Overview

In essence, the model calculates the workload by multiplying the number of work hours it takes to complete one unit of each activity by the number of activities to be completed. The total number of hours is then multiplied by the cost per work hour of a Full-Time Equivalent (FTE) employee to arrive at the estimated cost.

Consequently, assumptions about two variables "drive" the costs in the workload model. These variables are:

- The annual cost of a fully loaded FTE (includes overhead costs such as fringe benefits, administrative support, office space, equipment, and supplies), and
- The number of actual work hours available per FTE work year (after sick, holiday, vacation, and personal leave hours).

The annual cost of an FTE divided by the number of work hours per FTE year is the cost per work hour.

The default value for cost per fully loaded FTE is $70,000, and the default value for average number of work hours is 1,800 hours. These default values were based on the median values from participating states and the best professional judgment of Task Force members. At the beginning of the study, the State Task Force had expected it to be relatively easy to find the FTE cost and the number of hours per work year in each state's budget and spending information. However, determining these numbers proved difficult. Unable to find a readily available national source for state FTE costs and deciding that the additional investment that would be required to get more accurate data was not warranted, the State Task Force agreed to use the median values from participating states and their professional judgment as the basis for the defaults.[3]

In developing the FTE cost formula and deciding what costs should be included in the "fully loaded" definition, the Task Force gave substantial consideration to existing state practices. While how states calculate FTE costs for budget and other purposes vary, the factors relevant to the formula are pretty much the same. Instructions in the Needs Model define fully loaded costs as the sum of fringe benefits (health coverage, vacation, sick, and holiday time, etc.); general training; indirect expenses such as professional support (administration, accounting, clerical, etc.); office space, utilities, telephone service, copiers, fax machines, and basic computing needs. The costs of computer maintenance or periodic hardware or software upgrades are not included.

Observations and Analysis

Because the values are multipliers for almost everything else in the model, FTE cost and number of work hours in a year have the greatest potential impact on both the national and individual state resource needs estimates. As explained earlier, the model covers more

than 600,000 person-hours of work. Since the total state resource need is based nearly entirely on the number of person-hours of work multiplied by the per-hour cost of an FTE, an error in FTE cost would be magnified 600,000 times in the state's total.

The average number of hours that an FTE is actually available for work directly affects the number of people who must be hired. The model defines tasks by the number of hours taken to complete them. Total hours are then translated into the number of FTEs that would be needed to carry out that work, using the assumption that the hours per FTE-year should include only hours actually worked. For example, based on the default value of 1,800 work hours in a year, an activity that would take 2,700 hours would require 1.5 FTEs to complete. (The default value of 1,800 hours in an FTE work year assumes an employee works an eight-hour workday and has 280 hours off for sick, holiday, vacation, and personal leave.)

There are pitfalls in making direct comparisons of fully-loaded FTE costs among the states. The instructions for the model list the costs that should and should not be included in the fully-loaded FTE cost. However, the instructions are subject to differing interpretations. If a state's accounting records cannot be readily aligned with how fully-loaded FTE costs are defined in the model, it may be difficult for the state to make an accurate estimate of the average fully-loaded FTE cost.

Further complicating the issue is the concept of the "average" fully-loaded FTE cost. For fully-loaded FTE costs, the Task Force sought to develop a figure that would represent the salary of an "average" water program official. They agreed that the average cost of all state employees, encompassing all kinds of workers, would be inappropriate for water program officials who normally need specialized training and skills. To ensure that participating states submit comparable estimates of FTE costs in future versions of the model, the State Task Force might consider defining the level and kind of worker to be represented as the "average" water program official.

Most participating states did provide their own data for FTE costs and hours per work year. Among the states that did provide these data, there was considerable variation. As the table below shows, 10 of 16 states provided their own values for the number of hours in a work year, and 13 of 16 provided their own values for average FTE cost. This suggests that most states may be able to produce this information. Significantly, the Academy found considerable variation in both FTE cost and hours per work year across the 16 participating states. FTE costs ranged from a low of $55,000 to a high of $90,000, while hours per work year ranged from 1,500 to 1,950 hours.

			Based on actual data from 16 states					Based on 19 reporting states
Item		Default Value	# of States Using Default	# of States Using Own Value	Average for all 16 States	Average *only* for States Using Own Value	High-Low Range for States Using Own Value	Average for 19 reporting States
Hours per FTE-year		1,800 hrs	6	10	1,750 hrs	1,720 hrs	1,950 hr s - 1,500 hrs	1,744 hrs
Annual cost per FTE (fully loaded)		$70,000	3	13	$79,192	$73,603	$90,000 - $55,000	$77,186

The model asks states to enter FTE costs and work year hours separately, but they are inter-related. A high state salary combined with a large number of work hours in a year may mean that the per-hour cost for that state is actually lower than a state that has a lower state salary but also a low number of work-hours per year. Consequently, comparing state FTE costs alone can be misleading.

To develop a standard unit that would allow for costs to be compared across states, Academy researchers developed a simple formula for calculating a "cost per work hour."

Formula: Annual FTE cost *divided by* hours per FTE year *equals* cost per work hour

Using this formula with the default values of $70,000 FTE employee cost and 1,800 work hours per year, the cost per work hour is $38.33. Using this formula with actual data from 16 states, Academy researchers found:

highest cost per-work-hour	$50.00
average cost per-work-hour	$41.67
median cost per-work hour	$41.46
default cost per-work-hour	*$38.33*
lowest cost per-work-hour	$28.20

Errors in state FTE cost per work hour could be significant for a state's own estimates. Academy researchers wanted to know how sensitive the model was to errors in estimates of FTE costs per work hour. So they performed an experiment: they ran the model with the default numbers and then with actual data submitted by states on cost-per-work-hour. In the experiment, total costs deviated 25 percent plus or minus from those produced in the default model. As the table below shows, using the median "reported" FTE per-hour cost results in approximately 6 percent higher total states costs (or $1.6 million) than the "default" total costs. When viewed within the context of an individual state's water program budget, this is a significantly larger number.

	FTE Cost-Per-Work-Hour	Total Cost for for Model (based on defaults)	Percent Difference from the Default Calculation
Lowest Actual	$28.21	$19,675,435	- 24.69%
Default	$38.88	$26,125,980	0.00%
Average	$41.86	$27,916,237	+ 6.85%
Median Actual	$41.67	$27,795,633	+ 6.39%
Highest Actual	$50.00	$32,804,591	+ 25.56%

At the national level, though, the significance of errors in state FTE per hour costs diminishes. A simple demonstration illustrates the relatively small impact at the national level: the difference between the total cost of the model for 50 states using the default value and the cost for 50 states using the median value is less than $100 million.

Total cost of model using DEFAULT value: $26,125,980 X 50 states = $1.30 billion
Total cost of model using MEDIAN value: $27,795,633 X 50 states = $1.38 billion

A workload model developed for the drinking water program may provide useful information on state salaries for the Needs Model. Academy researchers tried to find other sources of information regarding state salaries, using the category of "professional engineer" as a surrogate for an average water quality official. In addition to searching websites of the National Association of State Budget Officers, National Governors Association, and state budget offices, they searched for general state salary information. Nothing useful was found.

The workload model of the Association of State Drinking Water Administrators (ASDWA)[4] may provide some insights for refining FTE costs in the Needs Model refinements. ASDWA's model also goes through a process of estimating salaries along with their associated overhead and direct costs attributable to develop the cost of a fully loaded FTE.

Despite the overall similarity in approach, the ASWA model may not be a good one to draw on, however, because it uses multiple default values. Specifically, there are five different categories of states, ranging from a "Very Small State" to a "Very Large State," with FTE costs varying from a low of $52,527 for the smallest states to $93,631 for the largest states.

Additionally, the ASDWA model is confusing in terms of how it incorporates fringe benefits, overhead and direct costs in its estimates of fully loaded FTE costs. For example, it is unclear whether the overhead ratio of 23 percent of salary includes wage plus fringe benefits, or whether the fringe benefits and overhead are additive to the base wage. This lack of transparency makes it difficult to compare its estimates with the Needs Model estimates.

Considering these two issues, the ASDWA numbers can only be used as a broad rule of thumb for a range of FTE estimates.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), Briefing presented to Academy Panel (Washington, D.C.: September 20,2002).
[2] State Task Force, *State Water Quality Management Resource Analysis -- Interim Report on Results* (Washington, D.C.: April 1, 2002).
[3] Personal communications between Academy researchers and Cadmus Group representatives (October and November 2002).
[4] Association of State Drinking Water Administrators, *Drinking Water Self Assessment* (2000).

APPENDIX C

NEEDS MODEL: POINT SOURCE MODULES

Overview of Point Source Modules

Four modules in the Needs Model collectively describe state activities related to controlling point sources of water pollution: the Permitting Module, the Compliance and Assistance Module, the Enforcement Module, and the Septage Module. Each module describes a separate set of activities related to point source pollution control. The modules relating to Permitting, Compliance and Assistance, and Enforcement are the primary modules of this group in terms of size and complexity and are applicable in almost every state. The Septage Module is comparatively insignificant and is relevant in only some states.

In addition to the four modules, there is a Point Source Assumptions Worksheet that states must complete before the Point Source Modules. The Worksheet collects data on facilities subject to the National Pollution Discharge Elimination System (NPDES) program and on permits issued to different categories of point sources. These data are then automatically incorporated into the four subsequent Point Source Modules.

In this appendix, observations that relate generally to all or most of the Point Source Modules are followed by more detailed analysis of the Worksheet and each Point Source Module.

General Observations and Analysis

The state data entered into the Point Source Assumptions Worksheet largely determine the costs of all four Point Source Modules. For any given state, the workload calculated for most activities on all four Point Source Modules depends on the state's inventory of regulated facilities, permits, and other sources. This inventory is covered in the Point Source Assumptions Worksheet that precedes the Point Source Modules. Numbers from this worksheet then become multipliers to calculate resource needs throughout the Point Source Modules.

The Task Force designed the default values, which represent the inventory of regulated facilities for non-participating states, to reflect the requirements of a typical, or average, state. Due to the variability in state programs, this approach may not accurately reflect the collective needs of all states. Differences between actual state inventories and the default values can have a very small or very large impact on total state resource needs, depending on the amount of work hours required for the activities associated with each type of facility. For example, issuing individual permits for major water pollution sources requires hundreds of work hours per facility, while very few work hours are required to issue a permit for a facility subject to a general permit.

Although the Needs Model does provide a reasonable estimate of national needs, increased state participation in the Resource Analysis project could alleviate any uncertainty caused by using default values for non-participating states. See discussion below on the Point Source Assumptions Worksheet and the individual Point Source Modules for more information and analysis.

The primary Point Source Modules -- Permitting, Compliance and Assistance, and Enforcement -- contain extensive detail that may not be necessary for estimating the national resource needs. The Point Source Modules contain a greater level of detail than modules such as Nonpoint Source (NPS) or Total Maximum Daily Loads (TMDLs), partly because states have more experience with these older and more developed point source programs. Some of the detailed information relates to activities that occur so rarely, or require so little time, that their contribution to the national needs estimate is minimal. This may indicate that a less complex module would suffice to calculate an estimate of national resource needs.

Yet, the extensive detail in the three primary Point Source Modules may be useful to states in their own planning and budgeting processes. Explaining that certain information is not essential for estimating the national need, but may be useful for a state's own purposes, might reduce the burden of completing the Needs Model and thus improve the rate of participation by states.

Point Source Assumptions Worksheet

Overview

Four modules of the Needs Model (Permitting, Compliance and Assistance, Enforcement Module, and Septage) describe state activities related to point source pollution control. Because these modules all rely on many of the same data (numbers of facilities, permits, etc.), the Point Source Assumptions Worksheet helps participating states to set certain constant values with respect to point sources. In each of the subsequent Point Source Modules, the data from this Worksheet is used automatically, in conjunction with other inputs, to calculate resource needs.

The Worksheet requires the states to identify the number or amount (inventory) of various facilities, sites, and general permits in the following four categories:

1. Permitted Facilities, including:

    - Major facilities with individual NPDES permits
    - Minor facilities with individual NPDES permits, including aquaculture facilities and ballast discharges
    - Publicly owned treatment works (POTWs)
    - Power plants with regulated thermal discharges
    - Wet weather discharges, including combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs)
    - Facilities covered by state general permits, including concentrated animal feeding operations (CAFOs), stormwater discharges and other facilities

2. State General Permits

- General *permits* relating to CAFOs, storm-water and other discharges (not the *facilities* registered to use them, which are covered above)

3. Biosolid Application Sites

- Existing, retired, and prospective replacement sites

4. Septage Haulers and Disposal Sites

- Certified haulers
- Approved and future disposal sites
- Only to be used by states that have septage programs

All states must provide data for the first three categories. States that also regulate septage haulers or septage application sites must provide data for the septage category.[1] Although the Worksheet is not, strictly speaking, a module, the four modules grouped under it as Point Source Modules depend heavily on the assumptions and entries states make for the Worksheet.

Observations and Analysis

The numbers of facilities and permits entered on this Worksheet are significant drivers of costs for all four Point Source Modules. The assumptions states make for the Worksheet about the number of point sources -- such as the number of major and minor NPDES permits, wet weather permits, CAFOs facilities and permits, and bio-solid application sites -- are multipliers for all four Point Source Modules. The Needs Model calculates most of the cost estimates by taking a percentage of the number of permitted facilities or sites in the Worksheet and multiplying that percentage by the effort required to regulate each site.[2]

Because data in the Worksheet are used as multipliers throughout the four Point Source Modules, having more actual state data would improve the reliability of resource needs estimates. The State Task Force devoted extensive effort to establishing default values that reflect the needs of non-participating states. However, this approach introduced some uncertainty into the national needs estimate. Future efforts to improve the Resource Analysis project should focus on encouraging more states to participate and, in particular, to submit data for these critical assumptions regarding point source facilities.

Several default values in the Worksheet do not appear to be consistent with averages of actual state data from 19 participating states. Assuming that these 19 participating states are representative of all states (data from two large states considered to be outlier were excluded in calculating the averages), then some default values appear to be set too high, while others appear to be set too low. Specific examples are outlined below. These inconsistencies reinforce the need for achieving greater state participation in order to gain more accuracy and credibility for the Needs Model.

- ***The default value may underestimate the number of POTWs.*** The default value for the number of POTWs per state is 260, which is remarkably close to the average state value of 259 for the 19 stats that submitted data (only 1 state used the default value).[3] In 1996, however, the Clean Water Needs Survey determined that the average number of POTWs per state was about 319.[4]

- ***The default values for the Wet Weather Program and for the General Permit Program are smaller than the average of the actual data submitted by 19 participating states.*** This suggests that the use of these default values may underestimate actual workloads for non-participating states.

	Default	Average State Value
Wet Weather Program CSOs	15	99
Wet Weather Program SSOs	2	40
Stormwater	500	2,765
Other	200	884[5]

- ***The default values for biosolid application sites, septage haulers, and land application sites are larger than the average of the actual data submitted by 19 participating states.*** The inventories of sources submitted by participating states are less than the default values, suggesting that reliance on the default values in the Point Source Modules may overestimate states' workloads for these programs.

	Default	Average State Value
Existing sites for Biosolids	1,000	534
Certified Septage Haulers	465	133
Approved Sites for Septage	3,500	603
New Land Application Sites	350	60 [6]

The Academy's sensitivity analysis showed that the difference between actual state data and certain default values could have a measurable effect on the estimated total current needs for a single state, but the effect on the national needs estimate would be minimal.

For example, the default value for the number of minor facilities with NPDES permits is 800, but state-submitted data ranged from below 100 to above 1,800 permits. To conduct a sensitivity analysis, Academy researchers assumed that the default value for the number of minor facilities with NPDES permits could vary from the actual number by as many as 400 permits, well within the range of state-submitted data. Entering a value of either 1,200 or 400 for the number of minor facilities with NPDES permits into the Worksheet, while keeping the rest of the Needs Model's default values constant, results in a ±17.4 percent change in the total costs of all the Point Source Modules and a ±4.6 percent change in the total current need of a single state.

Academy researchers performed a similar sensitivity analysis for the number of POTWs. State-submitted data for the number of POTWs ranged from less than 20 to over 500. A change in the number of POTW permits of ±150 permits from the default value of 260, results in a ±4.2 percent change in the total costs of all the Point Source Modules and a ±1.0 percent change in the total current need of a typical state. Using the number of POTWs determined by the Clean

Water Needs Survey, 319, produces about a 1.7 percent change in the total costs of the Point Source Modules.

These results highlight the risk in relying on defaults to calculate resource needs for non-participating states, especially where defaults differ significantly from average state values. However, it should be noted that the default values for minor NPDES permits and POTWs are two of the more significant values (by their effect on total costs) for the Point Source Modules. Differences between state-submitted data and the default values for other variables in the Point Source Assumptions Worksheet do not have as great an effect on total state program costs. Furthermore, their effect on the national needs estimate are even less. Thus, the appropriateness of each individual default value for the Point Source Assumptions Worksheet is not necessarily *critical* to providing a reasonable national needs estimate.

The accuracy of the Point Source Modules could be improved in the future by taking into account the potential effects of new policies and programs.

- Animal Feeding Operations (AFOs). The law governing which AFOs are regulated as concentrated animal feeding operations (CAFOs) that must obtain NPDES permits is in a state of flux. EPA has proposed new rules and is in the process of obtaining public comments on its proposal.

  The instructions for the Point Source Modules could clarify that states should incorporate new federal policies and regulations for AFOs and CAFOs, when they become effective, to ensure that estimates of future workload are as accurate as possible. Furthermore, a broader CAFO policy may require more state management effort to develop new individual or general permit terms, to identify and classify animal operations as AFOs or CAFOs, and to issue actual individual permits or general permit authorizations to CAFO facilities. It is possible that some of these additional costs would also be associated with programs covered in the Nonpoint Source and Coastal Nonpoint Source Module.

  EPA has posted on its website contains the State Compendium on AFOs, a compilation of AFO-related state programs to illustrate how states are regulating AFOs.[7] The site, updated in May 2002, contains relevant information regarding state definitions, designation, and regulation of AFOs and CAFOs. Although it is beyond the scope of this report to undertake a state-by-state analysis of the status of CAFO regulation, the availability of these data suggests that there may be additional opportunities for the State Task Force to verify some of its assumptions in this evolving area of CWA regulation. For example, among the information available on this website is actual data about which states use more stringent definitions of CAFOs than EPA's definition, thereby regulating more AFOs as CAFOs and increase state program costs.

- Sanitary Sewer Overflows (SSOs) and Stormwater Discharges. EPA is proposing to clarify and expand permit requirements under the CWA to better address SSOs. The effect of the proposed SSO rule is likely to be significant. EPA predicts that the proposed SSO rule could cost municipalities an additional $93.5 to $126.5 million each year in total.[8] While these

costs may be largely for infrastructure, there could be some state management costs planning, permitting, and enforcement that should be counted by the Resource Analysis project.

EPA also has proposed effluent guidelines for regulating stormwater discharges from construction through NPDES permits, which may increase the workloads for states in the future.[9] It is reasonably certain that state workloads will increase as a result of the new rules for SSOs and other stormwater dischargers. Thus, the future needs predicted by the Needs Model may be too low, and efforts to improve and fine tune the Needs Model could focus on incorporating these and other new and changing water policies and rules.

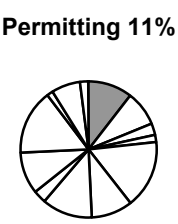
The State Task Force might consider revising the Septage Module default values to reflect a state without a septage program, which would appear to be more consistent with data submitted by participating states. The Module allows participating states to enter "no" if they do not have a program for septage haulers or land application sites, but assumes that non-participating states have both, thereby possibly overestimating the cost.[10] However, the significance of the Septage Module is quite small overall, and has a minimal effect on the national needs estimate.

Specific Observations on the Point Source Modules

Permitting Module

Overview

The Permitting Module is one of four modules that cover state activities related to point source pollution control. The costs for the activities in the Permitting Module represent about 11 percent of total state resource needs, based on default values.



The Permitting Module covers the full range of agency activities related to NPDES point source permitting. Most significantly, the Module covers the costs of NPDES permit issuance and renewal for major and minor facilities, including permits for aquaculture facilities, ballast discharges and permits for thermal discharges under Section 316. These activities include everything from pre-application meetings through draft permit development and public participation to final permit issuance or renewal. Collectively, these activities represent about 68 percent of the total costs covered by the Permitting Module, using default values.

In addition, the Module covers the costs of overall permit program planning and management, development and revision of permit program rules and guidance, administration of permit fees, and general permit development and revision.[11] It also covers the costs of managing permit appeals for major, minor, and general permits. Finally, states can enter numbers to cover the costs of handling extraordinary permits.

The Module relies on each state's data from the Point Source Assumptions Worksheet. To complete the Permitting Module, states entered the percentage of facilities to which a particular activity applies annually (e.g., 20 percent of major NPDES permits will be reissued annually) and the time in FTE hours required to complete one permit. The Module then automatically applied that percentage to the number previously entered on the Worksheet for that type of facility (e.g., 20 percent of the total number of major NPDES facilities) and multiplied the result by the number of hours entered and the hourly rate calculated in the General Assumptions to obtain the total annual cost for the activity. All activity totals were then summed to obtain the state's total for the Module.

Observations and Analysis

The accuracy of the costs in the Permitting Module depends on the accuracy of the inventories of regulated sources in the Worksheet. Depending on the number of work hours required for an activity, the effect of any inaccuracies, or any differences between the default values and actual state data, in the Point Source Assumptions Worksheet could range from very small to fairly significant. If the activities related to a particular type of facility require many employee work hours, the effect of inaccuracies in the relevant inventory for that type of facility could be large. This can be especially problematic where the defaults used to calculate resources needs for non-participating states are not accurate.

For example, in reviewing data from 16 states, Academy researchers found a wide range in the number of facilities receiving minor NPDES permits and the number of facilities subject to general permits for CAFOs and stormwater dischargers. This suggests it may not be possible to represent the number of facilities for non-participating states with one default value.

The potential effect of using non-representative default values can be seen using actual numbers. The default value for issuing a minor NPDES permit is 200 hours, while the default value for authorizing a facility for coverage under a general CAFO or stormwater permit is less than five hours per facility. Thus, the potential for error in overall cost will be much greater for the minor NPDES permit calculations. Although the potential impact on the cost of the Permitting Module may be significant for a single state, the potential impact on the total national need is relatively minor.

Future refinements of the Permitting Module may need to address the increased effort required to incorporate TMDLs into permits. The State Task Force decided to focus the Needs Model on current program requirements. With regard to TMDLs, the instructions and notes for the Permitting Module state that the states' data for permit issuance and renewal should include efforts connected with development or revision of permit limits. Because TMDLs are generally not yet adopted, states did not assess the extra workload associated with incorporating any revisions to discharge limits in other NPDES permits that may be necessary to implement TMDLs.

Incorporation of TMDL-based limitations into permits will likely draw increased public attention and participation in the permitting process, as well as resistance from applicants required who must now meet stricter discharge levels. TMDL-based permits may also involve the

development and use of innovative approaches such as pollutant trading so that permitted facilities can meet new, stricter limits. Thus, incorporating TMDL-based limits into permits may require substantial additional state efforts. Future versions of the Needs Model should cover the states' workloads and costs these additional permit-related work efforts.

To provide a more accurate estimate of needs, the Permitting Module should take into account planned changes to regulations and policies that may increase the number of point sources. In addition to the expected increase in the number of sources required to be treated as point sources (see discussion of the Point Source Assumptions Worksheet above), changes in regulations and policies may increase the number of hours associated with certain activities. For example, changes that affect the number of AFOs subject to NPDES permitting requirements as CAFOs, might require more state work hours.

Fewer than half of the participating states entered independent values for staff workloads to issue water permits, which reinforces the importance of having accurate default values. States may have used a default value because it closely approximates thier own experience, which would validate the default value, or because they have little or no information on which to make different estimates, which would not validate (or invalidate) the default value. The Needs Model provides no mechanism for determining whether participating states used defaults for the latter or former reason. However, to increase confidence in the default values, members of the State Task Force reported that defaults were set after extensive deliberation considering evidence and evaluation of actual times spent on such activities in various states, based on time sheets and other records).

Even so, relatively few states entered their own values for the work hours required to issue permits. This may suggest that the default values are good approximations, especially because they were based on the considerable state experience with issuing permits. However, the Task Force may need to re-visit these default values in the future to ensure they reflect the additional workloads associated with revising effluent limitations to incorporate TMDLs or address other new developments.

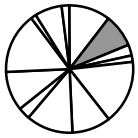
The Permitting Module contains extensive detail that may not be necessary for determining the national needs estimate, but which are useful to states for their own budgeting processes. For a more in depth discussion of this point, see the Point Source Modules Overview above.

Compliance and Assistance Module

Overview

The Compliance Module covers a variety of activities associated with determining whether facilities are complying with the requirements in their individual or general point source permits. The costs for the activities in the Compliance and Assistance Module represent about eight percent of total state resource needs, as estimated by using the default values in the Needs Model.

Compliance and Assistance 8%



Activities in this Module include the review of discharge monitoring reports, which are filed by NPDES dischargers, usually on a monthly basis, to report compliance with its effluent limits, as well as compliance inspections for permitted dischargers. Public outreach, compliance assistance, and water sampling necessary to support compliance activities are also covered in this Module.

All major and minor NPDES dischargers, CAFOs, CSOs, SSOs, and POTWs are covered by this Module. There are also substantial line item allocations for diagnostic inspections of POTWs and for general compliance assistance activities. The allocation for compliance assistance activities is calculated as a percentage of all point source control activities, described in the four Point Source Modules for Permitting, Compliance and Assistance, Enforcement, and Septage. The Module also covers report reviews and inspections of biosolids application permittees. A caveat: the Module covers only monitoring and sampling that is directly related to point source discharges; compliance activities related to wetlands and nonpoint sources are covered in other modules.

Observations and Analysis

The accuracy of the costs calculated in the Compliance and Assistance Module depends on the accuracy of the states' data entered on the Point Source Assumptions Worksheet. This observation is discussed above in the Point Source Modules Overview, Point Source Assumptions, and Permitting Module.

The validity of the "Assistance Activity" add-on in this Module could be strengthened by using outside data sources and by increasing the number of participating states. The Module assumes "[m]any states provide substantial assistance to regulated and unregulated facilities to enhance the ability of these facilities to comply with regulations and protect public health." [12] To account for this expense, the Module includes a default add-on line item for Assistance Activities equal to the sum of ten percent of the total costs from the four Point Source Modules.

After adding on this default percentage, Assistance Activities account for 25 percent of the total cost of the Compliance Module. States are able to change the percentage applied, but 16 out of the 19 participating states chose to leave the default in place. It is unclear whether states chose the default because it was deemed accurate or because the states did not have better information.

Interestingly, one state that entered its own value used 20 percent for the add-on value. This increases the total cost of the Compliance Module by approximately 25 percent, assuming defaults for all the other values. In this situation, the Assistance Activities portion represents approximately 40 percent of the Module total. In short, changes in this default value can substantially alter a state's total resource needs estimate for compliance and assistance activities, which reinforces the importance of using an accurate default value and gaining more state participation. It should be noted, however, that the contribution of this one activity to the national needs estimate is minor.

Academy researchers were unable to replicate the default total for Assistance Activities. Using the numbers provided in the Compliance and Assistance Module and the formula given for determining this line item according to the Module instructions and notes, Academy researchers obtained results that varied slightly from the total included in the default calculations shown for this Module.[13] This default value is calculated by taking ten percent of the total costs for each of the four Point Source Modules (Permitting, Compliance, Enforcement and Septage). Taking ten percent of the total Module values (from the Current Needs columns on each module's summary report, using all defaults), Academy researchers obtained a total for Assistance Activities of $611,987.[14] But the line item in the Needs Model for Compliance and Assistance is $541,498.[15]

The Compliance and Assistance Module contains extensive detail that may not be necessary for determining the national needs estimate, but may be useful to states in their own budgeting processes. For more discussion of this point, see the Point Source Modules Overview section above.

3. Enforcement Module

Overview

The Enforcement Module covers activities associated with investigating complaints about regulated/permitted and unregulated facilities and responding to violations. The costs for the activities in the Enforcement Module represent about eight percent of total state resource needs as estimated by using the default values in the Needs Model.

Violation response includes a full range of initial responses, such as telephone calls or notices of violation (NOVs); follow-up responses such as conferences, administrative orders, civil and criminal referrals; and post referral follow-up activities.

The Module covers enforcement activities for all point sources; and may also cover complaint investigation related to wetlands and nonpoint sources. Complaint investigation activities account for more than 55 percent of the total costs covered by the Module, with investigation of non-regulated facilities alone comprising over 40 percent of these costs. The Module also accounts for the workloads of states' emergency response staffs.

The Enforcement Module works very much like the other Point Source Modules. The Module relies extensively on the inventories of facilities and other data entered in the Point Source Assumptions Worksheet. To complete the Module, states enter the percentage of facilities to which a specified activity applies annually (such as ten percent of major NPDES facilities will require a complaint investigation annually) and the time in FTE hours required to complete one such activity. The Module then automatically applies that percentage to the state's number for that type of facility previously entered on the Worksheet and multiplies the result by the number of work hours entered and the hourly rate calculated in the General Assumptions module to

obtain the total annual cost for the activity. All activity totals are then summed to obtain the Module total.

Two line items for this Module are calculated as add-ons based on a percentage of other line items. The Module assumes the number of non-permitted facilities that will require a complaint investigation is equal to three times the number of complaints investigated for all permitted facilities. States had the opportunity to adjust the actual number generated by the Needs Model (not the multiplier). With respect to the emergency response costs, the Module assumes the size of a state's emergency response staff is equal to a specific percentage of all FTEs dedicated to complaint investigations. The default assumption is five percent, and states could also adjust this number.[16]

Observations and Analysis

The accuracy of the costs calculated in the Enforcement Module depends on the accuracy of the states' data entered on the Point Source Assumptions Worksheet. For a discussion of this point, see the Point Source Modules Overview, Point Source Assumptions, and Permitting Module sections above.

Instructions for the Enforcement Module could be more consistent in explaining whether the line items for complaint investigations are supposed to include investigations related to wetlands or nonpoint sources of pollution. The Module worksheet states explicitly: "Note: This module is not designed to reflect the workload associated with NPS or wetlands enforcement (if applicable). These activities should be covered in the NPS and Wetlands modules, respectively."[17] There is no footnote or other instruction on the Module that indicates any exception to that rule. However, the instructions and training materials imply otherwise in certain places.

For example, the Wetlands Module contains a footnote instruction on the actual Module worksheet (which states use to enter data) stating that wetlands "complaint investigations are covered under the Enforcement Module." [18] The Nonpoint Source Module contains a similar instruction, but it also contains a misprint, telling states the "workload associated with complaint investigations (even for AFOs) . . . is covered in the Compliance Module."[19] The Compliance Module does not cover any type of complaint investigation. Presumably this instruction is intended to refer to the Enforcement Module, as it does in the Wetlands Module.

The directions for this Module should be more consistent and clear to reduce errors when states complete the modules, such as by double counting, or failing to count, complaint investigations associated with nonpoint sources and/or wetlands.

The default assumption for the number of unpermitted facilities requiring complaint investigations is a significant portion of the costs covered by the Enforcement Module, but its accuracy is difficult to assess. The Module assumes the number of unpermitted facilities requiring complaint investigations is equal to three times the number of permitted facilities requiring complaint investigations. Based on this default assumption, states reported a total of 511 complaint investigations at unpermitted facilities. The cost of complaint investigations for

unpermitted facilities is quite significant -- equal to nearly 42 percent of costs covered in the Enforcement Module. Consequently, the Task Force should check the accuracy of this number (specifically the three time multiplier) based on actual state data.

In reviewing actual data from 16 states, Academy researchers found the number of complaint investigations at unpermitted facilities ranged from 20 to well over 2,000, with an average of 1,090 investigations. However, because the Module's default value is calculated as three times the number of investigations at permitted facilities (which in turn is based on both the numbers of facilities entered on the Point Source Assumptions Worksheet and the percentages chosen on the Module itself), it would be extremely difficult to determine whether any states chose to alter the resulting number of unpermitted facility investigations, rather than accept the Module's calculation. Only one state used the default values throughout the Module. In short, with the data available to the Academy, it was not possible for Academy researchers to determine how many states used their own data rather than the default values, or what the average of state submitted data is.

The significance of this activity to the overall cost of the Module suggests it would be worth refining the default assumption to ensure it is as representative as possible. If complaint investigations do indeed consume 40 percent of enforcement resources, it also suggests that this area may be ripe for analysis so states can find ways to increase efficiencies and ensure these resources are being used most effectively.

The Module can probably be simplified without significantly affecting the results. As the Enforcement Module moves through an accounting of violations, it applies successive and increasingly smaller percentages for calculating the number of facilities subject to the various responses. For example, the Module's defaults assume that 50 percent of major NPDES facilities will be subject to an initial response. The Module then assumes that 20 percent of those facilities will require follow-up responses. It then assumes that five percent of these facilities will require follow-up with an administrative orders (AOs), and that 0.5 percent of AO facilities will be subject to civil or criminal enforcement.

The effect of these "cascading" percentages is to create small and, in some cases, rather insignificant numbers of facilities. Using the default number of major NPDES facilities, the number of facilities decreases from 100 facilities subject to an initial response to 0.01 facilities subject to civil or criminal referral annually, actually it would be .005 facilities but is rounded up to 0.01. This number is the equivalent of one referral every one hundred years, which is clearly much less than the usual number of referrals in most states (see below). Although the cost in terms of FTE hours per activity is high -- 1,000 hours per referral -- it translates to only $194 annually.

Many other line items, such as CAFO facilities and stormwater dischargers, result in similar and even smaller totals. The resulting numbers do not contribute significantly to the cost of the Module, much less to the national estimate of resource needs. This may indicate that a less complex module with fewer sub-categories is needed in order to calculate a national estimate of resource needs. The full set of sub-categories may, however, be useful for some states in their own budgeting processes.

The very small default values for some sub-categories of responses to violations may under-represent the actual costs of the states' violation response programs. As discussed above, the small and cascading percentages used for increasing levels of violation response lead to a very small workload cost for each violation response. Even considered collectively, the total resource need for all higher-level violation responses for all types of facilities together -- major and minor NPDES facilities, CAFOs, stormwater dischargers, and other facilities -- amounts to a default value of less than $34,000. That is less than five percent of the total resource needs for the entire Enforcement Module, although taking just one facility's violation through that entire process for higher level response would entail over 1,500 employee work hours for a cost of more than $57,000, based on default values.

In addition, some of the smaller default values are not consistent with the average of the states' actually reported values. For example, actual state data for 19 states shows that average percentages of facilities referred for civil or criminal prosecution were considerably larger than the default assumptions. Specifically:

Facilities subject to Civil/Criminal Referral	Default Value %	Avg. State Value %
Majors (previously subject to AO)	.5	10.4
Minors (previously subject to AO)	.25	8.8
CAFOs (previously subject to AO)	.25	5.2
Stormwater dischargers (previously subject to AO)	.05	7.1

This chart demonstrates that the average of actual state values are at least an order of magnitude larger than the default values. This suggests that, in reality, states make civil and criminal referrals much more often for facilities subject to an administrative order than the default values assume.

Although the overall contribution of this sub-category to the total state needs estimate remains small, even using the average state value, it suggests that the default values may not accurately represent the enforcement costs of non-participating states. These default values should be refined using the data from participating states.

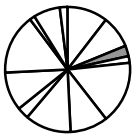
In conclusion, the Enforcement Module contains extensive detail that may not be necessary for determining the national needs estimate, but which may be useful to states in their own budgeting processes once the default values are refined.

Septage Module

Overview

The Septage Module is applicable only to states that have programs to manage the land application of septage wastes by certifying septage haulers and/or approving and inspecting the development of land application sites for septage. The costs of activities associated with the

Septage 2%



Septage Module represent about two percent of total state resource needs as estimated using the default values in the Needs Model.

States have an opportunity essentially to opt out of this Module when completing the Point Source Assumptions Worksheet. States that opt in are asked to enter data on the number of certified haulers and land disposal sites that are then carried forward and used in calculations in the Septage Module. The Module includes separate costs for program planning, management, and oversight; for rule and guidance development; and for regulation of septage haulers through reviewing annual reports, audits, and certification activities. The Module also covers the costs for in-office and on-site review of new and replacement septage application sites.

In contrast to the other point source modules, the Septage Module includes compliance inspections and formal enforcement activities related to septage programs, whereas these activities are included in the Compliance and Enforcement Modules for other point sources. Finally, the Septage Module includes a public education add-on line item that is based on a default value of five percent of the total cost for all other activities covered by the Module.

Observations and Analysis

Although the Septage Module is part of the group of point source modules, it is not integrated with those modules. The Septage Module includes the costs of rule development, compliance inspections, and enforcement, which are covered in the Permitting, Compliance, and Enforcement Modules for all the other point sources. Septage is treated as a set of activities that are separate from the rest of a state's water management program. This separation from the Compliance and Enforcement Modules that are otherwise designed to include all activities within their scope may be confusing to states completing the Needs Model. States that integrate septage regulation with the rest of their water programs may find it difficult to separate the workload associated with compliance and enforcement activities for septage, making it harder to complete the Needs Model.

Actual state data from more states would allow the State Task Force to refine the default values in the Septage Module. Of the 16 states that reported actual data, seven entered zero for numbers of certified septage haulers and land application sites on the Worksheet, apparently because they do not have septage programs. Of the nine remaining states, three relied on the defaults values, so only six states reported actual data for the Septage Module.

However, opting out of the program on the Worksheet apparently does not eliminate all the defaults for the Septage Module itself, which could be changed in future versions of the Needs Model to facilitate analysis of reported state data. Consequently, based on data available to Academy researchers, the extraneous default data makes it difficult to determine the averages of actual state data. With respect to compliance inspections, it does appear that the states with septage programs routinely inspect significantly more permittees than the two percent default value. The overall average including states using defaults was 29 percent, including three states

that apparently inspected all septage facilities at least once per year. The data reported by states suggest that this default value may need to be refined for future estimates.

The overall impact of the Septage Module is minimal. It is important to keep the significance of this Module in perspective. Although it is grouped among the very significant Point Source Modules, the Septage Module alone, even using default values, represents less than two percent of the total resource needs for a typical state. Only the Standards Module is smaller in terms of overall cost impact.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), *State Water Quality Management Resource Analysis Needs Model (Needs Model), General Assumptions for Point Source Modules,* Instructions.

[2] State Task Force, *Needs Model, General Assumptions for Point Source Modules*.

[3] State Task Force, 19 state data summary provided to the Academy.

[4] U.S. Environmental Protection Agency (EPA), *1996 Clean Water Needs Survey*. The CWNS, under the section entitled "Standard Report #1," listed and summed the number of POTWs in each of the 50 states, the District of Columbia and 5 U.S. territories (American Samoa, Guam, North Marinas, Puerto Rico, Trust Territories and Virgin Islands). The number of POTWs in DC and the 5 territories was subtracted from the sum. The average number of POTWs in the remaining 50 states was then calculated. Available at http://www.epa.gov/owm/mtb/cwns/1996report1/index.htm.

[5] State Task Force, 19 state data summary provided to the Academy.

[6] Ibid.

[7] EPA, *State Compendium: Program and Regulatory Activities Related to Animal Feeding Operations* (Washington, D.C.: May 2002). Available at http://www.epa.gov/npdes/pubs/statecom.pdf.

[8] EPA, Office of Water, *Proposed Rule To Protect Communities From Overflowing Sewers* EPA 833-01-F-001 (Washington, D.C.: January 2001).

[9] EPA, *Industrial Water Pollution Controls, Effluent Guidelines* (Washington, D.C.: November 11, 2002). Available at http://www.epa.gov/waterscience/guide/construction/.

[10] State Task Force, *Needs Model, General Assumptions for Point Source Modules*.

[11] State Task Force, *Needs Model, Permitting Module*. For general permits, the majority of effort and expense lies in the initial development, public notice and comment, and final promulgation of the permit (or its subsequent re-issuance). Once the permit is established, the individual application of that permit to specific facilities takes very little time or expense. Typically, facilities simply register to use it. This is in contrast to the individual permit process that requires separate permit development, public notice and comment, and final publication of a unique permit for each permitted facility.

[12] State Task Force, *Needs Model, Compliance and Assistance Module.*

[13] Ibid.

[14] Using the Current Needs totals from the Permitting Summary, Compliance Summary, Enforcement Summary and Septage Summary respectively, the calculation was done as follows:

(.1 x 2,780,954) + (.1 x 2,158,520) + (.1 x 760,285) + (.1 x 420,114) = $611,987.3

[15] State Task Force, *Needs Model, Compliance and Assistance Module.*

[16] State Task Force, *Needs Model, Enforcement Module,* footnote 2.

[17] State Task Force, *Needs Model, Enforcement Module.*

[18] State Task Force, *Needs Model*, *Wetlands Module.*

[19] State Task Force, *Needs Model, Nonpoint Source and Coastal Nonpoint Source Module.*

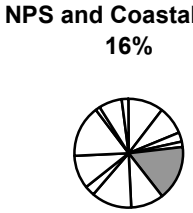
APPENDIX D

NEEDS MODEL: OTHER PROGRAM MODULES

Nonpoint Source and Coastal Nonpoint Source Management Module

Overview

The Nonpoint Source and Coastal Nonpoint Source Management Module (Nonpoint Source Module) covers strategic planning for all state nonpoint source (NPS) programs, including coastal NPS programs. It also includes developing NPS rules and guidance, and managing NPS projects and grants.[1]



The costs for the activities in the Nonpoint Source Module represent about 16 percent of total state resource needs, making this Module one of the most significant.

The Module covers nonpoint source programs required under the 1990 amendments to the Coastal Zone Management Act (CZMA). These coastal nonpoint source programs are included because the 1990 CZMA amendments served as an update and expansion of the Clean Water Act's nonpoint source programs in coastal states, essentially amending the Act to include coastal nonpoint source programs. The programs are only applicable to the 29 states in the United States with marine and Great Lakes coastlines.[2]

Observations and Analysis

The default need estimates in the NPS Module are likely to be lower than a state's actual need. The default value for the amount of effort associated with coordinating locally-based programs and projects may be underestimated. The default value is less than half of the average state value based on actual state submissions (1,800 hours compared to 3,781 hours). Because this single entry accounts for 50 percent of the Module's needs based on the default values, the workload estimate based on the default values is likely to be a very conservative estimate of total NPS needs. Moreover, as NPS and coastal NPS programs continue to be implemented they are likely to grow, and future efforts should focus on developing this Module to reflect this growth.

The State Task Force could consider explicitly defining a nonpoint source to help participating states understand the scope of the Nonpoint Source Module. The absence of a precise definition of nonpoint sources for purposes of completing the Module has the potential to create inconsistencies in what states report, because some states may include the costs of a source that other states may not include.

A 1999 GAO study found that EPA models for assessing the costs of its NPS programs are based on three types of nonpoint sources -- agriculture, silviculture, and animal feeding operations (AFOs).[3] Alternatively, GAO identified five activities that contribute most to NPS pollution, including silviculture, grazing, drainage from abandoned mines, recreation, and

hydromodification.[4] EPA noted that other nonpoint sources are excluded from its model because of a lack of nationwide information.[5] The variation between the GAO and EPA definitions suggests the Task Force should list what it considers to be nonpoint sources for the purpose of completing the Needs Model.

The accuracy of the Module could be improved by addressing the potential effects of new policies for animal feeding operations (AFOs), once these effects are known. The potential inclusion of new policies for AFOs in the Needs Model could have an effect on the workload estimates for the NPS Module, particularly in NPS assessments, which include selecting which AFOs to regulate as CAFOs.[6]

The new policy may affect the Point Source Modules more than the NPS Module, as the costs of permitting, compliance, and enforcement of concentrated animal feeding operations (CAFOs) are covered in the Point Source Modules.[7] However, the workload for dealing with AFOs as nonpoint sources will be reduced to the extent more AFOs are considered CAFOs and thus regulated as point sources. NPS rules are changing in fundamental ways, in contrast with the relatively more "settled" rules regulating point sources, making it more difficult to develop a module that incorporates all of the workload needs for managing NPS programs. The "increasing overlap of [nonpoint sources] with sources regulated under the point source (NPDES) provisions of the Clean Water Act"[8] highlights the need to refine this Module as well as the Point Source Modules as nonpoint source programs evolve.

Many states do not carry out formal enforcement of NPS programs, which raises the question of how to account for this activity in the Module. The 29 states covered by CZMA are required to develop enforceable NPS programs for coastal waters.[9] Section 319 of the CWA allows states to develop enforceable NPS programs or not "as appropriate," but states are not required to have enforceable NPS programs[10] -- and many currently do not. The Task Force determined that an NPS enforcement program is an element of an adequate NPS program and included it in the Module, even though not required by EPA. About 25 percent of the participating states used the default values for the formal enforcement sections of this Module. The default values for NPS formal enforcement activities should be refined based on state submitted data.

The Module could be improved by further clarifying how states should represent the complexity of their NPS programs. NPS programs are often carried out through complex arrangements involving multiple federal, state, and local agencies. This is reflected in the Module's notes which explain that planning and coordination aspects of NPS programs "will require the development of strong working partnerships and collaboration with appropriate state, interstate, tribal, regional, and local entities (including conservation districts), private sector groups, citizen groups (e.g., watershed advisory board), and federal agencies (e.g., EPA, USDA, and DOI)."[11]

The Needs Model does ask states to estimate the workload for interagency coordination for many activities,[12] but it is unclear how or how many states were able to do this while completing the Needs Model. More than half of the states that completed the survey entered their own values for this activity, but it is not clear whether states consulted other agencies in completing this

portion of the Needs Model. The Task Force could consider providing a place for the states to list which agencies share responsibility for implementing elements of the water program such as NPS, and list the agencies whose costs and activities were included in their estimates.

Values varied a great deal among states who entered their own data into the Nonpoint Source Module. The Module relies on 34 default values to estimate the costs. The high variability among states may indicate that some have less developed NPS programs while other states have highly developed programs with much higher workloads.

There was particularly high variation among states in the following entries:

- **Locally-based program/project coordination**, where the average state effort entry was 3,781 hours compared to the default value of 1,800 hours, with a standard deviation of 9,562;

- **Technical assistance for NPS project management**, where the average state effort was 6,900 hours compared to the default value of 1,800 hours, with a standard deviation that exceeds 13,000; and

- **Clean lake program development**, where the average state effort was 964 hours compared to the default value of 200 hours, with a standard deviation of 1,534.

The variability for locally-based program coordination is particularly significant because it represents about 50 percent of the Module's total resource needs (based on default values). This variability in the state data again highlights the need for increasing state participation in the Resource Analysis project.

Efforts to improve the Nonpoint Source Module (and the Needs Model generally) should focus on providing more precise costs associated with this relatively new program. The Nonpoint Source Module seems to have a lower level of detail than the Point Source Modules and other well-established programs based on the relative number of variables and defaults included in the different modules. (There are 34 default values in the Nonpoint Source Module, 44 in Permitting, 75 in Enforcement, 78 in Compliance, and 101 in the Monitoring Module.)[13] As with all the modules, more detail may be valuable to states who choose to use the Needs Model for budgeting and planning.

The Module should address the potential effects of new policies and proposed rules, such as for stormwater discharges, once these effects are known. The potential effects of the proposed stormwater Phase II Rule were deliberately excluded from both the Nonpoint Source and the Point Source Modules. The effects of this rule, when finalized, may increase the costs of NPS control programs.

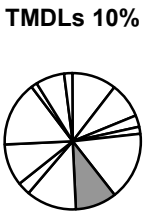
EPA predicts that the proposed Storm Sewer Overflows (SSO) rule could cost municipalities an additional $93.5 million to $126.5 million annually.[14] While these will be primarily local infrastructure costs, there are likely to be additional state costs for planning and coordination with local governments and for rule and guidance development that fall within the scope of the

water quality management gap analysis. In addition, a broader CAFO policy may require more management work to classify CAFO facilities. It is possible that some of these additional costs would be associated with programs covered in the Nonpoint Source and Coastal Nonpoint Source Module.

Total Maximum Daily Load Module

Overview

The Total Maximum Daily Load (TMDL) Module covers all TMDL activities currently required under the Clean Water Act.[15] The costs for the activities in the TMDL Module represent about 10 percent of total state resource needs as estimated by using the default values in the Needs Model.



TMDLs are required by law when a state finds that existing permit controls are insufficient to meet quality standards for that body of water.[16] A TMDL is the maximum amount of a pollutant that can be contained in the water body without violating the water quality standard. In addition, the state is required to establish a wasteload allocation for point sources and a load allocation for nonpoint sources that will meet the water quality standard, allowing for a margin of safety.

EPA is putting more emphasis on the TMDL program as a result of successful litigation against the agency for failure to implement this requirement of the Clean Water Act.

The Module's default values assume that "all known TMDLs" will be completed within 13 years as now required by EPA, and that "related program areas, such as the monitoring, standards, and nonpoint source programs, are adequately funded."[17]

As in the Nonpoint Source Module, TMDL programs are undergoing change at the national and state levels and are subject to greater uncertainty than the Point Source Modules. At the national level, EPA is developing new policies, such as encouraging states to use trading programs as a method for implementing TMDLs, that may increase states' workloads. At the state level, substantial uncertainty remains about which water bodies will require the development of TMDLs.

Observations and Analysis

Because the Module's default values are based on "all known" TMDLs, the Module may underestimate the number of TMDLs requiring development. EPA estimates more than 20,000 water bodies may require TMDLs, but there is substantial uncertainty about which water bodies are subject to this requirement. Many water-bodies have not been adequately monitored to determine if their water quality meets applicable standards.[18] In 1998, 39 states had monitored and assessed the water quality of less than 50 percent of their streams and 18 states had

monitored and assessed less than 50 percent of their lakes.[19] This means that the TMDL workload is likely to increase as more water bodies are monitored and found to require TMDLs.

In addition, the costs associated with conducting the monitoring to assess whether a TMDL is needed are included in the Monitoring Module (and the TMDL Module assumes monitoring receives adequate funding).[20] Once specific needs are known, default values for the Monitoring Module may need to be increased to reflect the additional monitoring needed to support TMDLs.

The number of required TMDLs is likely to remain uncertain for the foreseeable future because of the lack of adequate monitoring data to determine which water bodies will require TMDLs.[21] State water officials have acknowledged that improved monitoring is likely to reveal more water bodies that do not meet water quality standards and thus require development of TMDLs.[22]

Since it is not yet known what EPA will require for the full implementation of TMDLs, the current Module probably will not be a good proxy for future costs of this program. The current configuration of the TMDL Module covers all TMDL activities required under the Clean Water Act as of February 2000, including allocation and implementation analysis and tracking of TMDL implementation.[23] However, it is not designed to cover the full cost of implementing TMDLs. The only implementation activities included in the Module relate to assessing, developing, and negotiating with stakeholders the plans or proposals for implementing TMDLs. Actual costs of implementing TMDLs are not covered.

In the future, the Module also could be refined to include implementation costs to agencies outside the state environmental department, which in the case of TMDLs, may be large. The notes to the Module and the training materials currently do not mention the potential involvement of other state agencies in any aspect of the TMDL program.[24]

The assumption that other programs, such as water quality monitoring, standards, and nonpoint source programs, are adequately funded to support TMDLs may result in a conservative estimate for total TMDL needs for non-participating states.[25]

The needs of non-participating states are based on the Needs Model default values. The default values in the Monitoring Module were deliberately based on existing state experience, and are not designed to reflect the needs for TMDL monitoring,[26] as these needs are not yet clearly known. The General Accounting Office (GAO) has reported that state monitoring programs are currently inadequate to support the needs for determining if TMDLs are required.[27] If the work required to support the development of TMDLs included in other Modules is not adequately funded, states may lack the necessary tools for the development of TMDLs.

The State Task Force might further consider how to reflect efficiencies that currently exist in the TMDL program. Many states have only begun to develop TMDLs, and there may be efficiencies or obstacles unanticipated by the TMDL Module. For example, a watershed approach to water quality management could reduce redundancies in the TMDL program by jointly developing TMDLs in the same watershed.[28] Wasteload allocations previously developed as part of NPDES permitting may also help in the development of TMDLs.[29]

Future refinements to the TMDL Module should incorporate the effects of future TMDL rule changes. Because the Needs Model is based on TMDL activities required as of February 2000, it does not include the potential additional costs related to the July 2000 proposed TMDL rule changes. EPA has estimated the additional costs to states and territories due to this rule change at $23 million annually.[30] Because this rule is currently being revised, the costs associated with it may change, but it is likely to increase states' costs to some degree.

The default values in the Module result in an estimate of TMDL development costs that are significantly higher than estimates made by EPA. The State Task Force could compare the results of the Needs Model with studies by EPA and others estimating the costs of TMDLs, and then explore why its estimates are significantly higher. In "The National Costs of the Total Maximum Daily Load Program (Draft Report)," EPA estimated the total cost of developing TMDLs, primarily by states, at $63 million to $69 million per year nationwide for fifteen years.[31] (This includes the additional provisions of the July 2000 rule.) For the purpose of comparison with the Needs Model's estimate, this amounts to approximately $1.3 million per 'typical' state compared to about $2.5 million using the default values in the TMDL Module.[32]

While EPA's estimate cannot be directly compared to the Needs Model because of differences in scope and assumptions, the large difference in estimates highlights the uncertainty surrounding TMDL development costs, and the need to further refine the cost estimates developed by the Needs Model. Further comparison to estimates of future TMDL costs made by EPA and GAO might help to refine the TMDL Module.

The default values for "contracts issued" for TMDL activities are lower than the average state values for participating states. The default values related to contracts for TMDL activities are as follows: $100,000 for the total value of contracts, zero contracts issued, and 100 hours per contract for the average effort required to manage each contract. This results in a default value of zero for contracts and contract management FTEs.[33] But the average actual state values are significantly higher: namely, $514,005 for the total value of contracts, 11.8 contracts issued, and 172 hours per contract for management time.

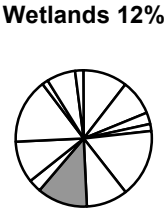
Thus, it appears using the default values to estimate the costs for non-participating states provides a conservative estimate of the costs associated with TMDLs. The instructions note that the default values assume that state employees are developing the TMDLs. If some of the TMDL work is being done by contractors, fewer state employee hours would be needed while contract costs would be higher. Actual state submissions support that assumption: average state staff hours are lower than the default values for most of the TMDL-related activities, while contractor costs are higher.[34]

Efforts to improve the TMDL Module (and the Needs Model generally) should focus on providing more precise costs associated with the TMDL program. The TMDL Module seems to have a lower level of detail than the Point Source Modules and other well-established programs based on the relative number of variables and defaults as a rough measure of detail or precision. As with all modules, an increased level of detail may be particularly valuable to states that use the Needs Model for budgeting and planning.

Wetlands Module

Overview

The Wetlands Module is designed to cover state efforts to regulate activities in wetlands under authority of Clean Water Act Section 404 and/or to certify activities in compliance with state water quality standards under Section 401. The costs for the activities in the Wetlands Module represent about 12 percent of total state resource needs as estimated by using the default values in the Needs Model.



The Module is different from the others because, although there is no opportunity to "opt out" of the Module, many states do not formally implement Clean Water Act requirements with respect to wetlands. Although many states do independently regulate activities that affect wetlands, those efforts are not, strictly speaking, driven by requirements under the federal law.

The Module provides states with several options in how they describe their level of involvement in the federal wetlands program. The Module recognizes that to date only two states have formally assumed the Section 404 permitting program for regulating activities in wetlands. Other states have taken on partial responsibility for Clean Water Act wetlands permitting by agreeing to implement a State Programmatic General Permit (SPGP), which authorizes a state to issue federal permits for some Section 404 activities (typically those with smaller impacts). Finally, some states only participate in federal wetlands permitting through the process of issuing Section 401 certifications that assess whether the federal permit action is consistent with state water quality standards.

Activities covered by the Module include wetland program and management activities, watershed project planning and review, wetlands permitting, permitting under an SPGP, and Section 401 certifications. Other significant line items include: operation of a compensatory mitigation program, enforcement, litigation support, and development of water quality standards for wetlands (included here rather than in the Water Quality Standards Module). There is also an add-on for public education and outreach that is based on a percentage (default 5 percent) of all other wetland activities.

Activities not included in this Module are: monitoring for wetlands, listing impaired wetlands (Section 303(d)), wetlands reporting (Section 305(b)), and mapping necessary to support wetlands programs. These activities are included in other modules of the Needs Model.[35]

Because many states will not be undertaking all listed activities, and many of the line items are actually mutually exclusive, it is difficult to assess the relative significance of different activities in the Module. For example, if a state has assumed the permitting program it will not have an SPGP (and vice versa). Indeed, the overall significance of this Module to the entire Needs Model will likely vary considerably from state to state.

Observations and Analysis

In keeping with the conservative bias in the Needs Model, the State Task Force might consider revising the Wetlands Module's default values to assume that states do not have a Section 404 program. Now, using the default values, Section 404 permitting makes up over one third of the costs of the Wetlands Module.[36] Because only New Jersey and Michigan have formally assumed responsibility for Section 404 permitting, this does not reflect the current status of a typical state program. Although it is possible that more states may assume this responsibility at some point, there is no indication that this will occur in the near future.

Although it is relatively easy for a participating state to change the default values, the assumption that all non-participating states have assumed Section 404 permitting does not accurately describe the scope of state programs, unless it is the intent of the State Task Force to declare that an adequate state program must or should include assumption of the wetlands permitting authority. In addition, as noted above, many states do not undertake all the activities listed in the Module, and some components of the Module are actually mutually exclusive. Thus, the significance of a typical state's resource needs for Clean Water Act wetlands programs is greatly overstated. It should be kept in mind, however, that changing the Wetland Module's default values would not have a significant impact on the national estimate of state resource needs.

Data suggest that states may have completed the Wetlands Module incorrectly. Neither of the two states that have assumed responsibility for Section 404 permitting participated in the Needs Model survey. Nevertheless, at least four states included data (often default data) for the permitting section of the Module -- when all states participating in the analysis should have zeroed out the permitting section. This suggests that either, (i) participating states did not realize they needed to actually zero out the section if they had not assumed the program; (ii) they believed they could or should enter data relevant to their own state permitting programs even though they were not strictly speaking Clean Water Act programs; or (iii) they believed that assuming responsibility for the wetlands permitting program was essential to an adequate Clean Water Act program.

Future refinements to the Wetlands Module could take into account changes in federal regulation of certain isolated wetlands. In *SWANCC v. Corps of Engineers*,[37] the U.S. Supreme Court held that the Clean Water Act did not reach certain wetlands that are not adjacent to navigable waters. This decision has created substantial uncertainty concerning which wetlands continue to be regulated under the federal law and which wetlands are now subject to regulation only by states. Since the *SWANCC* decision, many states have begun to consider whether they need to establish new laws, regulations, and programs to protect wetlands no longer covered by the federal law.

The workload associated with planning and developing these programs does not appear to have been considered in this Module. This makes sense because the model was largely developed, and the default values established, before the Supreme Court issued its decision.

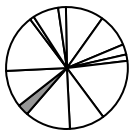
The Wetlands Module contains 62 default values to represent the needs of a "typical" state. The Wetlands Module has a relatively large number of default values, which also means

states must enter an equally large number of values to complete the Module. In future revisions, the Task Force should consider reducing the number of required data entries or provide options that simplify the process.

Coastal and Marine Module

Overview

The Coastal and Marine Module covers the water quality management aspects of coastal and marine programs that are required to meet the objectives of the Clean Water Act.[38] It includes developing, reviewing, and revising coastal and marine rules and guidance; managing the Coastal Monitoring Program; establishing No Discharge Zones; and managing the National Estuary Program.



This costs associated with activities in this Module represent approximately 3 percent of the total national state resource needs as estimated by using the default values in the Needs Model.

Observations and Analysis

The Coastal and Marine Module should be refined to recognize the fact that all 50 states are not required to have a coastal and marine program under the Clean Water Act. The Coastal Zone Management Act (CZMA) applies only to states with marine and Great Lakes coastlines (29 states). The national need estimate should be re-tooled to account for exactly the number of non-participating states required to conduct coastal and marine program activities.

In future data collection efforts, the State Task Force might let states automatically opt out of this Module if they do not have a coastal and marine program. A relatively high number of the states participating in the survey used default values for the Coastal and Marine Module,[39] when only 14 were subject to the requirements of this Module. This raises the question of whether all of the participating states correctly submitted the Module. An opt-out option might make it easier for states to complete the Module.

Coastal water quality management activities are divided between this and other modules. While this level of detail may yield the most precise workload estimate if done properly, participating states may not have been able to devote the time necessary to give accurate estimates. The high use of default values may reflect this observation.

If EPA and the National Oceanic and Atmospheric Administration (NOAA) were to begin implementing the National Coastal Monitoring Act (NCMA), the costs for this Module will most likely increase. While Section 2803 of the NCMA calls for EPA and NOAA to develop a program to measure the long-term quality of coastal waters,[40] the Act currently is not being implemented. If EPA and NOAA were to implement NCMA, the states would be required to perform the tasks listed in the Module that now have a default value of zero.[41]

Pending legislation may substantially increase the workload required of states under the Beach Action Plan.[42] If enacted, States would need to adjust the default value to reflect the specific demands of their legislatures.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), *State Water Quality Management Resource Analysis Needs Model (Needs Model), Nonpoint Source and Coastal Nonpoint Source Management Module,* Training Presentation, 4-5.
[2] 16 U.S.C. §1455b.
[3] U.S. General Accounting Office (GAO), *Water Quality: Federal Role in Addressing and Contributing to Nonpoint Source Pollution* RCED-99-45 (February 26, 1999) 6-7.
[4] Ibid., 4.
[5] Ibid., 47.
[6] .State Task Force, *Needs Model, NPS and Coastal NPS Module,* footnote 2.
[7] Ibid., Instructions.
[8] Environmental Law Institute, *Enforceable State Mechanisms for the Control of Nonpoint Source Water Pollution* (Washington, D.C.: October 1997), 4.
[9] 16 U.S.C.§ 1455b.
[10] 33 U.S.C. § 1329.
[11] State Task Force, *Needs Model, NPS and Coastal NPS Module*, footnote 1.
[12] Ibid., footnotes 1, 5, 8, 9.
[13] State Task Force, *Needs Model, NPS and Coastal NPS Module, Permitting, Enforcement, Compliance, and Monitoring Modules*.
[14] U.S. Environmental Protection Agency (EPA), Office of Water, *Proposed Rule To Protect Communities From Overflowing Sewers,* EPA 833-01-F-001 (Washington, D.C.: January 2001).
[15] *Needs Model, TMDL Module*, Instructions.
[16] 33 U.S.C. §1313(d)(1).
[17] State Task Force, TMDL Module Training Presentation, 3.
[18] Ibid.
[19] Ibid., 11.
[20] *Needs Model, TMDL Module,* Instructions, footnote 2, and TMDL Module Training Presentation, 3.
[21] GAO, *Clean Water Act: Proposed Revisions to EPA Regulations to Clean Up Polluted Waters* GAO/RCED-00-233 (Washington, D.C.: June 2000) 8.
[22] GAO, *Inconsistent State Approaches Complicate Nation's Efforts to Identify Its Most Polluted Waters* GAO-02-186 (Washington, D.C.: January 2002), 11. Available at http://www.gao.gov/new.items/d02186.pdf.
[23] State Task Force, TMDL Module Training Presentation, 2, 11, and 12.
[24] State Task Force, *Needs Model, TMDL Module*, Instructions and TMDL Training Presentation.
[25] State Task Force, TMDL Module Training Presentation, 3.
[26] State Task Force, *Needs Model, Monitoring Module.*
[27] GAO, *Water Quality: Inconsistent State Approaches Complicate Nation's Efforts to Identify its Most Polluted Waters* GAO-02-186 (Washington D.C.: January 11, 2002), 11.
[28] EPA, Fact Sheet on "The National Costs of the Total Maximum Daily Load Program (Draft Report) EPA 841-F-01-004" (Washington D.C.: October 30, 2002). Available at http://www.epa.gov/owow/tmdl/coststudy/costfact.html.
[29] State Task Force, *State Water Quality Management Resource Analysis, Interim Report on Results* (Washington, D.C.: April 1, 2001) Appendix D-5.
[30] EPA, Fact Sheet
[31] Ibid.
[32] State Task Force, *Needs Model, TMDL* Module, Summary of Needs.
[33] Ibid., Instructions.
[34] Ibid., Default Summary.

[35] State Task Force, *Needs Model, Wetlands Module*, Current Need.
[36] Ibid.
[37] *Solid Waste Agency of N. Cook County v. Corps of Engineers*, 121 S.Ct. 675 (2001).
[38] State Task Force, *Needs Model, Coastal and Marine Program Module,* Training Presentation, 1.
[39] Default Summary.xls, provided to the Academy by the Cadmus Group.
[40] 33 U.S.C. §2803.
[41] State Task Force, *Needs Model, Coastal and Marine Program Module,* footnote 3.
[42] Ibid., footnote 5. *See also* EPA, *Action Plan for Beaches and Recreational Waters* EPA/600/R-98/079 (Washington, D.C.: March 1999).

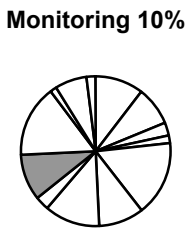
APPENDIX E

NEEDS MODEL: CROSS-CUTTING MODULES

Monitoring Module

Overview

The Monitoring Module covers management and implementation of all water quality monitoring necessary to support Clean Water Act programs, except for compliance monitoring of point source discharges, which is covered in the Compliance and Assistance Module. The costs for the activities in the Monitoring Module represent about ten percent of total state resource needs as estimated by using the default values in the Needs Model.



Covered activities include planning, coordinating, and managing a monitoring program; sampling water bodies; analyzing these samples; certifying and auditing laboratories that analyze samples; ensuring monitoring data are accurate and reliable; and managing and contracting for external support of monitoring activities, such as for universities, private firms, or volunteer groups.

The most significant parts of the Module in terms of total resource needs are the activities associated with water body sampling and sample analysis. To assess these costs, states are required to complete a preliminary sampling worksheet at the beginning of the Module. The sampling worksheet is structured to calculate the total effort required for a variety of different types of sampling protocols. The Module identifies a total of ten different types of samples to assess ambient water chemistry, sediments, biological impacts, and habitat. For each of the ten types of sampling, states must enter four different parameters: the number of sample sites, the number of site visits per site per year, the time required to conduct each site visit,[1] and the number of staff involved in each site visit. The product of these four numbers is the total annual effort for water body sampling for each sampling type.

The data are transferred automatically to the worksheet for the Monitoring Module, where states enter the dollar amount of other costs associated with in-the-field data collection and in-the-lab sample analysis. The total costs of data collection and sample analysis are then calculated for each of the ten sample types.

Based on the current needs determined by the default values in the Needs Model, the 20 line items associated with sample collection and analysis for these ten types of sampling constitute 66 percent of the Monitoring Module's cost. The most costly items, in terms of total annual effort, include routine sampling of ambient water quality, intensive sampling of ambient water quality (as required for more difficult-to-measure pollutants or to gather a time series sample for priority pollutants), and biological community sampling to determine the types of aquatic organisms present in a water body.

Observations and Analysis

There may be alternative ways of structuring the Monitoring Module in order to make it easier for states to estimate the cost of their monitoring activities. The Monitoring Module is designed to accommodate a variety of state monitoring programs by being structured around sampling types, as described above. Monitoring activities are not always conducted by sampling type, that is, state programs are not necessarily structured in the same way as the Module. For example, the Module instructions tell states to "include only the incremental difference in effort required" for sampling types that are performed in conjunction with each other.[2] That is, a state may perform different types of sampling together, making it difficult to enter the activities as separate line items.

The instructions for the Monitoring Module could be improved by clarifying where "contracted" sample analyses should be recorded. In the worksheet and instructions, it appears that the costs of lab analyses of monitoring samples performed by outside labs are to be reported collectively included under a single line item for external support. Directions in notes to the PowerPoint training materials state this clearly. This should be repeated in the Module instructions.

The default values in the Monitoring Module are based on existing state experience and "will <u>not</u> be adequate to cover emerging monitoring needs such as those necessary to support NPS, wetlands, and TMDL programs."[3] Other modules, such as NPS, Wetlands, and the TMDL Modules, are based on the assumption that water quality monitoring programs are adequately funded to support their activities. The default values in the Monitoring Module should be modified to reflect state needs for new and emerging programs once they are known. This is an instance were the Needs Model is deliberately conservative due to the uncertainty about new requirements. Once these requirements are finalized, there may be additional costs to states. For example:

- In an August 2001 study, *The National Costs of the Total Maximum Daily Load Program*, EPA estimated about a $17 million annual increase for all states in total water quality monitoring costs to support TMDLs.[4] Future revisions to the Monitoring Module should account for the potential additional costs of these emerging needs.

- Future additions to the Module sould take into account new monitoring requirements, such as the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000, which requires monitoring at public beaches.[5] The workload associated with these monitoring activities may also have additional costs to the states.

In future versions of the Needs Model, the State Task Force might consider how to reflect efficiencies in water quality monitoring that may result from EPA's Consolidated Assessment and Listing Methodology (CALM). EPA is working to help states streamline water monitoring by compiling a compendium of state best practices.[6] CALM may enable states to reduce their workloads for water monitoring, resulting in efficiencies not reflected by the

default values in the Needs Model. In materials provided to the Academy,[7] participating states noted the potential to incorporate possible impacts of CALM guidance in future versions of the Needs Model.

Additional analysis of the Monitoring Module's default values did not reveal any other discernible trends. Academy researchers tested the six default values associated with the three most costly sampling activities -- routine ambient sampling, intensive ambient sampling and biological community sampling -- by comparing them to the reported state average values for the same variables. There were a number of differences between default values and state average values. Some averages were relatively higher; some, relatively lower. But the researchers could not determine the overall significance of these differences.

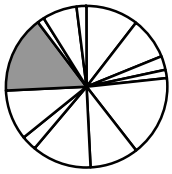
The Monitoring Module contains 101 default values. These default values represent the number of entries that a state must make to complete this Module. The number of entries required in this Module is higher than for any other module. The State Task Force might consider revising this Module by reducing the number of entries, thereby decreasing the time needed to complete it encouraging more state participation. However, the comprehensive level of detail in the Module may be helpful for states wishing to use the Needs Model as a management or budgeting tool.

Data Management Module

Overview

The Data Management Module covers a variety of activities associated with developing, maintaining, and operating data systems to support a state's water quality management program. Covered activities include data processing, such as providing data for the Permit Compliance System (PCS); upgrading and integrating computer systems; maintaining and administering data systems; developing and operating a Geographic Information System (GIS); developing and maintaining a website on water quality; and costs associated with participating in the One Stop Reporting Program. While the One Stop Reporting Program is included so that states participating in the program may estimate the necessary workload, it is not included in the Module's default values because most states do not yet participate in that program.

Data Management 16%



Overall, based on the default values, the Data Management Module represents over 15 percent of a typical state's total resource needs, making it the second largest module in the Needs Model.

The greatest needs, based on the Data Management Module's default values, are for maintaining and administering data systems, updating data systems, and developing a GIS. Providing user support for state water employees accounts for almost 19 percent of data management costs, the largest single line item in the default values for the Module. To determine the workload necessary for user support, the Model sums the FTE needs from all of the other 13 modules and

then divides the total by a state's value for the number of technical support employees per FTE, as determined by the Data Management Module.[8]

The Module's default costs associated with developing and operating a GIS are also substantial. To assess GIS costs, states must enter the costs and effort required to develop, maintain, and improve a GIS in a preliminary worksheet at the beginning of the Module. States may enter these costs in two different ways, based either on the total state GIS costs or on a per square mile basis. These costs are then automatically used in the primary Module worksheet to determine the total costs of developing, maintaining, and improving a state's GIS. According to the Module's instructions, if states "elect to input cost data on a per-square mile basis, the land area default will be based on USGS data for [that] state."[9]

Observations and Analysis

The complex nature of data management, where related activities often span other programs and agencies, may have made it difficult for states to estimate their resource needs for some activities covered by the Data Management Module. A state's GIS program is a good example. Many different environmental programs or state agencies may use, and therefore share, the costs of developing and maintaining a state's GIS. Upgrading data systems or maintaining a website may also be costs that are shared with others or conducted together for all of a state's environmental programs.

While the Module's instructions and footnotes tell states to include only data management costs associated with their water quality management programs, it may be difficult for states to make these estimates, as indicated by the high use of default values by participating states. The State Task Force should consider reducing the amount of information states must provide in the future for this module. It should be noted, however, that the level of detail does appear appropriate to reflect the complexity of data management activities for managing state water quality programs.

Default values in the Data Management Module are based on one large state's experience with developing and maintaining a GIS.[10] This particular state recently spent approximately $500,000 per year over four to five years to develop its water quality-related GIS. Once the system was put into place, the annual cost of maintaining the system was about $75,000. Based on this example, the Module's default value for developing a GIS was set at $300,000 per year, with annual maintenance costs of $50,000. Not all states may develop such a system. However, for some states, it may be reasonable to assume similar costs to develop a GIS. Furthermore, states may now exchange the GIS technologies and knowledge, thereby reducing their costs to replicate GIS from other states.

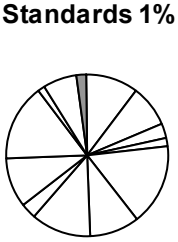
Many states used default values for the Data Management Module. There were three entries for which most of the participating states submitted their own data: the number of permits requiring PCS processing, the number of water quality samples requiring data processing, and the number of special monitoring studies requiring data processing, such as "the characterization of effects of an industrial accident".[11]

However, for all of the remaining line items, including line items that contribute substantial costs to the Data Management Module's total cost, ten or more states used the default value. This includes 14 states using default values for the number of technical support employees per total number of FTEs, and 13 states using the defaults for the cost of implementing data system upgrades -- two of the Module's largest costs. This suggests some states may have found it difficult to assess their data management needs. The State Task Force might consider reducing the level of detail in the Module to encourage more states to submit their own data. In addition, the Task Force might look for a way to add an identifier so states can show whether they are choosing a default value because it matches their actual needs.

Water Quality Standards Module

Overview

The Water Quality Standards Module covers state costs for developing and implementing water quality standards for all water bodies except wetlands (covered in the Wetlands Module) and for preparing use-attainability analyses.



States are asked to enter their workloads associated with implementing both current and expected EPA regulations and guidance on bacteria, ammonia, nutrients, human health criteria, mixing zones, anti-degradation requirements, and undesignated waters. States are also asked to anticipate impacts from evolving programs, including the TMDL and storm water programs.[12]

To complete the Module, states are asked to fill in three line items asking for their annual FTEs devoted to developing and implementing standards and preparing use-attainability analyses.

The total cost of the Water Quality Standards Module amounts to about $370,000 based on the Module's default values, just over one percent of the total state water program costs.[13]

Observations and Analysis

While the Water Quality Standards Module asks states to report the workload of future but expected regulations in their estimates, it is not clear whether these costs are included in the Module's default values. If the default values do not reflect the work required by these expected regulations, the default values are likely to provide a conservative estimate of state costs. The states' needs to support these expected regulations should be included in future additions to the Needs Model once they are known.

About half of the participating states used the Module's default values. Of the 19 states for which the Academy had data, 11 used the defaults for developing standards and use-attainability analyses and nine used the default for standards implementation.[14] This is surprising considering that the Module instructions specifically noted that the defaults were based on national averages,

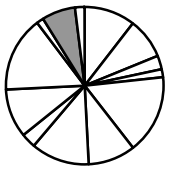
and that some states would have considerably larger needs based on size or participation in regional initiatives, such as the Chesapeake Bay and Great Lakes.[15] This observation suggests either that many states found the default values accurately reflect their needs, or that states had difficulty estimating the specific needs of their programs.

Clean Water State Revolving Fund (CWSRF) and Other Grants Management Module

Overview

This Module covers the workload and costs of managing the CWSRF and other grants.[16] It includes the costs of managing grants received from EPA, as well as grants made by the state to local governments and others.

CWSRF & Grants Management 7%



This Module represents seven percent of the total estimated need based on the default values, making it the eighth largest Module.

Observations and Analysis

The default value for the activity of Bond Fund Management assumes all non-participating states issue bonds.[17] Although this is a reasonable assumption, six of the participating states changed the default value to "No." Increased state participation could help the State Task Force reduce the use of default values, and uncertainty about whether non-participating states issue bonds. It is not clear, based on reported state data, which assumption is more appropriate. On the other hand, the effect of this assumption on the costs of the Module is relatively small compared to the total resource need for the Module because this item represents slightly less than seven percent of the total default value for this Module. Furthermore, it represents an extremely small proportion of the national need.

The default value for closing out construction grants is zero, reflecting the fact that many states have little or no funds remaining in the construction grant program.[18] Although this is a reasonable estimate, eight of the participating states changed the default value and entered specific numbers of projects and hours required. This default assumes no state has a construction grant program, thereby possibly underestimating this aspect of the Module's cost. On the other hand, the effect of underestimating this need would be slight. The average state values for the eight states that entered their own data for this line item were only 1.2 projects and 14.8 hours per project, an insignificant proportion of the approximately 600,000 of work hours represented by the Needs Model.

The State Task Force should consider revising the default values for public outreach based on the data submitted by participating states. Costs for public outreach are calculated as a percentage added to the costs for program grants, cooperative agreements, project grants, and the

performance partnership program. The training materials define public outreach as educating stakeholders about types of grants available, application procedures, and project success stories.

The default value for public outreach is five percent, while the average state value based on actual data was 0.1.[19] This and all the other default values, could be refined using the actual data from participating states.

The Module assumes that states do not participate in the Performance Partnership Program, although many states do participate. By setting default values at zero, the Module assumes non-participating states do not have either a Performance Partnership Agreement (PPA) or a Performance Partnership Grant (PPG). In 2000, 35 states had a PPA, a PPG, or both. Of the states with PPGs, 31 included Section 106 grants, 16 included Section. 319 NPS grants, 10 included Section104b(3) grants, and eight included wetlands grants.[20] The default value should be revised to reflect the actual state data.

More than half of the states entered data for these line items, reporting average state values of 307 hours for developing a PPA and 365 hours for tracking, coordinating, and managing a PPG.[21] It is questionable, however, whether the costs identified here for PPAs and PPGs are captured appropriately, particularly if they are intended to cover only those aspects of PPAs and PPGs that are related to water quality management.

All the grants received from EPA require tracking, coordination, and management. Thus, this default raises several questions: Are the costs for PPGs significantly higher than for other types of grants? Where does the Module capture costs for managing routine categorical grants in states without PPGs? With regard to hours for developing a PPA, are these hours for managing water programs more than other strategic planning activities normally undertaken by a state?

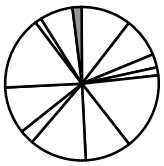
The Module assumes states do not have a Hardship Grants Program for rural communities, although a number of states do. The default value for the Hardship Grant Program is set at zero because many states have already used the funds from this one-time federal authorization, while other states decided not to participate.[22] While this may be a sensible estimate, more than half of the states entered data for this item, indicating that a number of states still maintain hardship grants programs. However, if the default were based on the actual state average of 116 hours for this activity, the workload estimate would increase only slightly.

There is potential to improve technical assistance efforts for CWSRF projects. During one of the focus sessions where states developed the Needs Model, one state suggested that a multi-state technical assistance and coordination committee could help to facilitate assistance and communication among state agencies and organizations. Targeting the majority of technical assistance efforts during the CWSRF project development and review stages could, states believed, result in a more efficient CWSRF program and swifter overall loan process.[23]

Reporting and Planning Module

Overview

The Reporting and Planning Module covers state activities and resources needed to comply with the reporting requirements of Sections 305(b)[24] and 303(d) of the Clean Water Act.[25] The Module also covers costs associated with: the development of Water Quality Management Plans, reporting for Section 391, and states' Continuing Planning Process for states to outline their ongoing CWA implementation plans. [26]



The default values for the Reporting and Planning Module costs amount to approximately $520,000 which is just less than two percent of the total state water program costs measured by the Needs Model.

Nearly 50 percent of the total state costs of this Module are associated with submission of the 305(b) report and the 303(d) list. Reviewing and updating regional, state, and/or basin Water Quality Management Plans accounts for another 32 percent of the default values for this Module.

Observations and Analysis

The Reporting and Planning Module's default values include a ten percent add-on for optional public outreach for 303(d) lists and 305(b) state water quality assessment reports, which may go beyond what is needed for managing an adequate state program. States are required to conduct some public outreach for 303(d) lists, and that work is explicitly included in the Module as a default value. However, the Module's default values also include a line item for "optional" outreach that covers other state activities not required under the Clean Water Act, such as communication with watershed advisory groups and distribution of educational materials.

The focus group developing this Module included these activities in the default values because they would "greatly enhance public understanding and smooth the reporting process."[27] This may be a reasonable assumption given the increased attention to Section 303(d) lists resulting from the new emphasis on TMDLs, or it could go beyond an adequate state program.

Regional Initiatives Module

Overview

The Regional Initiatives Module covers regional programs for the Gulf of Mexico/Mississippi River, Great Lakes, United States-Mexico border, and the Chesapeake Bay. It also allows states to enter data for other regional programs.[28] It is intended to cover the workload associated with development, planning, coordination, and management of these programs, but not implementation costs.[29] The default value for this Module is zero.

Observations and Analysis

Because workloads for these regional initiatives vary significantly by state, no default values were developed for the various programs identified in the Module. [30] This has the potential to underestimate actual national needs, as a number of states participate in regional initiatives. The default values in this Module could be refined based on the actual values of participating states.

As the instructions for this Module warn, it has the potential to double-count workloads. The Module's instructions direct states to enter workloads associated with only program development, planning, coordination, and management for regional initiatives. Monitoring, nonpoint sources, and other activities performed as part of regional initiatives are supposed to be entered in the appropriate modules.[31] Despite these instructions, it may have been difficult for states to separate these activities and avoid counting them in more than one module.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force) *State Water Quality Management Resource Analysis Needs Model (Needs Model), Monitoring Module*. The Module denotes this as both time per sample and hrs/site visit. This makes it unclear whether the value is meant to reflect the time required per sample or the time required per site visit. Based on the units of the other values in the module, the value appears to reflect the time required per site visit, as it is used in conjunction with the number of staff per site visit to determine the total number of FTE hours required per site visit.
[2] Ibid., Instructions, 2.
[3] Ibid., Instructions, 1.
[4] U.S. Environmental Protection Agency (EPA), *The National Costs of the Total Maximum Daily Load Program.* (Washington, D.C.: August 2001).
[5] P. L. 106–284, *Beaches Environmental Assessment and Coastal Health Act of 2000*. (October 10, 2000). Available at http://www.epa.gov/ost/beaches/beachbill.pdf.
[6] EPA, *Consolidated Assessment and Listing Methodology* (November 7, 2002). Available at http://www.epa.gov/owow/monitoring/calm.html.
[7] State Task Force, *Proposed Items for Consideration During Model Revision*.
[8] State Task Force, *Needs Model, Data Management Module,* Directions, 8.
[9] Ibid., Instructions.
[10] Ibid., Directions, 4.
[11] Ibid., Instructions.
[12] State Task Force, *Needs Model, Water Quality Standards Module*, Instructions.
[13] Ibid., Current Need.
[14] State Task Force, 19 state data summary provided to the Academy.
[15] Ibid., *Water Quality Standards Module*, Instructions.
[16] State Task Force, *Needs Model, CWSRF and Grants Management Module* , Directions, 2.
[17] Ibid., Directions, 4.
[18] Ibid., Directions 12.
[19] State Task Force, 19 state data summary.
[20] EPA's Office of Congressional and Intergovernmental Relations, *Performance Partnerships Status and Trends* (Washington, D.C.: November 12, 2002). Available at http://www.epa.gov/ocirpage/nepps/pdf/trends_links_97-2000.pdf.

[21] State Task Force, *Needs Model*, *CWSRF and Grants Management Module*, Current Need.
[22] Ibid., footnote 10.
[23] State Task Force, *State Water Quality Management Resource Analysis: Interim Report on Results.* (Washington, D.C.: April 1, 2002), D-5.
[24] Section 305(b) of the CWA requires states to conduct water quality assessments to determine whether their waters have water quality sufficient to meet their designated uses. States are required to update and report this information to EPA every two years. The state reports are commonly referred to as 305(b) Reports.
[25] Section 303(d) of the CWA requires states to submit lists of waters not meeting water quality standards or not supporting their designated uses. The list of impaired waters is commonly referred to as the 303(d) List. TMDLs must be developed for waters on the 303(d) List.
[26] Section 319 of the CWA deals with controlling pollution from nonpoint source. States are required to submit an annual report including a list of water bodies impaired by nonpoint sources, and the type of sources affecting those waters, as well as a description of their activities for controlling nonpoint sources.
[27] State Task Force, *Needs Model, Reporting and Planning*, footnote 5.
[28] State Task Force, *Needs Model, Regional Initiatives,* Instructions.
[29] Ibid.
[30] Ibid.
[31] Ibid.

APPENDIX F

ESTIMATION METHODOLOGIES

About one-quarter of the states did not submit information for the State Expenditures Survey, and more than half did not submit information for the State Water Quality Management Resource Needs Model. Of those states that did provide data, some provided only partial data.

As a consequence, the State Task Force had to develop methodologies that could be used to calculate estimates for states with partial or no data. The Cadmus Group, which served as consultants and provided analytic support to the Resource Analysis project, worked with the Task Force to develop the estimation techniques that were used.

To understand the methodologies better, it is important to recognize the context of the overall data quality objective for the project. While Cadmus analysts did use statistical techniques to help develop and support the national estimates of state expenditures and needs, the intent from the outset was to develop a reasonable estimate of -- not a precise number for -- the national resource gap.

Instead of attempting to ensure that states reporting data were representative of all states, the Task Force considered it reasonable to assume that the average values derived from the data submitted by states were representative of a "typical" state and could be used to calculate the numbers for missing states.

This appendix discusses methodologies the Task Force adopted to derive their estimates of national resource needs, national state expenditures, and the gap between them. Appendix G describes Academy research on methodologies used in other studies of resource gaps.

National Estimate of State Water Quality Expenditures

Current water quality expenditures data were submitted by 36 states. The missing data for 14 states were extrapolated using a regression model.

First, the Task Force established that there was a strong positive correlation between state water quality expenditures and the total of all state expenditures for the 36 reporting states. Total state expenditures were drawn from NASBO's 1999 State Expenditure Report, June 2000. Then, the relationship between these two variables was expressed as an equation in a regression model, which was further used to extrapolate the water quality expenditures for states that did not submit data.

Adding together the data submitted by the 36 states and the results of the regression model for the remaining 14 states, the Task Force estimated that total state water quality management expenditures are somewhere between $722 million and $805 million. According to Task Force materials,[1] the upper and lower bounds of this estimate represent the 95 percent confidence interval for total state expenditures.

The Task Force considered using other methods and variables in the regression analysis to estimate state water quality expenditures for non-reporting states. One alternative method would have calculated the average of total state expenditures from the 36 reporting states as the basis for this estimate. However, the Task Force was reluctant to use this method because states differ greatly in terms of population, tax base, state expenditures, stream miles, water areas, and other factors. Therefore, any estimate of expenditures calculated using one average value for all non-reporting states would have been considered unreliable.

Another method considered was dividing the 26 reporting states into groups. For example, the groups might be based on size of state population. The average of expenditures for states in the highest population group would be used to estimate expenditures for the non-reporting states in the highest population group. However, the Task Force was unable to develop a credible way of dividing states into such groups.

The Task Force considered several other variables for the regression model to extrapolate water expenditures for non-reporting states. State river miles and water area were examined, but the correlation between these variables and water quality expenditures was not strong. Further, the databases for state river miles and water areas did not include two states -- Michigan and Alaska -- which have large water reservoirs. Without data from these two states, the results would have been biased.

The Task Force also considered a potential variable based on how much a state receives in Section 106 state grant dollars. However, this measure was rejected as inappropriate because some viewed these allocations as being influenced by political considerations.[2]

National Estimate of State Water Quality Resource Needs

Complete data for the Needs Model were submitted by 21 states. The State Task Force had to develop estimates for the other 29 states.

Two of the 21 states that submitted data are very large, and the Task Force considered their resource needs estimates to be outliers. After excluding the data from these states, the Task Force calculated an average of the resource needs for the other 19 states. These states encompassed a wide range of demographic characteristics, geographic locations, water resources, and water quality issues, so the Task Force assumed an average of their resource needs would be a reasonable estimate of the resource needs of a "typical" state.

To calculate an "average" value of the resource needs for each non-reporting state, the Task Force developed two approaches:

Approach 1:
State value = The average state resource need (based on the data submitted by 19 states)

Approach 2:
State value = The sum total of all default values in the Needs Model

These surrogate state values were then multiplied by 29 to arrive at a total value for the non-reporting states.

To arrive at a national estimate of total resource needs, these totals for the non-reporting states were then added to the totals for the reporting states. The results are shown below:

Approach 1:
Total Needs of 21 Reporting States + (19 States Average x 29 States) = $1.7 billion

Approach 2:
Total Needs of 21 Reporting States + (Model Default Values x 29 States) = $1.5 billion

Estimate of the National Resource Gap

The resource gap for funding state water quality programs was calculated by subtracting the estimated total state water quality resource needs from estimated total current state water quality expenditures. This is how the calculation looks in the State Task Force's *Interim Report*:

Resource Needs	*minus*	Current Expenditures	*equals*	Resource Gap
$1.54 - $1.69 Billion	*minus*	722 - $805 Million	*equals*	$735 - $960 Million

Observations and Analysis

The *Interim Report* may leave an impression that the results of the Resource Analysis project are more precise than they actually are. The report contains statistical terminology -- such as regression analysis -- that could lead some readers to assume statistical validity when none is intended. In addition, the number of significant digits used to express the funding gap may imply higher precision than is warranted by the methodology and results.

The reliability of the national resource gap estimate would be enhanced if consistent methods were used to estimate both resource needs and current expenditures. The State Task Force handled the problem of non-reporting states differently in the two cases. On the resource needs side, the average of actual state values from 19 reporting states was used to calculate estimates for the resource needs of non-reporting states. On the expenditures side, for which there were data from 36 states, the Task Force rejected this same approach. Instead, they used a regression analysis to develop the estimates.

The State Task Force should present the methodologies it used and the reasons behind them in its reports and other documentation.. Academy researchers found the *Interim Report* did not contain enough information when they tried to replicate the Task Force's results. After investigation, the researchers learned that some of the information in the *Interim Report*, such as the number of states that submitted data and the equation for how missing states were handled in calculating national estimates, were incorrect. While the Panel has concluded that correcting these problems would not significantly change the bottom-line results of the Task Force's work, these improvements would make the project's numbers easier to explain and defend.

From a statistical standpoint, it would be preferable to use the median of the states' reported resource needs rather than the mean (average). Whether to use either the median[3] or the mean depends on how dispersed[4] the sample is.

The median value for the 21 states that submitted data for the Needs Model is $28,800,000; the mean (average) is $36,800,000. Academy researchers found the results were highly dispersed (78 percent) due to several outliers in the sample. In this case, it would be preferable to use a median in order to avoid skewing the results.

Removing the outliers (the lowest and the highest values) reduces the dispersion to 46 percent. This dispersion is still considered high. In this case, the mean (average) could be used to calculate the "typical" value of the sample, but it would most likely be viewed as skewed, and therefore uncertain. Using *both* the median and the mean in this case to calculate the "typical" value of the analyzed sample would be reasonable and would give greater credibility to the results. The median value for the sample of 19 states, without the two outliers, is $28,800,000, whereas the mean (average) is $32,378,947.

The national estimate of resource needs lies somewhere between $1.3 billion and $1.7 billion; a reasonable single value to use is $1.5 billion. A credible estimate of the national needs can be made by using several alternative methods**.** The Academy calculated the national needs estimate using three methods in addition to the Needs Model default values:

		Needs Model Default Values	X 50 States	= $1.3 billion
21 States Reported Needs	+	Model Default	X 29 States	= $1.5 billion
21 States Reported Needs	+	21 States Median	X 29 States	= $1.6 billion
21 States Reported Needs	+	19 States Mean (Average)	X 29 States	= $1.7 billion

If a single estimate of resource needs is needed, $1.5 billion is a reasonable value because it is based on the median value of the states' reported data and it falls in the middle of the range of values derived from the alternative calculations above.

The State Task Force's use of a regression model to extrapolate water quality expenditures for the missing states makes sense. This is especially true because the two variables used in the regression model -- state tax base and population -- are also likely to influence the state water quality expenditures. Further, consistent data for state total expenditures are readily available.

A variable related to water quality programs might produce a more reliable estimate of state expenditures, but it may not be possible to find consistent data for all states. Some variables associated with water quality and the size and scope of state water programs were tested, but they were rejected by the Task Force because consistent data are not available.

ENDNOTES

[1] State Water Quality Management Resource Analysis Task Force (State Task Force), Briefing presented to Academy Panel (Washington, D.C.: September 20,2002).

[2] Personal communications between Academy researchers and Cadmus Group analysts (November 2002)

[3] Median: The value positioned in the middle of a sorted (ascending or descending) sequence of sample values. For example, in a sequence of 3, 8, 15**,** 38, and 50, the median value will be 15. The median should be used to estimate the "typical" value of the sample in those cases when there are outliers in the sample or the values differ significantly from each other. By using the median instead of the mean, one avoids skewing the results.

[4] Dispersion: Measures the diversity of the sample. It is the average percentage deviation of each of the values in the sample from the mean (average). If the dispersion is higher than 75 percent, which is considered to be very high, the mean (average) should not be used. In those cases, the median is considered to be a better method of estimating the "typical" value of the sample.

APPENDIX G

COMPARING METHODOLOGIES FOR RESOURCE ANALYSIS PROJECT WITH METHODOLOGIES FOR WATER INFRASTRUCTURE COSTS

The Panel wanted to learn whether studies of funding needs in other areas offer lessons that would be transferable to the Resource Analysis project. The answer is yes and no. Although Academy researchers were unable to find any comparable studies of the costs for *managing* environmental programs, they did identify a number of studies that estimated the costs of future clean water and drinking water *infrastructure* needs.

Many organizations -- including EPA, the Congressional Budget Office (CBO), the American Water Works Association (AWWA), and the Water Infrastructure Network (WIN) -- have conducted studies to estimate future funding needs for clean water and/or drinking water infrastructure. For the most part, these studies are based on EPA's 1996 Clean Water Needs Survey (CWNS) and its 1999 Drinking Water Infrastructure Needs Survey (DWINS). The methodology used by the state Task Force to determine the resource gap for *managing* water quality programs differs from the methodologies used in these water infrastructure studies.

Academy researchers reviewed the methodologies in the following six studies of infrastructure needs to determine whether any of them offer ideas that might be useful for improving future phases of the Resource Analysis project:

- Clean Water Needs Survey
- Drinking Water Infrastructure Needs Survey
- EPA: The Clean Water and Drinking Water Infrastructure Gap Analysis
- WIN: Clean and Safe Water for the 21st Century
- AWWA: Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure
- CBO: Future Investment in Drinking Water and Wastewater Infrastructure

Clean Water Needs Survey (CWNS)

In 1966, CWNS collected technical and cost information on approximately 16,000 publicly owned wastewater treatment facilities.[1] EPA asked states to document funding needs for wastewater treatment on a facility-by-facility basis. States were required to demonstrate both the existence of a need and the costs necessary to meet that need by providing one of 31 acceptable forms of documentation.[2] CWNS calculated a total need of $156.9 billion to fund wastewater treatment infrastructure nationwide.[3] This total included actual facility needs documented through the survey, plus the results of models that calculated funding needs for implementing storm-water phase one requirements and nonpoint source programs.

To model the costs of storm-water phase one requirements and nonpoint source programs, EPA used several methodologies. For cropland, pastureland, and rangelands, EPA estimated implementation costs by using actual data from the National Resource Inventory (NRI) on the extent of farmland areas, crop types, soil erosion rates, soil loss tolerance, slope, and conservation practices. For concentrated animal feedlots, EPA developed model feedlot costs

based on typical sizes of feedlots for each type of livestock. Using each state's data from the 1992 Census of Agriculture, EPA then projected the costs of controlling nonpoint sources based on the actual number of feedlots in each state. [4]

Drinking Water Infrastructure Needs Survey (DWINS)

In 1999, the DWINS collected cost information from a total of approximately 4,000 public water systems.[5] To calculate nationwide funding needs for drinking water infrastructure, EPA used the results of questionnaires sent to more than 1,100 largest systems, as well as to a random sample of the many smaller systems. These actual and sample data were then used to calculate a total need of $150.9 billion.[6]

To verify the actual needs of the large water systems, EPA required them to submit documentation of their facilities' plans and their engineering estimates, along with their cost data. For needs that were not sufficiently documented, EPA developed two types of cost models: unit cost models and linear regression models. In all, EPA used 59 different cost models to determine projected costs for over 95 infrastructure elements, such as replacing valves, building an elevated storage tank, or constructing entirely new treatment plants.

EPA's *Clean Water and Drinking Water Infrastructure Gap Analysis*

In September 2002, EPA issued its *The Clean Water and Drinking Water Infrastructure Gap Analysis*. That study calculated both the capital investments and operations and maintenance funding needed for future clean water and drinking water infrastructure over 20 years, from 2000 to 2019. EPA reported that the total 20-year funding gap for both types of infrastructure ranges from $950 billion to $485 billion for capital investments, and $72 billion to $724 billion for operations and maintenance costs, the range of figures resulting from different projections of future economic growth rates.

The study used CWNS and DWINS as the starting point for estimating clean water and drinking water infrastructure needs, but it was designed to take into account possible under-reporting of infrastructure needs in both of these studies. By conducting follow-up visits at some water systems to determine the accuracy of the needs they reported for CWNS and DWINS, EPA then compared the results of these visits and other prior infrastructure need calculations to generate a range of estimates for the total infrastructure funding gap.

AWWA's *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure*

This study by the AWWA concluded that $250 billion would be needed over the next 30 years to replace worn-out drinking water pipes and associated infrastructure for drinking water systems.[7] AWWA did not use data from either CWNS or DWINS, but extrapolated its total based on in-depth analysis of the investments in infrastructure by the drinking water utilities of 20 cities.

In its study, AWWA used the “Nessie Curve” technique to calculate each of the 20 cities' past investments in repairing and replacing drinking water pipes, based on a profile of each city's original pipe installations and how long its pipes typically last.[8] From the “Nessie Curves” for

each of the 20 cities, AWWA calculated an average cost of $10,000 per household for replacing water mains, treatment plants, pumps, and other drinking water infrastructure over the next 30 years. Then, using population demographics and the inventory of distribution mains from the 1995 Community Water Systems Survey (CWSS), AWWA estimated the total funding that would be needed nationwide for drinking water infrastructure.

WIN's *Clean and Safe Water for the 21st Century*

The WIN study calculated the capital investments needed to meet public health and environmental goals and to replace or maintain aging water infrastructure.[9] WIN estimated the total funding needed for drinking water and wastewater infrastructure is about $95 billion annually for the next 20 years. This estimate then produced an infrastructure funding gap of about $23 billion per year, after subtracting existing annual infrastructure investments of $72 billion.

WIN did not use CWNS or DWINS, but borrowed from AWWA's study to project the costs of replacing drinking water infrastructure. For replacing wastewater infrastructure, WIN relied on a 1987 report by the U.S. Department of Commerce, *Effects of Structural Changes in the U.S. Economy on the Use of Public Works Services.*[10] The methodology of this study assumed that 1/20 of the depreciated value of all drinking water systems nationwide would need to be replaced each year for the next 20 years. WIN's approach also calculated and included the costs of financing these infrastructure replacements. WIN assumed that 25 percent of the costs would be paid in the first year, and the remaining 75 percent would be financed with 20-year bonds or loans bearing a 3 percent real interest rate.[11]

CBO's *Future Investment in Dinking Water and Wastewater Infrastructure*

In May 2002, the CBO issued this study also calculating the costs of future capital investments and operations and maintenance spending for drinking water and wastewater infrastructure. CBO estimated that, during the period from 2000 to 2019, annual infrastructure costs would range between $11.6 billion and $20.1 billion for drinking water systems, and between $13.0 billion and $20.9 billion for wastewater systems.

CBO applied the same methodology as the WIN study described above, including the same data sources and models, to estimate costs of capital investments and financing those investments through loans and bonds. However, CBO used two different scenarios -- a low cost case and a high cost case -- to estimate water infrastructure needs. Each case had a different set of assumptions for the costs of capital investments and financing. CBO noted that the differences in the two scenarios largely depended on the "rate at which drinking water pipes are replaced, the savings associated with improved efficiency, the costs of controlling combined sewer overflows (CSOs), and the borrowing term."[12]

Comparison of Methodologies for the Infrastructure Studies and the Resource Analysis Project

The cost estimates developed in these studies of funding needs for drinking water and clean water infrastructure are not directly comparable to the Resource Analysis done by the State Task Force. The infrastructure studies are based on the projected costs of physical *capital*, whereas the Resource Analysis reflects the *workload costs* to manage evolving state water quality programs. Although the infrastructure studies are quite different from the Resource Analysis project, it is still possible to make the following comparisons among these studies.

- Both the Clean Water Needs Survey (CWNS) and the Drinking Water Infrastructure Needs Survey (DWINS) had high levels of participation. All of the nation's 1,111 large drinking water systems provided data for DWINS, and CWNS gathered information on approximately 16,000 publicly owned wastewater treatment facilities. The high levels of participation in both surveys reduced the need to model undocumented costs. Thus, increased participation by more states in future phases of the Resource Analysis project would reduce the Task Force's reliance on default values for non-participating states.

- Both CWNS and DWINS under-reported the funding needs for clean water and drinking water infrastructure. This under-reporting of needs was later confirmed by EPA's *Clean Water and Drinking Water Infrastructure Gap Analysis*, based on 200 follow-up site visits to medium and large water systems. EPA estimated that the reported needs for medium and large water systems had to be multiplied by a factor of 1.49 to compensate for this under-reporting. Similarly, the Panel has found that, while the funding needs estimated by the Resource Analysis project are reasonable, they probably are conservative. Thus, future phases of the project probably should try to compensate for possible under-reporting.

- Both CWNS and DWINS required respondents to document their need estimates. In future phases, it may be useful for the Task Force to ask that states document the sources of their need estimates for certain parts of the Resource Analysis project where information is available. It may also be helpful to those unfamiliar with state water quality management programs for the Task Force to provide more documentation on the default values used in the Needs Model.

- Many of the infrastructure studies used national statistics to determine future costs of drinking water infrastructure. The Task Force looked for similar national databases of state water quality management information to supplement the Resource Analysis model. However, unlike infrastructure costs, reliable data on state water management programs are simply not available.

- Many of the infrastructure studies use multiple methods to estimate total water infrastructure needs. The Resource Analysis project used two methods to determine a range of the total funding needed for state water quality management programs nationwide. This range illustrated the uncertainty in each state's need estimate, but also allowed the Task Force to calculate a reasonable measure of national need by combining

all of the estimated state needs. However, the Task Force could refine and expand upon these two methods in future phases of the Resource Analysis project to develop more precise estimates of the national need.

- The availability of multiple infrastructure studies allows for comparisons among the cost estimates, which cannot be made for the Resource Analysis project. As a whole, the Resource Analysis is unique. Consequently, such comparisons are only possible for certain elements of state water management programs. For example, estimates in the regulatory impact analyses on the cost of developing TMDLs could be compared with TMDL estimates in the Needs Model. The lack of available cost information on most other elements of state water management programs illustrates the importance of continued efforts and collaboration by the states and EPA on future phases of the Resource Analysis project.

ENDNOTES

[1] U.S. Environmental Protection Agency (EPA), *1996 Clean Water Needs Surve (CWNS)*, Executive Summary. (Washington, D.C.: 1996). Available at http://www.epa.gov/OW-OWM.html/mtb/cwns/foi.htm.
[2] EPA, *1996 CWNS Report to Congress - Assessment of Needs for Publicly Owned Wastewater Treatment Facilities, Correction of Combined Sewer Overflows, and management of Storm Water and Nonpoint Source Pollution in the United State* (Washington , D.C.: 1996). Available at http://www.epa.gov/OWOWM.html/mtb/cwns/1996rtc/append-d.htm.
[3] The Cadmus Group, Inc., *1999 Drinking Water Infrastructure Needs Survey: Modeling the Cost of Infrastructure* (February 2001).
[4] EPA, *1996 CWNS Report to Congress.*
[5] Ibid., Executive Summary.
[6] The Cadmus Group, *Drinking Water Infrastructure Needs Survey*.
[7] American Water Works Association, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* (New York, May 2001). Available at http://www.win-water.org/win_reports/infrastructure.pdf.
[8] Ibid.
[9] Water Infrastructure Network, *Clean and Safe Water for the 21st Century* (April 2000), 3-2. Available at http://www.amsa-cleanwater.org/advocacy/winreport/winreport2000.pdf
[10] U.S. Department of Commerce, Office of Business Analysis, *Effects of Structural Changes in the U.S. Economy on the Use of Public Works Services* (Washington, D.C.: 1987).
[11] Water Infrastructure Network, *Clean and Safe Water*, 3-1.
[12] Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (May 2002), 3.

APPENDIX H

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