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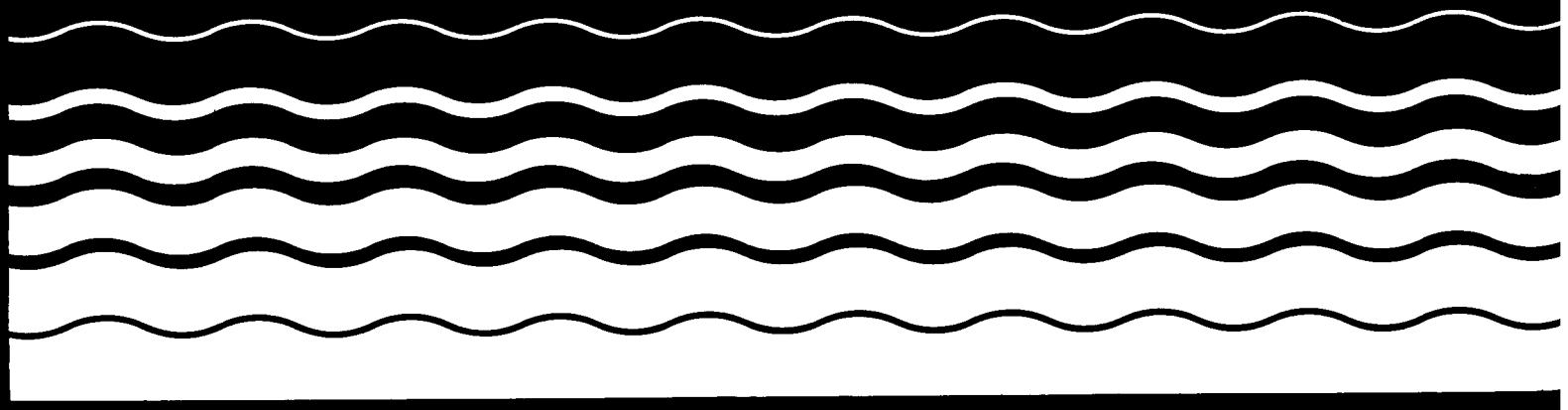
National Estuary Program Guidance

Technical Characterization in the National Estuary Program



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I. BACKGROUND

Overview of the National Estuary Program

Estuaries[1] are waterways, such as bays and sounds, where fresh water drained from the surrounding *watershed* mixes with salt water from the ocean. This blend of fresh and salt water makes estuaries biologically productive, sustaining many kinds of finfish, shellfish, marshes, underwater grasses, and microscopic marine life. Since estuaries have economic, aesthetic, and recreational value to people, they are attracting a growing number of coastal residents and commercial activities. Aquatic life and scenic values are affected in many ways by these growing populations.

Section 320 of the Clean Water Act established the *National Estuary Program* (NEP) to identify nationally significant estuaries threatened by pollution, development, or overuse and to promote the preparation of comprehensive management plans to ensure their ecological integrity. The program's goals are protection and improvement of water quality and enhancement of living resources. To reach these goals, the Administrator of the U.S. Environmental Protection Agency (EPA) convenes *management conferences* for each estuary in the NEP to provide a forum for consensus building and problem solving among interested agencies and user groups. The management conference studies environmental conditions and trends in the estuary and their likely causes, identifies the most significant problems, and develops an action-oriented *Comprehensive Conservation and Management Plan* (CCMP) to address high-priority problems.

Some estuaries have already been studied to determine the range of environmental problems. EPA has begun to focus on these estuaries as appropriate areas to "*streamline*" CCMP development. The intent is to use the NEP process to establish the validity of the initial characterization information and develop consensus on the priority problems and potential management solutions.

Purpose of this Document

Section 320 establishes several purposes (Figure 1) for NEP management conferences, including a requirement under purposes 1-3 to conduct an objective, technical assessment of the state of the estuary. This assessment, called characterization, is the basis for defining and selecting the problems to be addressed in the CCMP. In addition, purpose 5 calls for management conferences to develop plans to coordinate implementation of the CCMP by federal, state, and local agencies, and purpose 7 requires the

[1] **All italicized words are defined in the GLOSSARY OF TERMS.**

(1)	**Assess trends in water quality, natural resources, and uses of the estuary**
(2)	**Collect, characterize, and assess data on toxics, nutrients, and natural resources within the estuarine zone to identify the causes of environmental problems**
(3)	**Develop the relationships between the inplace loads and point and nonpoint loadings of pollutants to the estuarine zone and the potential uses of the zone, water quality, and natural resources**
(4)	**Develop a comprehensive conservation and management plan that recommends priority corrective actions and compliance schedules addressing point and nonpoint sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary, ... and assure that the designated uses of the estuary are protected**
(5)	**Develop plans for the coordinated implementation of the plan by states as well as federal and local agencies participating in the conference**
(6)	**Monitor the effectiveness of actions taken pursuant to the plan**
(7)	**Review all federal financial assistance programs and federal development projects ... to determine whether such assistance programs or projects would be consistent with and further the purposes or objectives of the plan prepared under this section.**

Figure 1. Purposes of an NEP management conference as defined in Section 320 of the Clean Water Act.

conference to review all federal financial assistance programs and development projects for consistency with the CCMP. EPA has interpreted these purposes to call for a two-part characterization process:

- TECHNICAL CHARACTERIZATION--An evaluation of the conditions of the resources and uses of the estuary, the priority problems being experienced by those resources and uses, and the causes of the priority problems; and

- BASE PROGRAM ANALYSIS--An analysis of existing federal, state, and local resource management programs.

This document provides guidance for NEPs on conducting technical characterization of the estuary, including:

- Defining the role of technical characterization in CCMP development;
- Outlining a broad, flexible process for conducting characterization; and
- Identifying responsibilities of key management conference participants.

A companion document, "National Estuary Program Guidance: Base Program Analysis" (EPA, 1993), provides guidance on management characterization of existing federal, state, and local resource management programs.

Although the primary audience for this guidance is the members of the management conference who will participate in the technical characterization effort, the process it suggests may have applicability beyond the NEP. The guidance is not intended to serve as a scientific treatise on estuarine studies; rather it suggests a shared NEP framework for assessing environmental data and ensuring that management decisions are informed by sound science.

The Role of Characterization

NEP management conferences follow four phases in developing their CCMPs:

Phase 1: Convening the management conference and establishing a structure of committees and procedures for conducting the group's work;

Phase 2: Characterizing the estuary to determine its health, reasons for its decline, and trends for future conditions; assessing the effectiveness of existing efforts to protect the estuary; and defining the highest priority problems to be addressed in the CCMP;

Phase 3: Specifying action plans in the CCMP to address priority problems identified through characterization and public input. The CCMP builds as much as possible on existing state, local, and federal programs; and

Phase 4: Monitoring the implementation of the CCMP, reviewing progress, and redirecting efforts where appropriate.

These phases need not occur sequentially, and do not under the streamlined approach. As the NEP has evolved, EPA has encouraged management conferences to proceed with the four phases simultaneously as often as possible. For example, early results of characterization (Phase 2) may indicate obvious management actions prior to completion of the CCMP. NEP participants are encouraged to take early action where solutions are already possible. In these cases, early implementation of management recommendations can proceed using funds other than those available under section 320. Figure 2 demonstrates the overlap in timing across the various activities associated with the four NEP phases for the Casco Bay Estuary Project. The Casco Bay Estuary Project completed a preliminary CCMP within the first two years of the program. Based largely on initial characterization work, the program identified five specific threats to the estuary. The preliminary CCMP was used as a tool to focus subsequent characterization work.

EPA has found this concurrent approach so effective that the Agency has based selection of new estuaries on their ability to streamline the NEP phases, focusing on estuaries where:

- Significant problem characterization is complete;
- A management framework analogous to a management conference already exists; and
- Key state and local agencies have already committed to participate in and support the NEP process.

Management conferences of NEPs selected under these criteria are expected to complete development of CCMPs in less time than has been allowed for previous management conferences. For example, a first draft of the CCMP is to be completed within the first twelve to eighteen months of the management conference being convened. Under the streamlined approach, these first draft CCMPs will be used as tools for implementing early actions to correct known and suspected problems of the estuary. In addition, the first draft CCMPs will focus characterization efforts on filling data gaps that, without further data collection, will prevent the management conference from deciding what action is needed to correct a problem. This streamlined approach to CCMP development will result in a more focused effort toward achieving the goals of the NEP.

But to address less obvious or more complex problems, sound characterization of the estuary's environmental and management status is critical. During Phase 2 of the NEP process, the management conference identifies and fills in information necessary to define priority problems, determines areas for action, and identifies appropriate corrective actions. Technical characterization answers questions about the physical, chemical, and biological processes at work in the estuary. It also considers the scope and intensity of threats to the estuary's health and identifies likely activities or

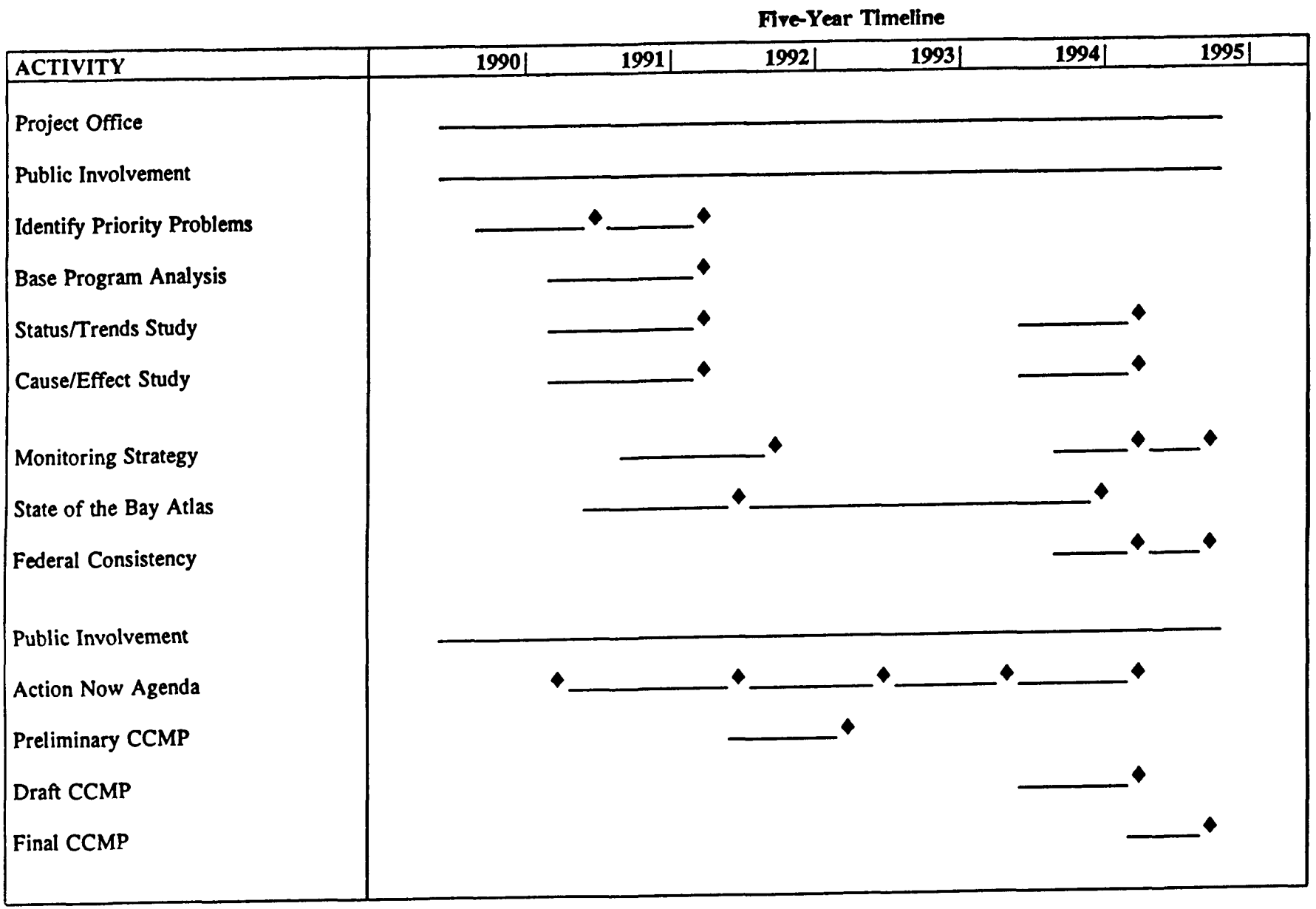


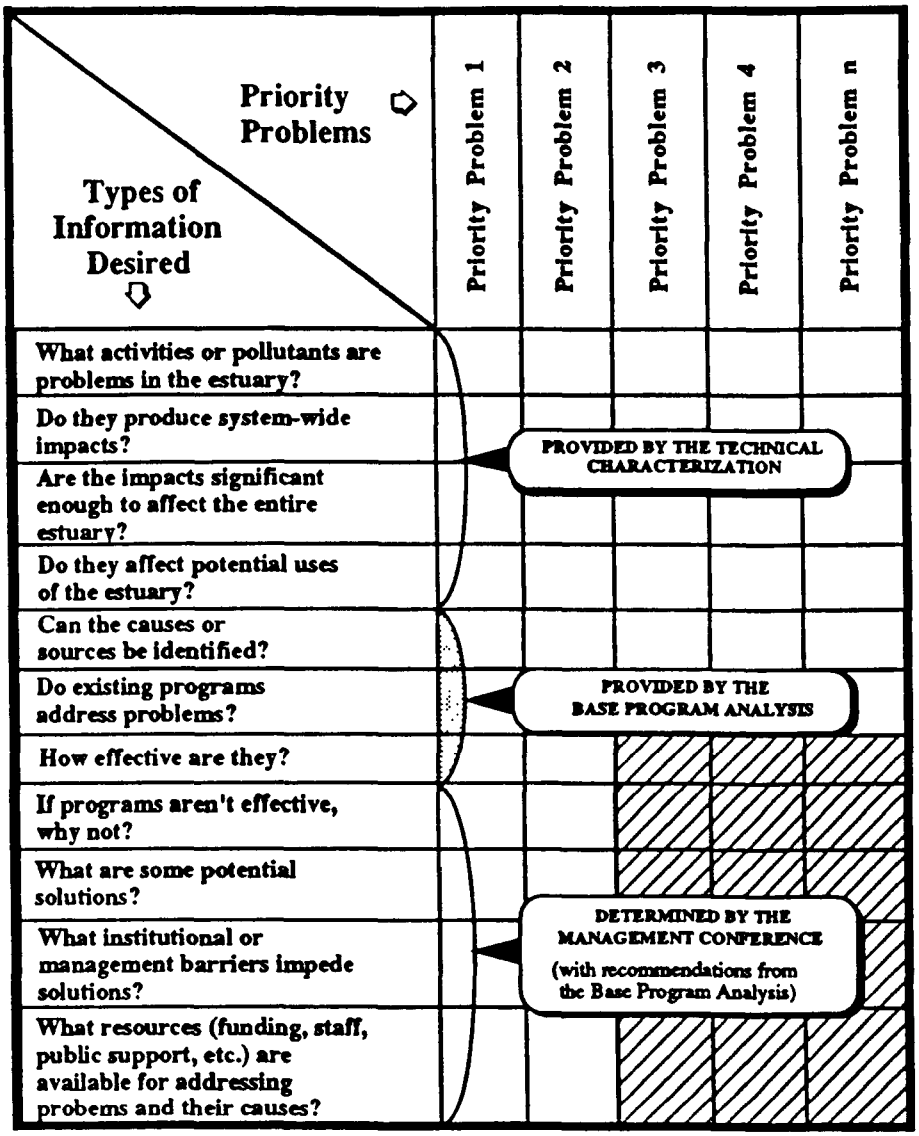
Figure 2. Casco Bay Five-Year Timeline, demonstrating overlap across the four phases of the National Estuary Program.

sources, such as inappropriate patterns of development, habitat destruction, industrial wastewater, or agricultural runoff, that could be causing problems in the estuary (Table 1).

TABLE 1. TYPICAL SOURCES OF ESTUARY PROBLEMS.

POINT SOURCES
Wastewater discharges from POTWs
Direct wastewater discharges from industrial facilities
Combined sewer overflows
Stormwater discharges
Animal feedlots
Boat discharges
NONPOINT SOURCES
Agricultural runoff
Urban and suburban runoff
Silvicultural runoff
In-place sediments
Mining runoff
Construction site runoff
Landfill runoff/leachate
Septic system leaks and overflows
Atmospheric deposition
Groundwater pollutant transfer
OTHER
Shipping and marinas
Dredging
Shoreline development
Freshwater inflow
Sea level rise

Essential though it is, however, science cannot marshall action alone. As presented in Figure 3, decision makers must also consider whether corrective actions are possible. Some problems, for example, may rate as high priorities for the CCMP because mechanisms to address them are already in place or could be readily implemented. The companion base program analysis, therefore, serves as a management characterization of the estuary through a process of describing the framework of institutions and programs within which a CCMP will be implemented. The base program analysis also assesses the effectiveness of that framework in managing and protecting the estuary's resources, and when combined with the technical characterization, recommends issues to be addressed in the CCMP based on potential management enhancements or alternatives.



During characterization and problem definition (Phase 2), the Management Conference assembles information (rows of this matrix) about suspected high-priority estuary problems (columns).

Each cell in this matrix actually represents from one to many pages of information answering the row's question for that priority problem. The Management Conference may decide to drop some priority problems from consideration (shown hatched above) because the technical characterization indicates they are not significant enough to require action in the CCMP.

Figure 3. Matrix of management conference information needs.

Together, the technical characterization and base program analysis provide the information necessary for developing CCMP recommendations and help the management conference secure effective mechanisms for addressing priority problems and their causes.

II. KEY TASKS IN THE TECHNICAL CHARACTERIZATION PROCESS

Overview

As defined previously, the fundamental goal of technical characterization is to provide information on which to base decisions and propose actions in the CCMP. To satisfy this goal, the following major objectives or tasks need to be undertaken:

Task 1: Identify and describe the valued resources/uses of the estuary

Task 2: Determine the condition of the valued resources/uses

Task 3: Identify the priority problems being experienced by the valued resources/uses

Task 4: Identify the likely causes of and possible solutions to the priority problems

Task 5: Provide input to the comprehensive conservation and management plan

The relationships among the technical characterization tasks are presented graphically in Figure 4. As is shown in Figure 4, the later tasks in the process build upon the results of the earlier tasks. It is important to note that the ability to move from one task to the next is governed by the availability and quality of environmental data, both of which may vary among the valued resources/uses. This variability may result in the development and implementation of recommended actions much earlier for some of the resources/uses than for others. For example, a management conference may be able to proceed relatively quickly, and with relatively less effort, through Tasks 1-3 if a particular resource has been well studied prior to the estuary being selected for the NEP. Therefore, the individual tasks that comprise technical characterization may occur on different timeframes for each of the valued resources/uses.

It is also important to note that technical characterization plays a key role in many of the decisions that are made by the management conference prior to the development of the CCMP. For example, the decision to implement early actions with other than section 320 funds (the "Action Now Agenda"; see Figure 2) is made based on a determination that an adequate understanding of a particular problem exists. Also, the selection of Action Plan Demonstration Projects by the management conference combines early technical characterization results with pilot-scale solutions that may be recommended later in the CCMP for estuary-wide application. Therefore, the value of the technical characterization process can be demonstrated on many levels.

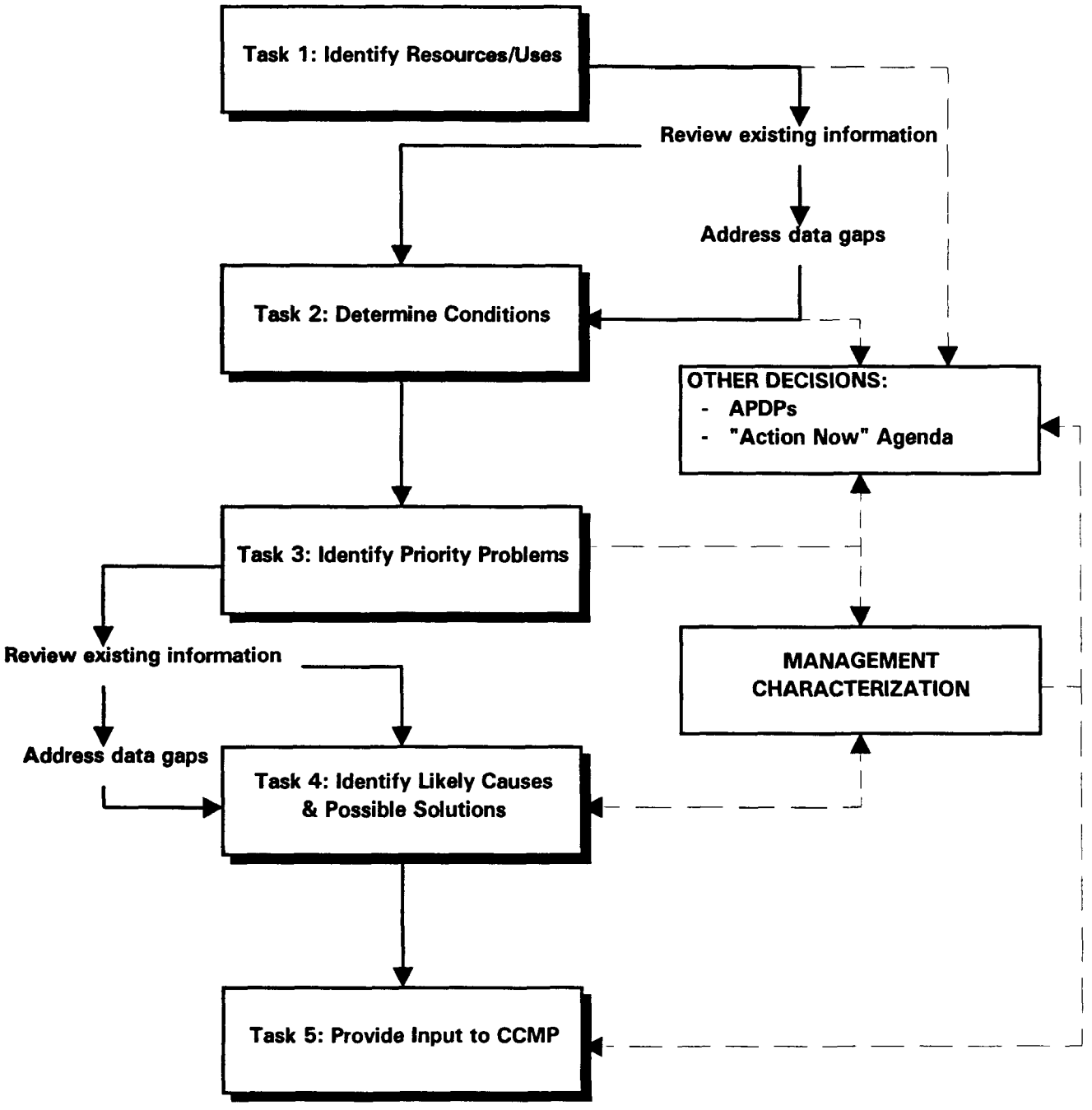


Figure 4. Relationships among the technical characterization tasks.

Although collection of new data may be required to address critical information gaps or specific issues that are identified for early action by the management conference, technical characterization in the NEP relies heavily on existing environmental data. In fact, a criterion for selection into the NEP is the advanced state of knowledge concerning the conditions of the estuary.

Effective management of environmental data is as important to the success of the characterization effort as collecting the data. Data analysis efforts conducted in conjunction with the technical characterization process are often hampered by historical data that are not readily available (i.e., lost, misplaced, or inaccessible) or that lack essential information necessary to evaluate the comparability of data sets (i.e., sampling methods, QA/QC protocols). Often, while significant funds are expended on data collection, the amount of funding allocated to data management is relatively small and inadequate. Failure to plan for data management early in the process can result in loss of information, thus wasting funds allocated to data collection efforts. To overcome these potential pitfalls, NEP experience to date suggests that three factors be considered when developing a data and information management system to support the technical characterization process:

- Location and accessibility of the data
- Methods used to collect and analyze the data
- Relevance of the data to the goals and objectives for the estuary

The following sections describe the tasks of the technical characterization process, including relevant examples from the NEP. The tasks outlined in this guidance are intended to provide a generic framework for technical characterization, leaving each management conference the flexibility to modify this framework to suit its specific needs.

Task 1: Identify and describe the valued resources/uses of the estuary

A critical first step, not only for characterization, but also for developing the CCMP, is to identify and describe the valued resources and uses of the estuary. It is important to begin the technical characterization process with a focus on resources and uses; because, in some cases, the management conference's efforts may need to be directed at protection rather than restoration (i.e., preventing a problem rather than correcting one). If the management conference only considers existing problems from the start, problem prevention may be overlooked. In addition, it is important that the management conference identify the most valued resources and uses of the estuary early in the technical characterization process, establishing priorities which will focus the remaining characterization work.

As a practical matter, much of the identification of valued resources and uses is accomplished during development of the *nomination package* that is

submitted prior to the estuary's entry into the NEP. In establishing the need to convene a management conference, the nomination package provides a general synthesis of available information on the economic and ecologic value of the estuary. In addition, the nomination package presents examples of the overall goals and environmental quality objectives that will be proposed to the management conference once it is convened. Therefore, accomplishing Task 1 does not generally require the collection of new environmental data once the management conference is convened.

The information summarized in the nomination package provides a valuable starting point for the management conference in accomplishing the first task of technical characterization. However, it is critical that, once convened, the management conference reach consensus on the valued resources and uses of the estuary. To accomplish this, the management conference must establish criteria for identifying the most "valued" resources and uses of an estuary, reflecting the overall goals and environmental quality objectives of the management conference. Identifying these criteria can often be difficult, because the value of many of the estuary's resources and uses are not easily quantified through traditional techniques. NEPs have used a variety of methods to develop these criteria, including ecological risk analysis, human health risk analysis, legislation, and public debate. Some of the NEPs, including Casco Bay, Indian River Lagoon, and Galveston Bay, are attempting to incorporate economic valuation factors into their priority setting process. EPA's Oceans and Coastal Protection Division is currently developing a handbook on the use of economic resource valuation in the NEP.

It is important to gather public input at this stage to begin building long-term commitment to achieving the program's goals. This has often been accomplished through public workshops and conferences sponsored by the management conference. For example, in 1989 and 1990, the Delaware Estuary Program conducted a series of facilitated workshops to form a "vision of the Delaware Estuary for the year 2020 which was shared by a diversity of people representing the users of the estuary" (DELEP, 1990). During facilitated discussions, workshop participants identified the most important uses and resources of the estuary, largely based on their individual perspectives as users (i.e., fishermen, recreational boaters, land developers, birdwatchers, businessmen, farmers, etcetera). Participants agreed on the following list:

- Fisheries
- Wildlife
- Recreation
- Water Supply
- Commerce

These uses and values were the basis for goals and objectives endorsed by the management conference.

Worksheets, such as the one shown in Figure 5, can be used to develop a graphical representation of the overall relative importance of the estuary's resources. The Santa Monica Bay Restoration Project used forms of this worksheet as workshop tools to stimulate discussion among participating managers and technical experts. Environmental managers and regulators were asked to position the valued resources along the Public Value axis; technical and scientific participants were asked to position the resources along the Ecological Value axis. The results were combined and resources were then positioned on a master worksheet. Valued resources in the upper right quadrant had the highest overall value, while those positioned in the lower left quadrant had the lowest value.

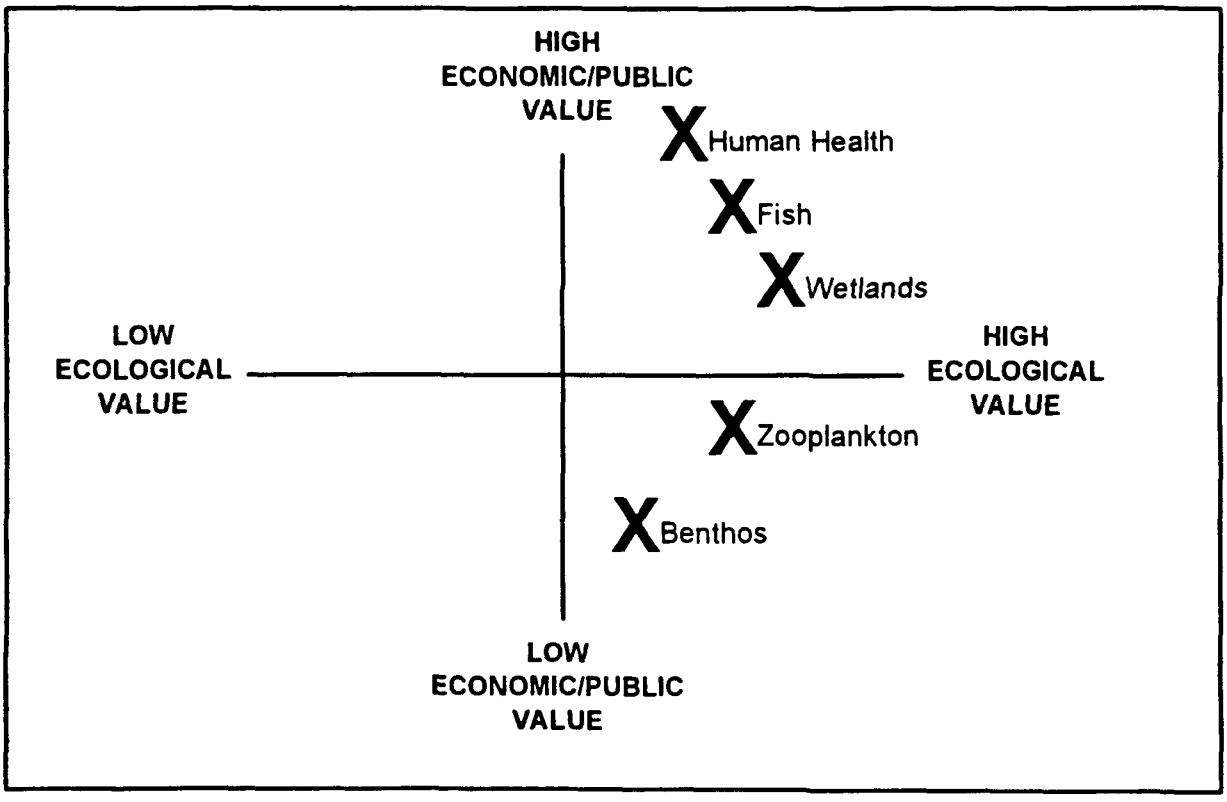


Figure 5. Example worksheet used to establish relative importance of an estuary's resources.

Opinion surveys have also been used frequently in the NEP to identify perceptions of user groups and the general public concerning the valued resources and uses of an estuary. In 1987, the Narragansett Bay Project

conducted such a survey to determine public perceptions concerning uses of the Bay, threats to those uses, and choices that should be made between competing uses (NBP, 1987). A random sample of adults was selected from a sampling frame stratified to reflect geographic distribution of the adult population of Rhode Island. According to the researchers who conducted the survey, the sample of 503 people produced results that were within ± 4 percent of the results which would have been obtained by sampling the entire adult population of Rhode Island. Based on the survey results, two closely related issues, pollution and risk from contaminated fish, were the most important issues to the public. Also, the researchers noted a consistent tendency by the public to assign a high priority to pollution issues. The results of the survey helped to set the direction of the Project in future years.

Identification of the most valued resources and uses allows the management conference to begin the process of identifying priority problems of the estuary. A focused approach to characterization is necessary under the NEP, because time and funding constraints limit an expanded assessment to only the more important or "valued" resources and uses. Those resources and uses which are ranked low by the management conference could be addressed in the "unfinished agenda" described later in this document.

Task 2: Determine the conditions of the valued resources/uses

Once the management conference has identified the valued resources and uses of the estuary, the current condition of each of these resources/uses must be assessed. Therefore, Task 2 of the technical characterization is essentially a *status and trends* analysis of each of the resources/uses. The status and trends analysis presents the past and current conditions of the estuary, and predicts the future conditions of the estuary should current trends continue. NEPs are also encouraged to analyze trends in demographics, land use, census, and other data that may influence the environmental conditions. Puget Sound's "State of the Sound" 1988 Report dedicated an entire chapter to "Human Development of the Puget Sound Area" which projected future trends in population, economic development, and land uses (PSWQA, 1988). In addition, Task 2 activities help to highlight gaps in information concerning the condition of the estuary. The identification of these information gaps can help determine the necessity for new data collection efforts during the technical characterization process.

A simple status and trends analysis can show obvious changes over time. These status and trends analyses consist of simple plots or other forms of graphical analyses of the available data. These very simple charts are most useful to demonstrate the estuary's current conditions and changes over time to the public and decision makers, the key audiences for the characterization results. For example, Figure 6, taken from the Tampa Bay Status and Trends Report, presents the historical record of seagrass habitat loss in Tampa Bay (TBNEP, 1993). Figure 7 presents the historical landings of spotted seatrout,

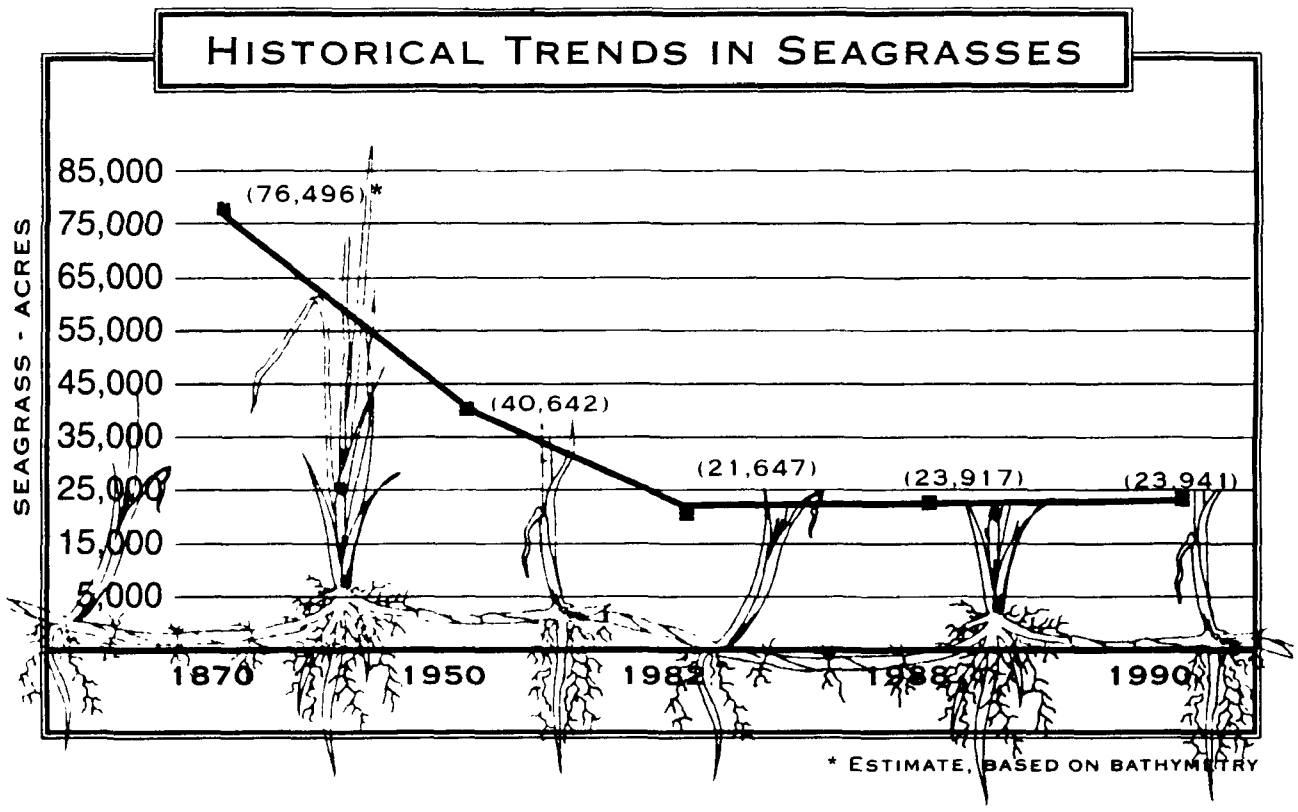


Figure 6. Historical record of seagrass habitat loss in Tampa Bay (TBNEP, 1993).

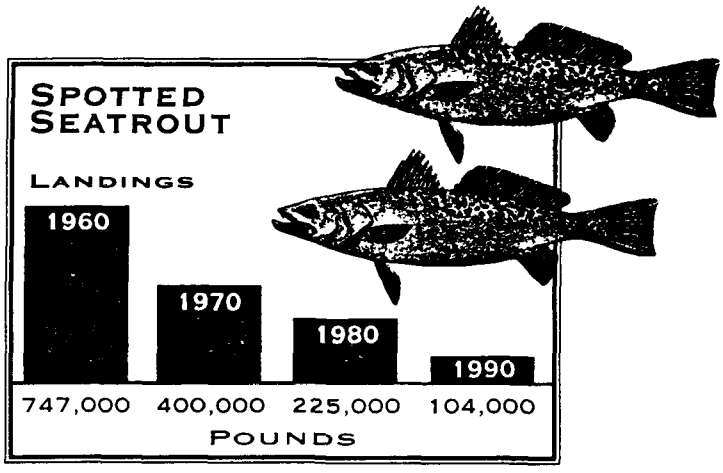


Figure 7. Historical landings of spotted seatrout, one of the most sought-after gamefish in Florida (TBNEP, 1993).

one of the most sought-after gamefish in Florida (TBNEP, 1993). The report did not point to a specific cause and effect relationship, but indicated that the combined loss of seagrasses and overharvesting have played a part in the decline of seatrout landings.

A basic trend analysis, while an important first step toward understanding the estuary's conditions, does not always lead to clear cut hypotheses or conclusions in itself. For example, Figure 6 shows that seagrass beds have stabilized in acreage since 1982, yet the sea trout landings (Figure 7) have continued to decline. But such trend analyses allow the conference to identify questions which direct future characterization work, leading the conference to the information it needs to formulate recommendations for the management actions. Questions such as "Although seagrass acreage has remained constant, has the health and productivity of the seagrass beds been altered?" and "What is the optimum level of seagrass habitat we need to support the seatrout fisheries?" can be identified by the conference through the simple trend analyses.

Detection of more subtle changes over time requires more detailed analyses and statistical tests. For these analyses, several attributes of the data (e.g., distributional characteristics, seasonality, and correlation among factors) need to be explored to determine the applicability of available tests for detecting changes in environmental conditions. Data collected during this task can help in designing sampling protocols for the monitoring plan, a requirement under purpose 7 of the management conference. The Sarasota Bay Program collected data demonstrating diurnal fluctuations in dissolved oxygen levels, as shown in Figure 8 (Tomasko, 1993). Figure 9 shows thatprevious sampling in Little Sarasota Bay was typically conducted during mid-morning to early afternoon, thus eliminating the highs and lows of the data, and biasing any dissolved oxygen trend analyses (Tomasko, 1993). The Sarasota Bay Program used this information to design the monitoring protocols for dissolved oxygen in the post-CCMP monitoring plan.

The "Monitoring Guidance for the National Estuary Program" (EPA, 1992a) provides examples of analyses conducted by the Chesapeake Bay Program to evaluate the response of water quality *parameters* to nutrient reduction actions. This case study includes an evaluation of existing data to determine the minimum trend that could be detected at different levels of sampling effort.

In evaluating the conditions of the estuary, it is often useful to adopt a *segmentation* scheme. Segmentation refers to the division of an estuary into subareas based on homogeneous conditions such as bottom type, salinity, or water temperature. Physical, chemical, and/or biological data for the estuary are then aggregated based on these segments. Segmentation represents a compromise between the difficulty of resolving the physical detail of an entire estuary and the expediency of dealing with a small number of geographical units. The purpose of technical characterization is to provide information that

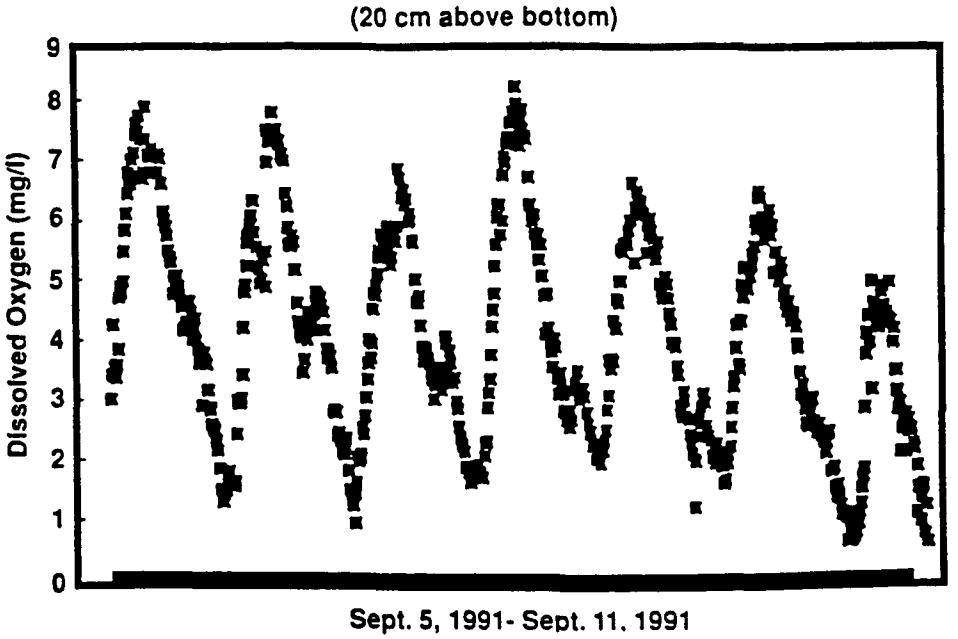


Figure 8. Dissolved oxygen levels (mg/l) over a seven day period in Little Sarasota Bay (Tomasko, 1993).

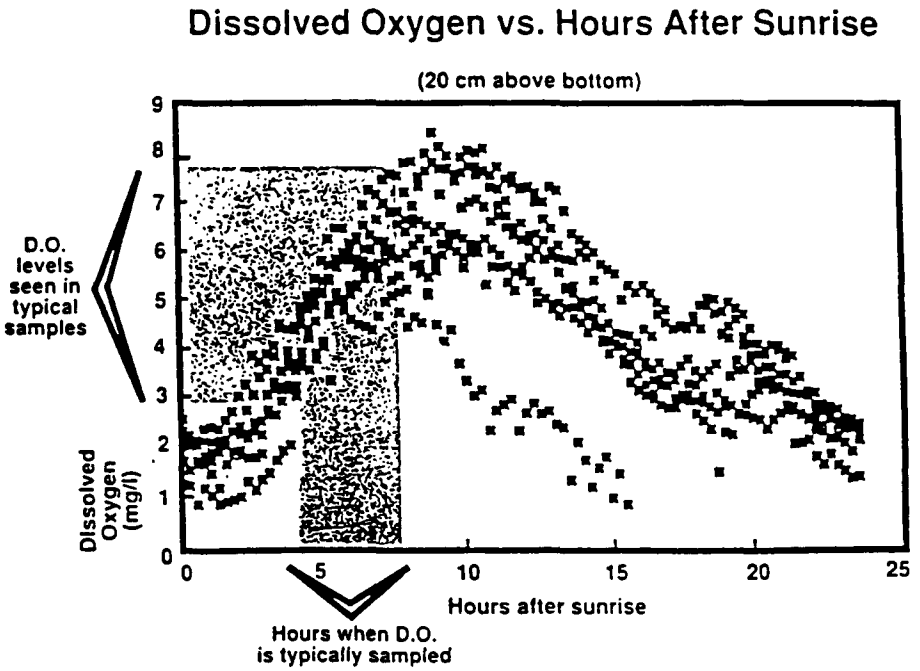


Figure 9. Dissolved oxygen levels (mg/l) versus hours after sunrise in Little Sarasota Bay (Tomasko, 1993).

can be linked with the results of the management characterization to recommend corrective actions in the CCMP. Since these actions are often geared toward meeting environmental restoration and protection goals for segments of the estuary, analysis of the status and trends of the resources for each segment is a natural approach. Figure 10 shows a segmentation scheme, adopted by the Tampa Bay National Estuary Program, that subdivides Tampa Bay into seven segments (Treat *et al.*, 1985). Pollutant load reduction goals, and management actions to achieve them, will be developed by the Tampa Bay management conference to address the following targeted habitats:

- Saline and oligohaline seagrasses
- Emergent marshes
- Mangroves
- Unvegetated benthic, intertidal, and superlittoral habitats
- Pelagic

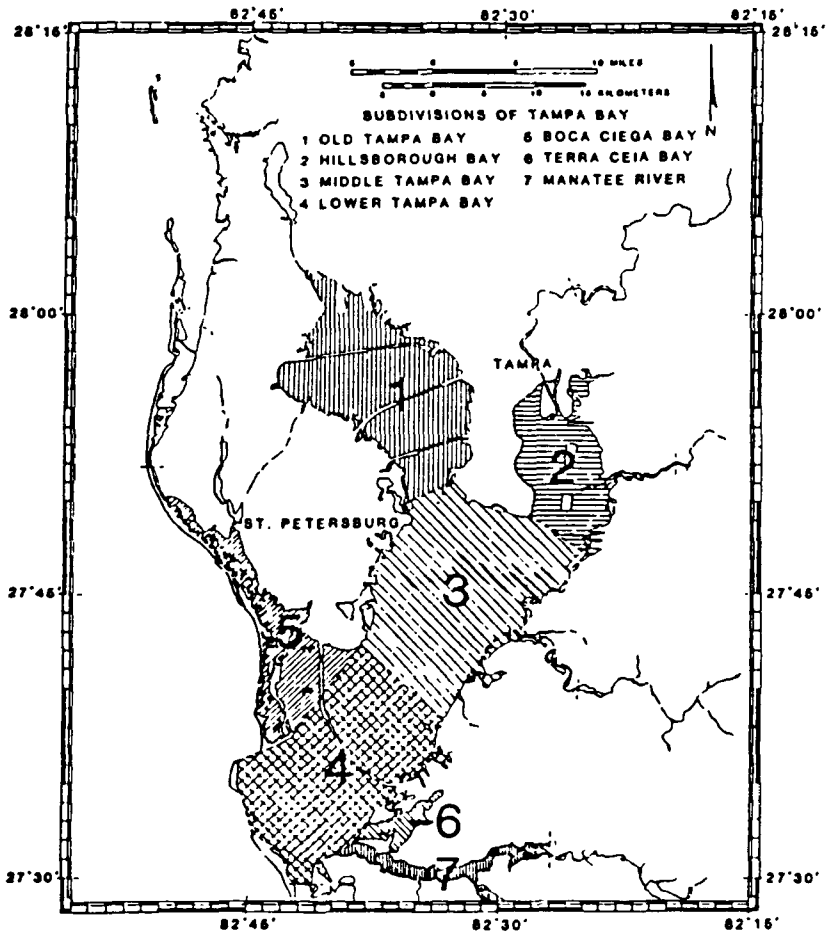


Figure 10. Segmentation of Tampa Bay by the Tampa Bay National Estuary Program (Treat et al, 1985).

From a statistical perspective, determining the status and trends of valued resources and uses has inherent uncertainty associated with it due to a number of factors, including errors of measurement, limits of precision in measurement or analytical methods, statistical variability of the analytical methods, and inherent spatial and temporal variability of the parameters being measured. Of equal importance is the actual range of values found in the data. A wide range of values may be due to natural variation, sampling design, and/or analytical methods. This uncertainty in the data is carried over into the status and trends analysis and affects the conclusions drawn from the data. For these reasons, Task 2 necessarily involves an evaluation of the quality of existing data based on completeness, accuracy, and precision. This information is used to assure the validity of comparisons being made between various data sets, which is important when quantitative analyses are required.

The expectation for Task 2 of the technical characterization effort is that the results will provide a summary of the status and trends of the estuary's resources and uses, leading to a set of hypotheses concerning cause-effect relationships under Task 4 based on a preponderance of evidence. In general, the basic research and effort required to establish definitive cause-effect relationships are beyond the timeframe of the NEP, given the considerations related to the use of existing data presented previously. However, some management conferences may be able to build on pre-NEP research to establish conclusive cause-effect relationships within the NEP timeframe.

Task 3: Identify the priority problems being experienced by the valued resources/uses

Once the conditions of the valued resources/uses have been assessed, the management conference must reach consensus on the highest priority problems being experienced by the estuary. These priorities form a critical foundation for development of the action plans in the CCMP, where it is often necessary to make choices from among the universe of management options.

As with the identification of valued resources/uses under Task 1, the identification of priority problems should draw on the groundwork established in the estuary's nomination package. However, as with Task 1, it is important that the management conference reach consensus on the priority problems. An approach for establishing priorities among the estuary's problems is summarized in the National Research Council's "Managing Troubled Waters" (NRC, 1990). The end product of this approach is an assessment matrix that presents valued resources and the likely causes of problems being experienced by those resources (Figure 11). Each cell in the matrix summarizes the effects of any given perturbation on a single valued resource. The assessment matrix also provides a quick assessment of how a perturbation affects a number of valued resources, and how a single resource is affected by a number of different perturbations.

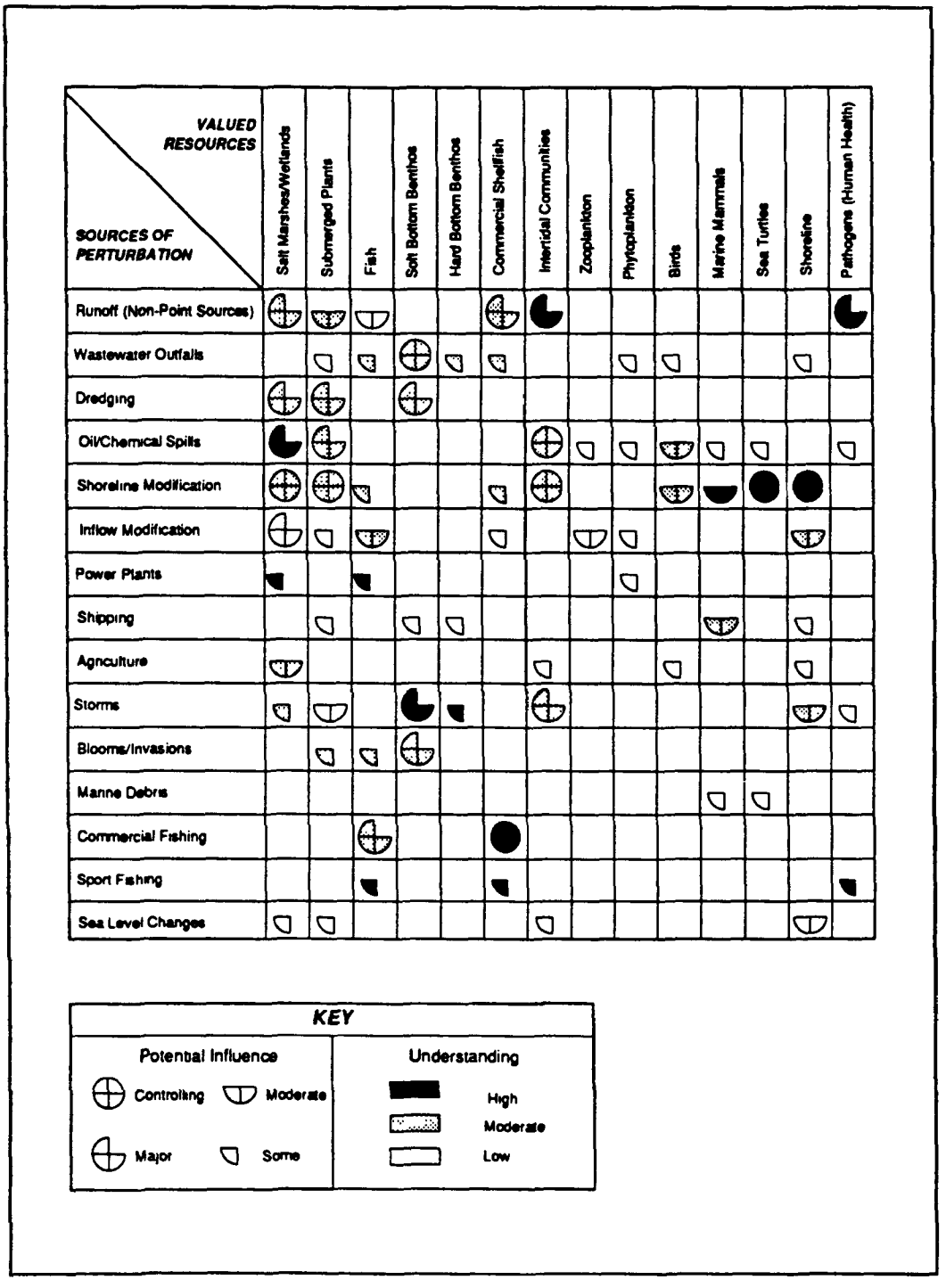


Figure 11. Assessment matrix for hypothetical estuary.

The process of developing the matrix provides an effective tool for building consensus among the wide range of parties participating in the management conference. The matrix is developed based on the answers to several questions about the estuary, including:

(1) What are the important or valued resources in the estuary?

(2) What perturbations cause problems with these resources?

(3) What is the potential influence of each perturbation on these resources?

(4) Do these perturbations cause system-wide problems?

(5) What is the level of scientific understanding of the interaction between each perturbation and resource?

It should be noted that these questions are similar in nature to, but more specific than, the information needs identified previously in Figure 3. Answers to these questions can be drawn from Tasks 1 and 2 of the technical characterization process. However, it is important to develop these answers through a consensus process that incorporates input from scientific and technical experts, managers, and the concerned public. To accomplish this, a worksheet similar to that shown in Figure 5 can be used to rank perturbation sources relative to their effects on the valued resources/uses identified under Task 1. For each cell in the matrix, it is necessary to summarize the present understanding of the relationship between each valued resource and each source of perturbation. This information is the result of evaluations and analyses performed under Task 2. Summarizing this information in the matrix also creates a powerful tool for assessing gaps in understanding the estuary.

The Galveston Bay NEP (GBNEP, 1994) used a similar approach for identifying and prioritizing valued resources and developing an assessment matrix (Figure 12). The GBNEP developed, with public input, a Priority Problem list to direct characterization work and to rank and fund projects. An initial assessment matrix was subsequently developed and circulated among members of the Program's Technical Advisory Committee. After a consensus was developed within this Committee, the matrix was forwarded to the Program's Management Committee for further refinement and approval. GBNEP found the matrix to be valuable for consensus building within the conference and to help guide and focus the scientific work of the conference.

This approach provides the essential information about estuarine resources and sources of perturbation. GBNEP's Ecosystem Impact Matrix also identifies certain relationships that are poorly understood and was used by GBNEP to identify and prioritize resources, priority problems, and sources of perturbation. The essential components of the approach are the basic questions identified above and some mechanism for consensus building and public participation. The results from ongoing studies conducted during the technical

Valued Ecosystem Components

Sources of Perturbation	Water Quality	Circulation	Sediment	Phytoplankton	Zooplankton	Oysters	Shellfish	Other Benthos	Finfish	Birds	Marine Mammals	Sea Turtles	Human Health	Submerged Wetlands	Submerged Plants	Shoreline	Aesthetic Appeal
Northers		**		?	?	*			**	*							
Hurricanes		**	*	?	?	*	*	**		*			?	?	***	***	
Inflow Modification	***	***	*	?	?	****	***	***	**			?		***	**		
Subsidence/Sea Level		**				*	**		*	*				****	***	****	
Shoreline Development	**	*	*	*			**		**	**				****	**	****	***
Dredging	***	****	****	?		**	*	**	**	***	?	?	?	***	**	***	**
Shipping	**		*								?			**		**	
Point Sources	****		****	***	**	***	**	**	**	**	?	?	****	*	**		**
Non-Point Sources	****		****	***	?	***	**	**	**	**	?	?	***	**	**		**
Commercial Fishing	?		?			**	****	?	***		?	?			**		
Recreational Fishing						*	*		***					?	*		
Boating/Marinas	***		***	?	?			**	*					*	*	*	?
Petroleum Activity	***		***	?	?	*	**	**	*	*	?	?	*	**	*		?
Oil/Chemical Spills	***		***	?	?	**	?	?	?	**	?	?	**	***	?		***
Marine Debris									?	*	*	**					***

* = Slight influence
** = Moderate influence
*** = Significant influence
**** = Major influence

? = Unknown relationship
= Possible management priority

Figure 12. Galveston Bay Ecosystem Impact Matrix (GBNEP, 1994).

characterization then provide essential information that assist the management conference in selecting the highest priority problems to be addressed in the CCMP. These studies often serve as the basis for distinguishing between perceived problems and real problems.

In characterizing an estuary, it is important to consider the linkages among the priority problems, in addition to considering them in isolation. These linkages could dramatically influence conclusions concerning cause-effect relationships under Task 4, and subsequent recommendations for action. An example of problem linkage can be found in the Barataria-Terrebonne National Estuary Program (BTNEP). The BTNEP Conference Agreement describes the interconnections among seven priority problems (Figure 13): hydrological modification, habitat loss, sediment loss, changes in living resources, eutrophication, pathogens, and toxic substances. Hydrological modification is identified as the "lynch pin" problem that influences all six of the other priority problems.

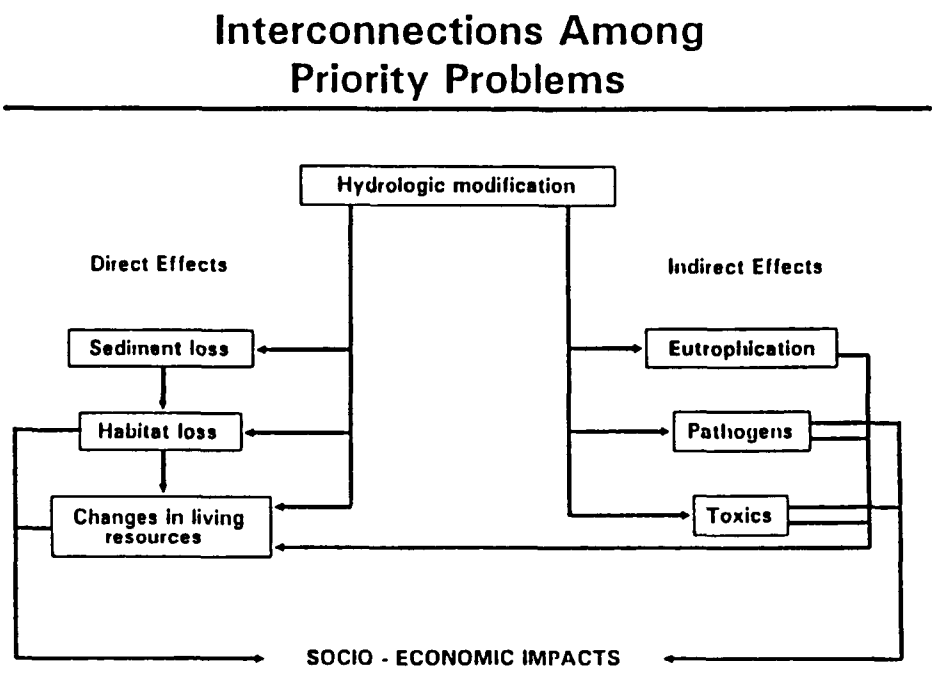


Figure 13. Problem linkage in the Barataria-Terrebonne Estuary.

Task 4: Identify the likely causes of and possible solutions to the priority problems

Under Tasks 1-3 of the technical characterization, the management conference evaluates the conditions of the estuary and identifies priority

problems. The results of these tasks provide a picture of the health of the estuary. However, because the ultimate goal of the management conference is to develop a CCMP that "recommends priority corrective actions," the most important output from the technical characterization is the identification of likely causes of the priority problems (Task 4). The likely causes become a link between the technical and management characterizations (Figure 4), providing targets for recommendations developed in the CCMP.

A basic description of the estuary's processes and functions is necessary to determine likely causes of the priority problems. This "snapshot" of the estuary allows the management conference to evaluate the relative linkages between various human activities and the priority problems. Therefore, to develop a complete picture of the estuary, it is important to have access to land use and demographic information as well as physical, chemical, and biological data. NEPs have used various methods to describe their estuaries, ranging from narrative descriptions to conceptual models. These two methods are presented below, but others may be useful as well.

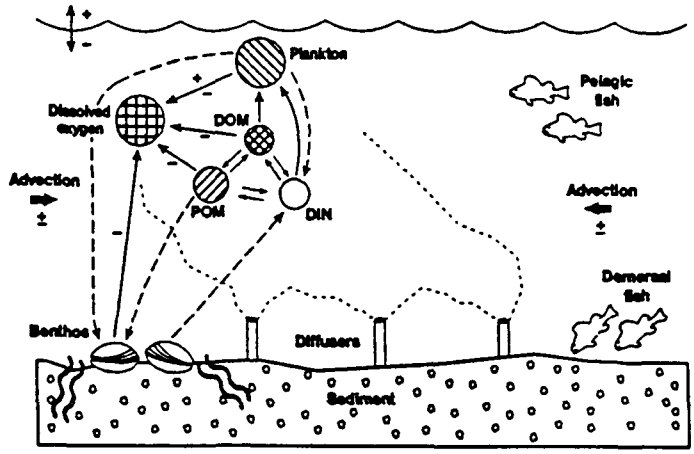
A narrative description may take the form of a qualitative, nontechnical summary of existing information explaining the relationships between natural and human perturbations and impacts on valued resources. A narrative description often includes a mix of qualitative and quantitative and technical descriptions. The Puget Sound NEP used this approach in its "1988 State of the Sound Report" (PSWQA, 1988). Qualitative, thorough descriptions of the estuarine processes were combined with simple diagrams showing circulation patterns, marine, freshwater, and terrestrial habitats, and living resource information, relating how various factors influence the estuarine processes and resources. This report also made use of easy to read qualitative narrative matrices to describe: 1) the possible causes, current status, and outlook for each problem indicator; 2) pollutants, possible sources, and associated impacts; 3) sources, effects, and trends; and 4) the distribution of certain contaminants in the Sound. These matrices were concise, simple, and contained on one page.

Another useful method for describing the affected estuary involves the development of a diagrammatic or *conceptual model* to represent the current understanding of estuarine structure and function. Good conceptual models clearly and succinctly represent the best understanding of ecosystem resources (e.g., wetlands, fish, sediments), processes (e.g., predation, turbulent mixing), and factors controlling their interactions. A well-constructed conceptual model can plainly represent and communicate the complex interactions and processes characteristic of estuaries in a form that is more concise than most narrative descriptions. Examples of three conceptual models, representing the three main issues related to eutrophication in Massachusetts Bays, are presented in Figure 14 (Kelly, 1991).

(a) Dissolved Oxygen Depletion

Contributing Factors

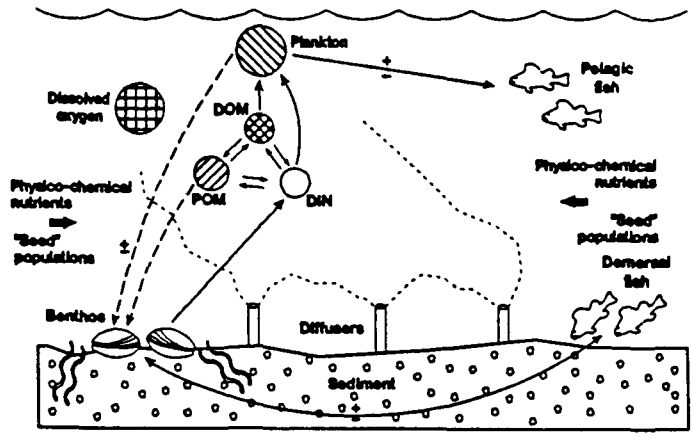
- Light
- Suspended matter
- Temperature
- Salinity
- Physics (mixing, stratification, advection, air-sea exchange)
- Nutrients
- Organic matter



(b) Stimulation of Problem Phytoplankton

Contributing Factors

- Nutrient quality and "quality" (N/P/Si)
- Light
- Suspended matter
- Temperature
- Salinity
- Physics (mixing, stratification, advection)



(c) Changes in the Food Web

Contributing Factors

- Light
- Suspended matter
- Temperature
- Salinity
- Physics (mixing, stratification, advection)
- Nutrient "quality"
- Plankton species

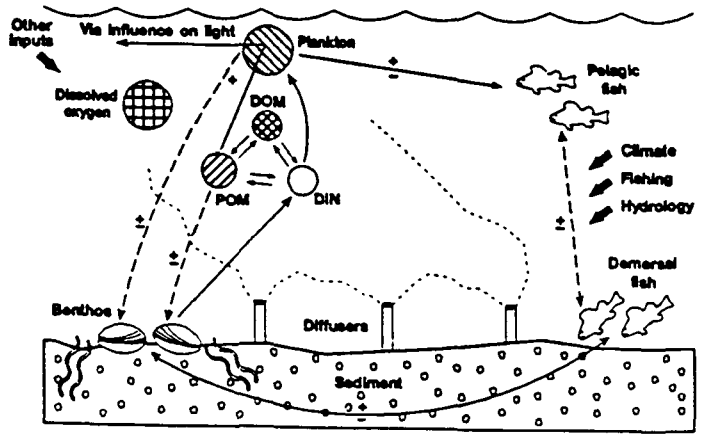


Figure 14. Conceptual models representing three main issues of eutrophication for Massachusetts Bays (Kelly, 1991).

Conceptual model development should be directed by a clear articulation of the model's purpose. A well-defined statement of purpose identifies the model's use, topic of concern, type of information to be included, and intended audience. Conceptual models possess the following attributes that can help advance the technical characterization process:

- They provide an explicit structure for organizing and summarizing existing knowledge of the system.
- They provide a common language, thereby enhancing communications between managers and scientists.
- They provide a frame of reference for reviewing the rationale behind management decisions.

The following elements should be included in any conceptual model:

- Natural and anthropogenic perturbation sources
- Potentially impacted, valued resources
- Processes affecting exposure to perturbations, and resource stress (i.e. contaminant transport; contaminant transformations; and contaminant bioaccumulation)

How an estuary, or part of an estuary, responds to anthropogenic and non-anthropogenic perturbations can involve the interplay of a number of valued resources and estuarine processes. It is important to understand this interplay to evaluate the potential for multiple benefits that may derive from addressing a single cause (e.g., control of storm runoff may have positive effects on submerged aquatic vegetation and shellfish beds). Conceptual models can assist the management conference by depicting these interactions in a manner that identifies likely cause-effect relationships, and that facilitates the development of appropriate management actions and monitoring objectives.

Once likely cause-effect relationships of the priority problems have been established, the management conference goes on to determine the strength of those relationships. Statistical techniques such as *regression* and *correlation analyses* can be used to explore the nature of these relationships and the degree to which measurements of two or more factors vary together. For example, Figure 15 shows a relationship between seagrass productivity and nitrogen loads in Sarasota Bay. Figure 16 shows the relationship between seagrass productivity and epiphyte loads (Tomasko, 1993). The Sarasota Bay Program found that elevated nitrogen loads negatively impact seagrasses, but stimulate the productivity of epiphytes, naturally occurring algae which adhere to seagrass blades, thus reducing light availability to the seagrasses (Tomasko *et al.*, in review). In order to document that water quality monitoring programs have biological relevance, a correlation analysis was performed on yearly average light attenuation coefficients versus the depth to which seagrasses

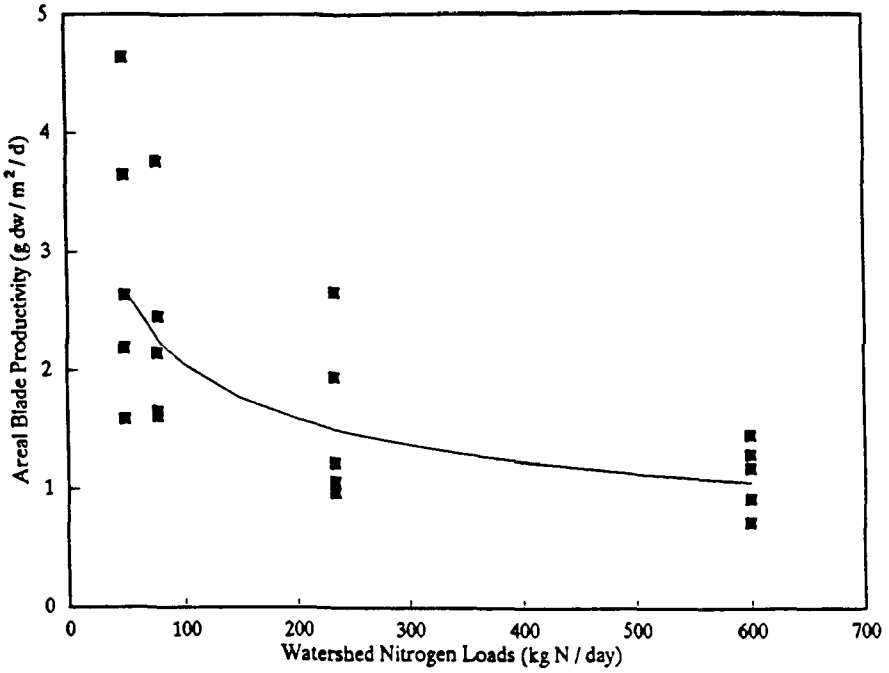


Figure 15. **Areal blade productivity plotted against watershed nitrogen loads for Thalassia testudinum from four sites in Sarasota Bay (Tomasko et al, in review).**

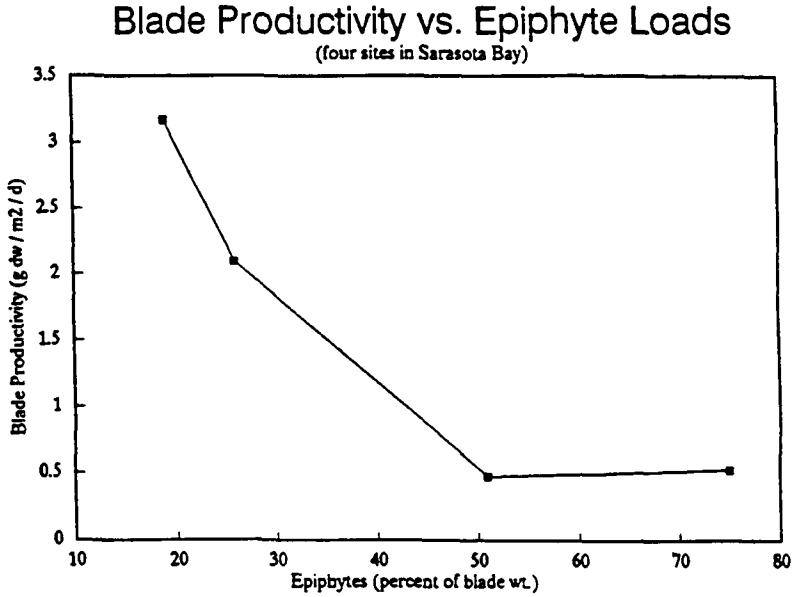


Figure 16. **Areal blade productivity of Thalassia testudinum versus blade epiphyte loads (Tomasko, 1993).**

grow in Sarasota Bay. As a result, Figure 17 suggests that this method of measuring water clarity is a meaningful tool for estimating the depth to which seagrasses grow. With shallow bottom slopes, dramatic increases in seagrass habitat can be achieved with minimal increases in water clarity (Tomasko, 1993). Such clear graphical depictions of characterization's key findings are extremely convincing to both scientists and the general public. If time and resources permit, the management conference can take these findings one step further by developing mathematical functions to summarize the observed relationships. These functions can form the basis for the use of predictive tools, such as the water quality and hydrodynamic models being developed by the Long Island Sound Study (LISS, 1990).

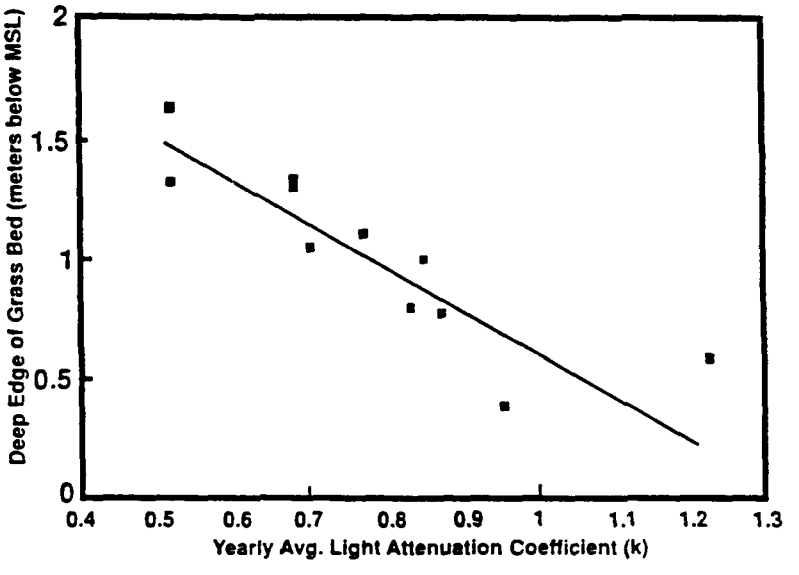


Figure 17. Depth limits of seagrasses in Sarasota Bay as a function of segment-wide annual average light attenuation coefficient (Tomasko, 1993).

It is important to again point out the distinction between identifying likely causes of priority problems under technical characterization and establishing absolute cause-effect relationships. The former involves the development of hypotheses, using the best available evidence, concerning cause-effect relationships. The latter typically requires the collection of field or laboratory data under controlled conditions; an effort that is often beyond the timeframe available for NEP characterization.

Task 5: Provide input to the Comprehensive Conservation and Management Plan

As was noted previously in this document, the fundamental goal of technical characterization in the NEP is to provide information on which tobase decisions and propose actions in the CCMP. This technical information is provided by establishing the status and trends of estuarine resources, identifying impacts being experienced, and determining the likely causes of those impacts. However, to be useful, the technical characterization must be linked with the management characterization, resulting in the direct development of management recommendations in the CCMP. This linkage occurs at two important points in the process (Figure 4). First, priority problems identified under Task 3 of the technical characterization provide the initial focus for evaluating the existing management structure of the estuary. Second, the likely causes identified under Task 4 indicate the kinds of programs, controls, and tools that should be evaluated during the management characterization. In addition, any gaps in coverage between the causes of priority problems and existing management programs may highlight a need to recommend new authorities or programs in the CCMP.

During this task, the conference scientists must glean and present to the conference the key findings of technical characterization, the important information that will help the managers and decision makers decide on the management actions. Generally, this results in three types of products:

- Individual project reports
- Characterization report
- CCMP public summary

These products vary in their level of detail depending on the audience, as described below.

Individual Project Reports

The products generated during technical characterization will include reports that present the conclusions of various studies commissioned by the management conference to accomplish Tasks 1-4. The content of these reports will most often be technical in nature, intended to provide a scientific basis for recommendations developed in the CCMP. It is important for these reports to be well written and, as much as possible, to emphasize the application of the findings to actual decision making. A clear set of conclusions at this stage helps the conference scientists, as well as the managers and the public, in determining the key findings of these studies. These individual technical reports will generally address fairly specific issues identified by the management conference. For example, the Barataria-Terrebonne National Estuary Program funded a survey of vegetation damage caused by nutria

feeding in the Barataria and Terrebonne basins. Individual project reports may also include syntheses of existing information on the estuary, such as the review and synthesis of historical water quality data funded by the Tampa Bay National Estuary Program (TBNEP, 1992).

Characterization Report

To convey a complete picture of the estuary, it is useful to combine the results of the technical characterization process in a single *characterization report* that contains the findings from the various individual project reports described above. This report should address all five tasks of the process, outlining the conditions of the valued resources and uses of the estuary, the priority problems being experienced, and the likely causes of those problems. Although members of the management conference may be familiar with the estuary's problems, the general public may not be as well informed. Thus, the characterization report can be an effective tool for building public support for the NEP in general, as well as recommendations made in the CCMP. In serving this function, the characterization report should clearly explain why the management conference has chosen to focus on the priority problems and provide sound scientific justification for the actions that are recommended in the CCMP.

The characterization report should address the following elements:

- Description of the valued resources and uses of the estuary.
- Measurable parameters that reflect the conditions of the resources/uses and the processes that affect those parameters. Important factors and relationships should be identified and their roles presented.
- Assessment of the trends in water quality, natural resources, and uses of the estuary.
- Final list, historic description, and background information on priority problems to be addressed in the CCMP. Background information should include the relationship between observed effects and economic, recreational, and aesthetic values.
- Description of the impacts of the problem on the resources and uses.
- Discussion of the strengths of the relationships between parameters, and the uncertainties in analyses. Knowledge of uncertainties in the data can be used to direct further data gathering and research efforts and is important to the development of an effective sampling design in the post-CCMP monitoring program.
- Hypotheses of cause-effect relationships for the priority problems, and research necessary to establish relationships.

It is essential that the conference committees, and management committee in particular, be briefed on the characterization report results and recommendations.

Characterization Summary

As described above, the characterization report makes recommendations for the management actions and provides the scientific justification for the recommendations. In communicating these recommendations, the characterization summary is an invaluable tool. Public meetings and workshops are extremely useful ways to ensure that the public summary reaches a wide audience.

Under the requirements of the Clean Water Act, technical characterization is intended to fulfill management conference purposes 1-3 (Figure 1). Documentation that these purposes have been met must be presented in the CCMP when it is submitted to the Administrator for approval (EPA, 1992b). To meet this requirement, each CCMP must include a plain-English summary of the technical characterization findings. This summary should describe the following:

- The estuary's priority problems and the selection criteria used to determine them.
- The environmental quality goals and objectives established for the estuary. These goals and objectives form the basis for the monitoring program developed to evaluate the effectiveness of actions implemented under the CCMP.
- The status and trends of the estuary's water quality, natural resources, and uses.
- The likely causes of the priority problems, including data on toxics, nutrients, and natural resources.
- The linkages between pollutant loadings and changes in the estuary's water quality, uses, and natural resources.
- As much as possible, some prediction of the estuary's conditions under different management scenarios.

Each CCMP should also clearly reference studies conducted as part of the technical characterization effort. Copies of technical studies generated must be available upon request.

The characterization summary can be used as a public outreach document, or can be the basis for other public outreach documents that condense the technical characterization results even further and present them in

a manner that is more useful for public involvement purposes. For example, the Sarasota Bay National Estuary Program's report titled "Sarasota Bay: Reclaiming Paradise" (SBNEP, 1993) presents a 42-page "summary of the Sarasota Bay Program's key findings, options for Bay improvement, and an in-depth discussion of the Bay's conditions." These kinds of reports do not take the place of the more technically-based reports, but rather they bring the results of the technical studies to a broader audience to solicit public understanding and support for recommendations made in the CCMP.

Relationship to Monitoring

Technical characterization directly assists the design of the monitoring program, developed under purpose 6 of the management conference, to assess the effectiveness of actions implemented under the CCMP. The first step in designing the monitoring program is the establishment of specific monitoring objectives (EPA, 1992a), identified through technical characterization. At a minimum, characterization provides the management conference with a baseline for monitoring (i.e., status analysis) and a concept of historical changes (i.e., trends analysis). A more sophisticated technical characterization provides a basic understanding of important physical, chemical, and biological processes in the estuary. This information helps to specify a set of parameters and ecological processes that can be used to detect changes in the estuary in response to management actions in the CCMP.

The protocols used in the data collection activities of the monitoring program should, as much as possible, follow the protocols used in the data collection and analysis activities during technical characterization. This allows for direct comparison of historical, current, and future data and illustrates the need for long-term planning, particularly if characterization leads to new data collection. In addition, the monitoring program may also be designed to address information gaps that are identified during the technical characterization process.

EPA's policy on managing environmental data in the NEP (EPA, 1994) states that:

1. Submission of data in ODES format to OCPD is no longer required.

2. OCPD will continue, either directly or indirectly, to provide access to and support for ODES, until ODES data are migrated into the modernized STORET system.

3. Responsibility for identifying and selecting data management systems and processes remains with the management conferences.

4. Grants and cooperative agreements awarded with NEP funds should require that the recipient organize and maintain all environmental data generated with NEP funds in a manner that allows potential

users of NEP data to readily identify data of interest, access those data for use, and determine the suitability of those data for other uses, based on readily available QA/QC and methodology summaries.

This policy gives individual management conferences freedom to use various data management systems and processes to meet the goal of on-going, easy access to data of known quality.

III. MANAGING THE TECHNICAL CHARACTERIZATION PROCESS

Roles in the Process

Like any other part of the NEP approach, advance planning and organization are key to successful completion of the technical characterization process. Because the characterization results help guide many decisions of the management conference, their timely integration into the conference is crucial. Likewise, each committee's involvement early in the characterization process is essential. In that regard, a management conference should plan to address five distinct roles that factor into completion of the tasks outlined in this document:

- Process management
- Scientific/technical direction and review
- Management/policy direction and review
- Public participation
- Technical work

Various members of the management conference, the program office, and principle investigators selected by the management conference assist in fulfilling these roles. In addition to federal, state, and public input, local governments are a critical contributor to the characterization process. Local governments should be factored into all five of the roles in the characterization process because they are often best suited to providing insight on the local issues and needs of the estuary's watershed, and are key to implementation of the actions.

Process Management

Because the sequence of technical characterization tasks can occur over different time periods (depending on the availability and quality of data for the valued resources and uses), completing the tasks requires attention to process management. A "big picture" view of the entire technical characterization process must be maintained in planning and implementing the process while specific technical issues are being investigated. Management of the process occurs at two levels. First, decisions that occur within each of the tasks are made by the Management Committee, with input from the advisory committees, as described below. These decisions may include the selection of priority problems, the identification of technical studies and other characterization projects to be conducted, and the selection of principal investigators to conduct the studies.

Second, most of the day-to-day management of the technical characterization process is the responsibility of the NEP *program office.* These responsibilities may include:

- Tracking progress
- Preparation of annual work plans that include the technical work identified by the Management Committee
- Identification of scientific experts and sources of technical information
- Oversight of principal investigators selected by the Management Committee to conduct technical work
- Preparation and dissemination of background information for management conference and public consumption
- Coordination of peer review processes for management conference products
- Management of data storage and synthesis, where needed
- Composition and/or review of draft and final products
- Release and distribution of final reports

In addition, the program office is often in the best position to oversee production of the characterization report. Active participation of program office staff, who are familiar with all aspects of the estuary program, helps to ensure coordination across all parts of this activity.

Scientific/Technical Direction and Review

Throughout the technical characterization process, there is a need for sound direction from scientists participating in the management conference who have first-hand experience working in the estuary. In addition to the general expertise in estuarine research these scientists bring to the process, their specific experience related to the estuary program's study area is an invaluable source of historical and practical information. In addition, there is a continuing need throughout the technical characterization process to recommend, evaluate, and interpret the results of technical studies commissioned by the management conference.

This role of providing scientific direction and review is typically played by the *Scientific and Technical Advisory Committee.* Although the Scientific and Technical Advisory Committee oversees the quality of the science, this does not exclude members of other management conference committees with scientific expertise from contributing to this role. For example, the San Francisco Estuary Project management conference created subcommittees that

included a cross section of the management conference committees to address five technical issues (intensified land use, decline of biological resources, freshwater diversion and altered flow regime, increased pollutants, and dredging and waterway modification). Status and trends reports were then developed by each of the subcommittees. These subcommittees provided for a diversity of input to technical discussions, and also facilitated support from the major committees for technical conclusions by involving them in the development of those conclusions.

Management/Policy Direction and Review

The technical characterization process must include input from entities familiar with and responsible for the resource management framework of the estuary program's study area. This input provides a critical reality check to the process, since recommended actions that result from the characterization effort will be implemented from within this framework. In addition, this aspect of the process makes it possible to recommend enhancements to the existing resource management framework, if such changes are necessary to achieve the goals established under Task 1.

The role of providing policy direction and review is played by the *Management Committee*. This direction includes general guidance over the process, with particular attention paid to timing and decisions concerning the use of characterization findings. The management committee typically consists of representatives of participating federal, state, and local agencies, as well as representatives of the estuary's user community, environmental advocacy groups, and the chairs of the *Citizen Advisory Committee* and the Scientific and Technical Advisory Committee.

The Management Committee of the Massachusetts Bays Program develops program goals and workplans, approves documents and reports, and serves as a forum for discussion of environmental issues. This committee has two standing subcommittees: the Workplan Subcommittee, which pulls all program work together each year for a unified budget proposal; and the Implementation Subcommittee, which guides CCMP development and action plan implementation. Establishment of the two standing subcommittees allows a focus to be maintained concerning the two primary areas of attention for the Management Committee (i.e., work planning and CCMP implementation). This provides continuity over time, since a core group of participants that carries a historical perspective is involved from meeting to meeting.

Public Participation

Because the NEP represents a consensus approach to management of the nation's estuaries, it is important to provide public access to the technical characterization process. This enables the public to participate in identifying and ranking priorities for action. The management conference benefits from this in two ways. First, the interested public is a source of knowledge about

the estuary and the threats to its valuable resources. Second, the general public has an important stake in the actions recommended in the CCMP. Their inclusion in the technical characterization process will increase awareness and, ultimately, build support for CCMP implementation.

The Galveston Bay NEP has had a characterization symposium each year called the "State of the Bay Symposium". GBNEP's CAC worked closely with the STAC to organize these yearly workshops. These workshops not only provided the public with early results of characterization, and an opportunity to interact with the scientists conducting the studies and comment on the early findings, but helped solidify the scientific community as well.

The Santa Monica Bay Restoration Project has effectively used the Citizen Advisory Committee (referred to as the Public Advisory Committee) as a mechanism to maintain this two-way communication throughout the characterization process. The Public Advisory Committee has worked with the scientists participating on the management conference to develop outreach products that keep the public aware of progress and in-step with current issues. These products have included written reports and fact sheets, as well as public events such as beach clean up days and meetings.

Technical Work

It is often necessary for the management conference to fund specific activities in support of the technical characterization effort. These activities may include synthesis of existing data, collection of new data, report writing, and support for the process itself, such as meeting support and facilitation. Projects should be strictly limited to those that will achieve the stated objectives of the program. The tendency to perform unnecessary studies to satisfy unwarranted scientific or public interests must be avoided.

The scopes of work for these activities are developed by appropriate members of the management conference. For example, they can be developed by members of the Scientific and Technical Advisory Committee or program office staff. Principal investigators to conduct these activities are typically selected through a competitive process, with the actual selection made by the Management Committee, based on recommendations from the advisory committees. With regard to the selection of principal investigators, management conferences should incorporate guidelines in their bylaws to outline proper procedures for management conference participants who wish to compete for technical work under the NEP. The Tampa Bay National Estuary Program included the following article in the Management Committee bylaws:

> *No member of the Management Committee or staff representative shall participate in any decision or vote which would constitute a conflict of interest under Federal or State law. Members must clearly state any potential conflicts of interest prior to any discussion and abstain from such discussions.*

Regardless of the vehicle used to procure technical support (e.g., contract, cooperative agreement, grant), adequate oversight of that vehicle by the program office must be assured. Proper management is critical to obtain a high quality product, within time and budget constraints, that meets the needs of the management conference. This requirement should be considered when staffing the program office, and when selecting individuals to lead projects.

Time Frame for Technical Characterization

The timeframe for technical characterization must be linked to both the management characterization (Figure 4: Task 3 and 4) and development of the CCMP (Figure 4: Task 5). To accomplish this nested scheduling, an overall vision of the entire NEP approach must be maintained from the time the management conference is convened. This vision is reflected in the *Conference Agreement*, which outlines all of the anticipated milestones leading to development of the CCMP. The Conference Agreement should provide a road map for completing the technical characterization tasks, as well as for ensuring that results are available in time for recommendations to be developed for the CCMP.

Soon after establishing the milestones in the Conference Agreement, the management conference should establish milestones for scientific work needed to complete technical characterization. Some broad-based activities that should be planned for include:

- Gathering of historical data
- Collection of new data
- Analysis or evaluation of data
- Synthesis of information
- Development of hypotheses of causes and effects of priority problems
- Preparation of status and trends reports
- Preparation of characterization reports

The timing of all of these activities should allow for peer review and revision for the final product. This timeframe for characterization activities should then be followed fairly closely by the management conference during the characterization process. It should be noted that, as results of various projects become available, minor changes in characterization milestones may be required. However, major changes in direction should be avoided because of the time constraints of the NEP.

As has been noted frequently throughout this guidance, completing the tasks of technical characterization can occur at different rates, depending on the availability and quality of information for each of the valued resources and uses. This idea is presented graphically in Figure 18 for two hypothetical resources/uses. Resource/Use A had been studied thoroughly prior to convening the management conference, data are of good quality, and the availability of the data is fairly complete. On the other hand, not much prior work had been conducted relative to Resource/Use B, requiring more effort in the review of existing information, as well as new data collection activities to fill gaps in information.

In the hypothetical situation shown in Figure 18, the technical characterization tasks can proceed in an independent fashion, making it possible to evaluate and recommend management actions for Resource/Use A much earlier than for Resource/Use B. However, as was described under Task 4, there is often a close linkage between two or more resources/uses (e.g., submerged aquatic vegetation and fisheries), tying the progress of characterizing one resource/use to the completion of tasks for another. These linkages must be considered early in mapping out the technical characterization process.

In addition, the review of existing information under Tasks 2 and 4 may indicate an unavoidable need to conduct more detailed research to address specific issues identified by the management conference. For example, such research may be necessary under Task 4 to establish cause-effect relationships to the satisfaction of the management conference. Decisions to conduct such research must be considered with respect to the NEP timeframe. Because funding for the development of the CCMP is only available for a limited period, it may be advisable to include an "unfinished agenda" in the CCMP, indicating continuing research needs relative to each of the estuary's priority problems. This tool can be used as a means to maintain progress towards action on those issues that are well understood, while highlighting those issues that require further attention in future years. The unfinished agenda should be addressed in CCMP implementation plans developed by the management conference.

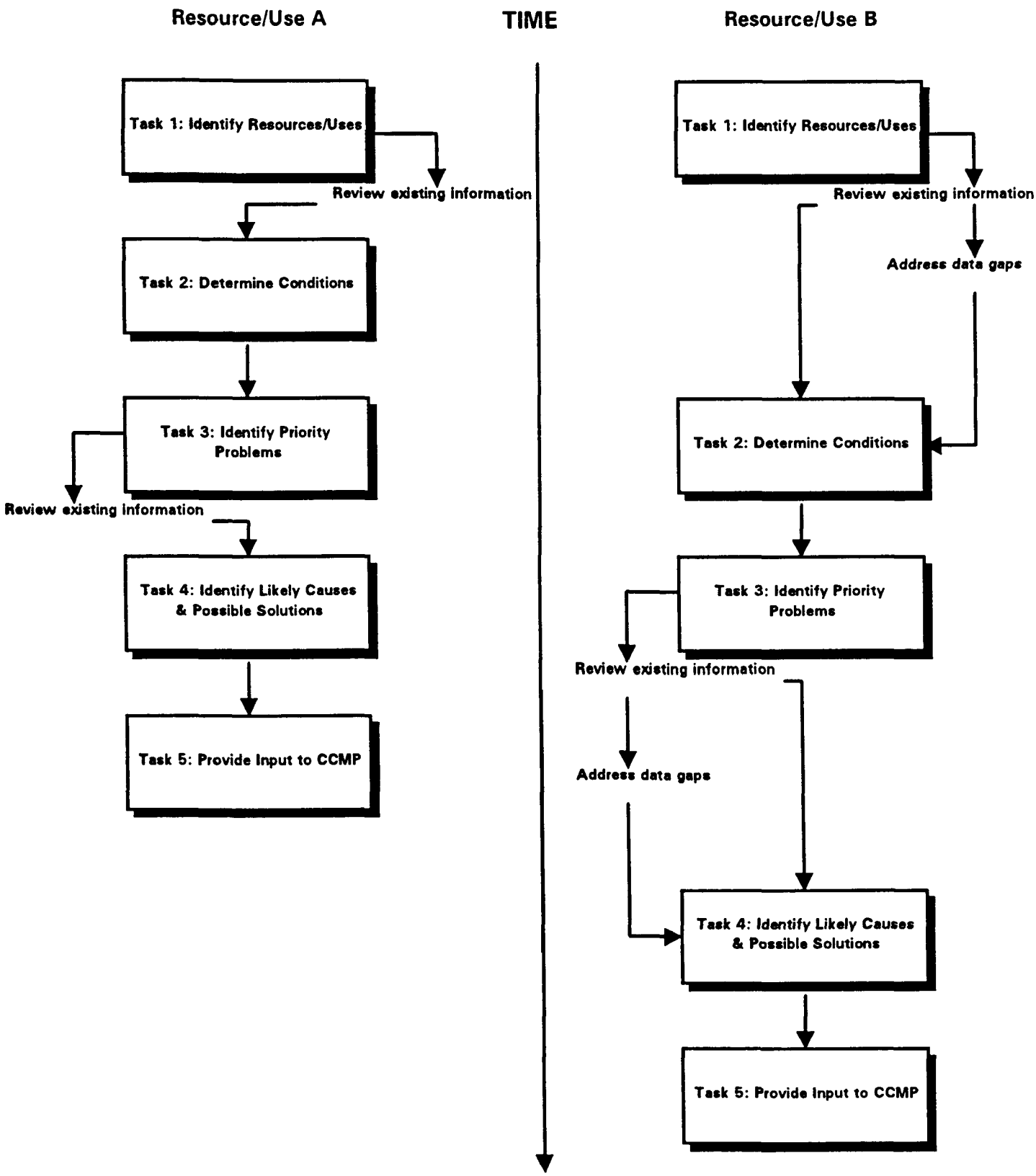


Figure 18. Hypothetical timeframes for characterizing two estuarine resources/uses.

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GLOSSARY OF TERMS

Characterization Report:

Report developed by an NEP management conference that presents the results of technical characterization, summarizing the conditions of the valued resources and uses of the estuary, the priority problems being experienced, and the likely causes of those problems.

Citizen Advisory Committee:

Committee within an NEP management conference that represents the public viewpoint and oversees mechanisms for broader public participation in the NEP process. This committee represents a spectrum of resource user and interest groups, as well as the general public.

Comprehensive Conservation and Management Plan (CCMP):

A CCMP summarizes the estuary's problems and indicates which ones will be addressed. Through a collaborative process, the management conference establishes program goals and objectives, determining desirable and allowable uses for the estuary and its various segments. Specific pollution control and resource management plans, designed to meet each objective, are the core of the CCMP.

Conceptual Model:

A diagrammatic method for describing the best understanding of an estuaries ecosystem resources (e.g., wetlands, fish, sediments), processes (e.g., predation, turbulent mixing), and factors controlling their interactions. A well-constructed conceptual model can plainly represent and communicate the complex interactions and processes characteristic of estuaries.

Conference Agreement:

Written agreement between EPA and appropriate state and local governments participating in an NEP management conference. The agreement outlines the activities, products, and schedules by which management conferences will complete their CCMPs.

Correlation Analysis:

Analysis of the relationship between two parameters, as well as the strength of that relationship.

Estuaries:

Biologically productive waterways where fresh water drained from the land mixes with salt water from the ocean (bays, harbors, sounds, etcetera).

Management Committee:

Committee within an NEP management conference that provides ongoing policy direction and review. This direction includes general guidance over the process, with particular attention paid to timing and decisions concerning the use of characterization results. The management committee typically consists of representatives of participating federal, state, and local agencies, as well as representatives of the estuary's user community, environmental advocacy groups, and the chairs of the Citizen Advisory Committee and the Scientific and Technical Advisory Committee.

Management Conferences:

The management structure convened by the Administrator of EPA to provide a forum for consensus building and problem solving among interested agencies and user groups. The management conference studies environmental conditions and trends in the estuary and their likely causes, identifies the most significant problems, and develops an action-oriented plan to address high-priority problems.

National Estuary Program (NEP):

Section 320 of the Clean Water Act established the National Estuary Program (NEP) to identify nationally significant estuaries threatened by pollution, development, or overuse and to promote the preparation of comprehensive management plans to ensure their ecological integrity. The program's goals are protection and improvement of water quality and enhancement of living resources.

Nomination Package:

Documentation submitted by one or more states requesting that a management conference be convened for a specific estuary. The nomination package includes information that demonstrates the national significance of the estuary, the need for a management conference, and the likelihood of success. If the estuary is selected for the NEP, the information in the nomination package is subject to review, evaluation, and redirection by consensus of the management conference.

ODES:

Ocean Data Evaluation System--A data management and analysis package originally developed by EPA to support monitoring programs that are implemented under Clean Water Act section 301(h) in connection with waivers from ocean outfall secondary treatment requirements. ODES has been expanded to contain NEP data, as well as data for other EPA programs.

Parameters:

A measurable characteristic.

Program Office:

Staff office established to provide ongoing support to the management conference during the CCMP development process.

Regression Analysis:

Analysis that allows one to make predictions about dependent parameters or variables using interval-level data.

Scientific and Technical Advisory Committee:

Committee within an NEP management conference that provides scientific review and direction. This committee typically includes scientists from universities and research organizations familiar with the estuary and its systems, as well as technical staff from participating state and federal agencies.

Segmentation:

The division of an estuary into subareas based on homogeneous conditions such as bottom type, salinity, or water temperature. Physical, chemical, and/or biological data for the estuary are then aggregated based on these segments. Segmentation represents a compromise between the difficulty of resolving the physical detail of an entire estuary and the expediency of dealing with a small number of geographical units.

Status and Trends:

Analysis of the past and current conditions of an estuary, as well as predictions concerning the future conditions of the estuary should current trends continue.

Streamline:

The application of lessons learned under the NEP, resulting in new management conferences being convened by EPA with an expectation that a CCMP will be completed in less time. In convening streamlined management conferences, EPA focuses on thoses estuaries where:

- Significant problem characterization is complete;
- A management framework analogous to a management conference already exists; and
- Key state and local agencies have already committed to participate in and support the NEP process.

Watershed:

The geographic region that drains into a particular stream, river, or body of water. Since all land within a watershed drains to a common place, all activities on the land have the potential to affect the entire watershed.