EPA United States Environmental Protection Agency

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COMMUNITY-BASED WATERSHED MANAGEMENT

LESSONS FROM THE NATIONAL ESTUARY PROGRAM

FEBRUARY, 2005

Chapter 3:
Identifying Problems and Solutions

INTRODUCTION

Once the estuary programs have built a framework for identifying, negotiating, and solving problems, they are ready to embark on other tasks. The NEPs begin to "take the pulse" of their estuaries, determining the state of their health and the reasons for their decline, and take early corrective action if possible. This process, referred to as Technical Characterization, defines the most pressing problems in the estuary, identifies the probable causes for these problems, and suggests possible solutions based on objective evidence.

Each NEP also conducts a Base Program Analysis. The Base Program Analysis determines whether existing institutional mechanisms are effectively addressing problems occurring in the estuary. The Base Program Analysis provides an assessment of existing federal, state, and local resource programs to identify gaps in estuary management and how they might be filled. It includes a review of public and private funding opportunities.

Together, the Technical Characterization and Base Program Analysis are the basis for defining and selecting the problems to be addressed in the Management Plan. This chapter outlines how the NEPs conduct the Technical Characterization and the Base Program Analysis. The chapter also discusses how the findings resulting from the Technical Characterization and Base Program Analysis are combined and translated into plain English, telling a story about the estuary and its watershed that the public and local decision-makers can understand.

NEP PRINCIPLES IN CHAPTER 3

- Technical Characterization describes the estuary's water quality and habitat problems and identifies likely causes of the problems.

- Technical Characterization relies primarily on existing scientific information.

- The Base Program Analysis is an evaluation of the institutional structures that affect the estuary. It is conducted in conjunction with the Technical Characterization.

- The results from the Technical Characterization and Base Program Analysis must be translated into plain English, telling a story about the estuary that the public can understand.

- The Technical Characterization and Base Program Analysis findings set the stage for the formulation of the Management Plan.

TECHNICAL CHARACTERIZATION

The fundamental goal of Technical Characterization is to identify the problems facing the estuary and present this information in a way that supports the selection of actions for inclusion in the Management Plan. To satisfy this goal, characterization proceeds through the following tasks:

Task 1: Identify and describe the resources and uses of the estuary.
Task 2: Determine the condition of the resources.
Task 3: Identify the priority problems that exist in the study area.
Task 4: Identify the likely causes of the priority problems.
Task 5: Provide input to the Management Plan.

The relationships among these tasks are presented graphically in **Figure 3.1**.
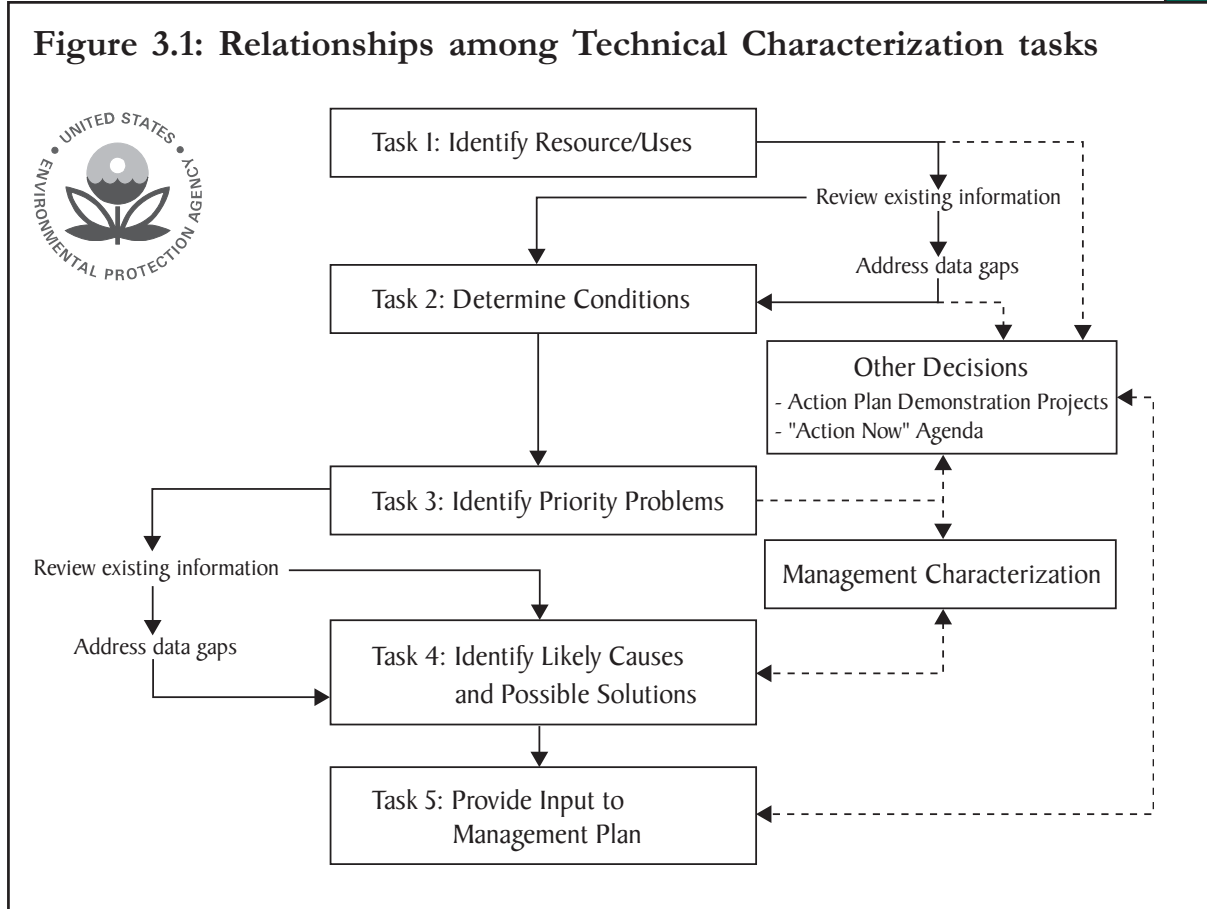
Technical Characterization of problems facing the estuary relies primarily on existing scientific information already collected by federal, state, and local agencies. Such information, which can be obtained and analyzed relatively efficiently and cost-effectively, provides the most direct way to evaluate trends in estuary conditions. **Table 3.1** (on page 24) lists the types of historical information used for characterization. These data are also used to shape new sampling and monitoring programs needed to define specific problems.

In addition to gathering scientific information to assist during the Technical Characterization process, the NEPs also rely on public input to provide additional direction and focus. Gathering public input at the early stages of the Technical Characterization process is essential for building a long-term commitment to achieving the estuary's goals. This is often accomplished through public workshops and conferences.

As a whole, the Technical Characterization process addresses historical trends, present conditions, and probable future trends if current practices are not modified. It is analogous to telling a story about the past, present, and potential future of each estuary. Results are used to substantiate environmental problems, evaluate their causes, recommend future remedial and management strategies, and develop long-term monitoring plans. Once this process is complete, the NEPs assess the effectiveness of existing efforts to manage the identified problems. This process, referred to as the Base Program Analysis, is discussed further on pages 32 through 34.

The following sections describe the tasks of the Technical Characterization process more fully.

Figure 3.1: Relationships among Technical Characterization tasks

Task 1: Identify Resource/Uses

Review existing information

Address data gaps

Task 2: Determine Conditions

Other Decisions
- Action Plan Demonstration Projects
- "Action Now" Agenda

Task 3: Identify Priority Problems

Management Characterization

Review existing information

Address data gaps

Task 4: Identify Likely Causes and Possible Solutions

Task 5: Provide Input to Management Plan

→ Technical characterization - - - ▸ Relationship to other parts of Management Plan development process

From EPA's *National Estuary Program Guidance: Technical Characterization in the National Estuary Program* (1994)

TASK 1: IDENTIFY AND DESCRIBE THE RESOURCES AND USES OF THE ESTUARY

The first step in the characterization process is to describe the resources and uses of the estuary and to identify the values it holds. Opinion surveys, public workshops, interviews, conferences, and other methods have been used by the NEPs to identify public perceptions concerning the resources and uses of an estuary.

TASK 2: DETERMINE THE CONDITION OF THE RESOURCES

Once the highest priority resources and uses of an estuary have been identified, the NEPs assess the condition of each of these resources. This involves a status and trends analysis of each of the resources. The status and trends analysis is a description of the past and current conditions of the estuary and forecasts the future conditions of the estuary should current trends continue. The NEPs include changes in demographics, land use, census, and other data that may influence the environmental conditions in the analysis.

NATIONAL ESTUARY PROGRAM
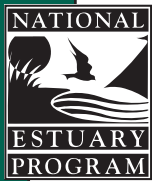
Table 3.1: Examples of historical information used for estuary characterization

Pollutant Sources to the Estuary
- Watershed geomorphology
- Land use patterns
- Freshwater input
- Pollutant loadings: direct discharges, riverine discharges, nonpoint source runoff

Circulation of Material in the Estuary
- Weather patterns
- Tides/currents
- Salinity
- Temperature
- Sediment grain size

Distribution of Chemicals in Estuarine Waters and Sediments
- Organic carbon
- Nutrients
- Dissolved oxygen
- Chemical contaminants

Distribution of Biological Organisms in the Estuary
- Plankton
- Benthic Invertebrates
- Fish
- Aquatic vegetation
- Endangered species
- Invasive species

Biological Indicators
- Primary production
- Secondary production
- Respiration
- Commercial fishery catches
- Recreational fishery catches

Factors Important to Human and Environmental Health
- Distribution of bacteria and pathogenic organisms
- Prevalence of disease in fish and shellfish
- Tissue contaminants

Geographic Areas of Special Importance
- Critical spawning or nursery habitats
- Recreational areas
- Beach closures
- Shellfish harvesting areas

The status and trends analysis can highlight gaps in information concerning the condition of the estuary, identify the need to collect new data, and suggest questions that direct future characterization work, such as "Although seagrass acreage has remained constant, has the health and productivity of the seagrass beds been altered?" and "What is the optimal level of seagrass habitat necessary to support the sea trout fisheries?" The NEPs collect data from virtually all possible sources—scientists, academic and research institutions, and public health and living resource agencies. Because collecting new scientific information is generally quite costly, historical data are used to set priorities for the kinds of new information needed for the characterization effort. To ensure the quality and validity of all data collected, the EPA has developed a set of procedures to follow when collecting and analyzing data (see EPA Guidance for Data Quality Assessment, www.epa.gov/quality1/qs-docs/g9-final.pdf).

Detection of 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) should 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 (detailed plans of a scientific experiment, treatment, or procedure for dealing with a sample) for monitoring plans. This data can be entered into STORET (short for STOrage and RETrieval), a repository for water quality, biological, and physical data that is used by state environmental agencies,

EPA and other federal agencies, universities, private citizens, and many others (see www.epa.gov/storet/).

In evaluating the conditions of an estuary, it is often useful to adopt a segmentation scheme. Segmentation refers to the division of an estuary into sub-areas based on homogeneous conditions such as bottom type 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. Analysis of the status and trends of the resources for estuary segments may also provide direction for individual actions in these segments.

From a statistical perspective, determining the status and trends of estuarine resources has inherent uncertainty associated with it due to a number of factors including measurement errors, precision limits, and statistical variability of the analytical methods. This uncertainty in the data often leads to a set of hypotheses concerning cause-effect relationships, rather than a definitive conclusion. The uncertainty in cause-effect relationships and trends in estuary health should be made clear to the public.

Photo: Steve Delaney

TASK 3: IDENTIFY THE PRIORITY PROBLEMS

Once the assessment is complete, the Management Conference must reach consensus on the priority problems. These priorities form the foundation for the development of the Management Plan, where it is often necessary to make choices from the universe of management options.

Because all the problems cannot be addressed at once, it is critical to rank them so that effort and funding levels can be allocated effectively. The Management Conference must establish criteria by which it will define and rank environmental problems for characterization.

Photo: Steve Delaney

The NEPs establish criteria for identifying priority problems to avoid overestimating the severity of certain problems which can divert attention from those that actually deserve greater concern. The presence of seasonal Harmful Algal Blooms (HABs), for example, may capture widespread public interest because of its potential effects on fish populations. However, the incidence of HABs may be limited to specific sites and may be the result of natural causes.

Problems with a system-wide impact generally rank higher than those with localized effects. Furthermore, problems that significantly curtail the designated uses of an estuary may be ranked high. Some problems may receive a high ranking because corrective measures, such as regulatory programs and authorities, are available but have not been implemented.

The Galveston Bay Estuary Program, for example, developed an assessment matrix to assist in establishing priorities among the estuary's problems. The Scientific and Technical Advisory Committee drafted an initial priority problem list. This list was subsequently reviewed and revised by the Management Committee through a series of public meetings. Based on this review, a draft assessment matrix was developed and reviewed by the Management Conference and technical experts, resulting in the final matrix presented in **Table 3.2**. This matrix presents the essential information about estuarine resources and sources of perturbation. The Galveston Bay Ecosystem Impact Matrix also identified relationships that were previously poorly understood, and was used by the Management Conference throughout the characterization process.

TASK 4: IDENTIFY LIKELY CAUSES OF THE PRIORITY PROBLEMS

To identify the likely causes of the priority problems, NEPs strive to collect data that are:

- relevant to defining the nature and extent of the priority problems;
- broad in temporal and spatial coverage;
- good quality; and
- available in a usable format.

Table 3.2: Galveston Bay Ecosystem Impact Matrix

Valued Ecosystem Components

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

From EPA's National Estuary Program Guidance: Technical Characterization in the National Estuary Program (1994)

* - Slight influence   ** - Moderate influence   *** - Significant influence   **** - Major influence   ? - Unknown relationship   ▨ - Possible management priority

Although existing information concerning a particular problem is first examined, the NEPs also conduct new research to illuminate possible causes. The NEPs work with many organizations that sponsor research including federal agencies such as EPA and NOAA, state and local government, and universities. For example, the Long Island Sound Study NEP collaborated with academic and not-for-profit institutions, as well as state and local governments to study hypoxia, examine the role of sea level rise in wetland losses, develop ecological indicators, and assess sources of nutrients and innovative technologies for their control.

Once the data are collected, the NEPs begin to answer specific questions about the relationships among pollutants, pollutant loadings, and their effects on water, sediment, and living resources. The general objectives of these analyses are to:

- determine the temporal trends and spatial patterns related to the most pressing problems of the estuary;
- determine possible causes of these problems;
- provide an integrated description of the estuary's conditions; and
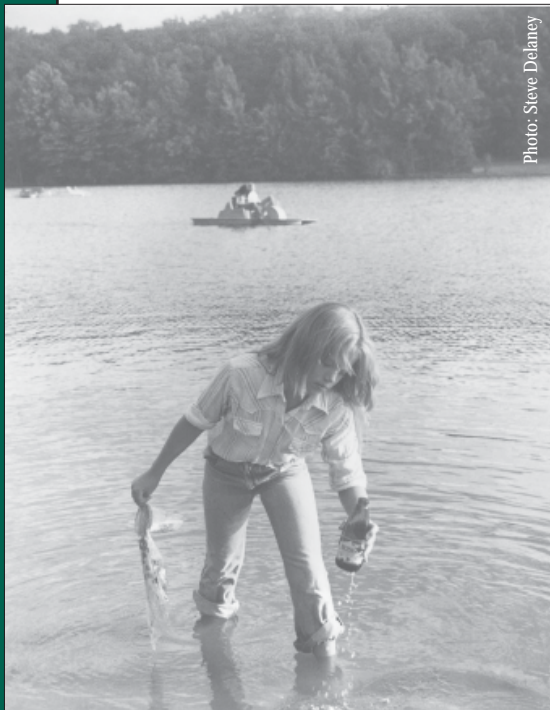- identify significant, missing data that warrant additional monitoring or sampling.

Photo: Steve Delaney

For example, the Barataria-Terrebonne NEP described the interconnections among seven priority problems (**Figure 3.2**): hydrological modification, habitat loss, sediment loss, changes in living resources, eutrophication, pathogens, and toxic substances. Barataria-Terrebonne NEP identified hydrological modification as the "lynch pin" problem that influences all six of the other priority problems.

Once likely cause-effect relationships of the priority problems have been established, the NEPs determine the strength of those relationships. Statistical techniques, such as regression and correlation analyses, have been used by the NEPs to explore the nature of these relationships.

Figure 3.2: Interconnections among priority problems in the Barataria-Terrebonne Estuary
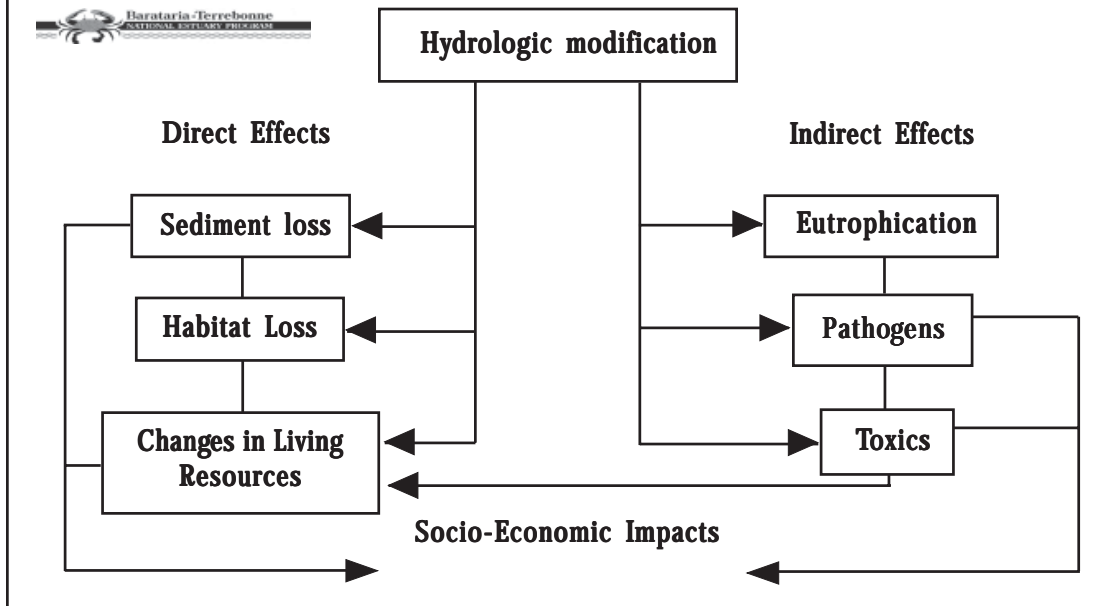
If time and resources permit, the NEP can take these findings one step further by developing mathematical functions to summarize the observed relationships. These functions can form the basis for the use of predictive tools, such as water quality and hydrologic models.

It is important to emphasize the distinction between identifying likely causes of priority problems 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 resources available to an NEP.

In characterizing an estuary, it is important to consider the links among the priority problems in addition to considering them in isolation. These links can dramatically influence conclusions concerning cause-effect relationships and subsequent recommendations for action.

TASK 5: PROVIDE INPUT TO THE MANAGEMENT PLAN

After data analyses are complete for each estuary problem, the NEPs synthesize results into reports that provide input to the Management Plan. These reports may be a series of findings on several identified problem areas and may be issued separately as they become available. To increase the pool of information and to encourage further research on the estuary, many NEPs publish their findings. These findings also help the NEPs design monitoring programs to assess the effectiveness of their actions.

The NEPs have used various methods to communicate the results of the characterization effort, ranging from narrative descriptions to conceptual models that describe estuarine processes and functions and determine likely causes of the priority problems. The NEPs develop characterization reports that:

- summarize major environmental problems within each estuary;
- identify suspected causes of the problems;
- recommend early actions and future remedial and managerial strategies; and
- suggest long-term monitoring efforts to evaluate the effectiveness of these strategies.

Photo: Steve Delaney

Most reports feature a narrative description that takes the form of a qualitative, non-technical summary of existing information explaining the relationships between human activities and impacts on resources. A narrative description may also include considerable quantitative and technical information to provide a more comprehensive assessment of these relationships.

Many reports include a conceptual model to present 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 estuary's complex interactions and processes in a form that is more concise than most narrative descriptions.

In general, the NEP Technical Characterization process culminates in three types of products that vary in their level of detail depending on the audience:

• Individual project reports provide technical information on the outcomes of discrete studies.

• Characterization reports furnish a comprehensive description of the estuary, including a summary of the results of individual project reports.

• Public outreach summaries provide a condensed version of the characterization reports.

The Technical Characterization results provide a baseline for monitoring and a basic understanding of important physical, chemical, and biological processes in the estuary. This information helps to specify a set of variables and ecological processes that can be used to detect changes in the estuary in response to management actions. The steps taken to ensure that high quality data results from the monitoring program should follow the same procedures used in the data collection and analysis activities during Technical Characterization.

With a baseline provided by Technical Characterization, ongoing monitoring serves as a tool to track the progress of the Management Plan and evaluate the relevance of management goals. Ongoing monitoring ensures that the Management Plan stays on target and can provide feedback for future revisions. The subject of environmental monitoring is addressed in greater detail in **Chapter 5**.

GETTING THE WORD OUT THROUGH A STAKEHOLDERS REPORT

The Mobile Bay NEP produced an award-winning stakeholders report, "Our Water Our Future," in preparation for the release of the Management Plan. This document highlighted the Mobile Bay area's history, environmental issues, and resources, and was developed in a sequence of text, graphics, and photos with Web site links for more information. Designed at an eighth grade level, the document appeals to audiences of all ages and remains in high demand. The document won a 1999/2000 American Advertising Federation Award. See www.mobilebaynep.com for additional information.

BASE PROGRAM ANALYSIS: UNDERSTANDING THE INSTITUTIONAL CHALLENGES

While the Technical Characterization describes the natural environment, the Base Program Analysis describes the institutional environment. The Base Program Analysis proceeds through the following tasks:

Task 1: Identify relevant local, state, and federal organizations.
Task 2: Assess effectiveness of existing programs.
Task 3: Identify changes needed to improve program effectiveness.

As with the Technical Characterization, it is wise to gather and review the results of previous programmatic analyses that have been conducted for the estuary. The use of valid existing information can speed up the Base Program Analysis process considerably. The following sections describe the tasks of the Base Program Analysis process.

TASK 1: IDENTIFY RELEVANT LOCAL, STATE, AND FEDERAL ORGANIZATIONS

The first step in conducting a Base Program Analysis involves the development of an inventory of existing organizations that have the potential for affecting the problems being assessed under the Technical Characterization. Base Program Analyses conducted in the NEP quite often go beyond basic statutes, codes, and legal authorities to identify the array of mechanisms available to protect the estuary. These mechanisms include influences on behavior, such as economic incentives, and technical assistance and education programs, factors not typically considered part of a resource management infrastructure.

The NEPs inventory existing organizations and mechanisms that may influence the estuary, including:

- regulatory programs;
- public and private resource management programs;
- incentive programs and voluntary initiatives;
- planning efforts; and
- public education and technical assistance programs.

Once the existing organizations have been identified, the basic information shown in **Table 3.3** can be collected for each of the programs.

TASK 2: ASSESS EFFECTIVENESS OF EXISTING PROGRAMS

The organizations and their programs identified by the institutional inventory are analyzed to assess their potential effectiveness for addressing the problems of the estuary. Programmatic strengths and weaknesses are identified, allowing an array of enhancements or alternatives to be considered during development of the Management Plan. The focus of this assessment is on how the framework and individual programs or activities within it are able to protect the estuary, particularly with regard to addressing the priority problems discussed in the Management Plan, and not on the effectiveness of the programs themselves.

Table 3.4 (on page 34) provides a range of questions that are often considered when conducting the programmatic assessment. Ideally, the programmatic assessment will result in as much objective, quantitative information as possible, including data on resources invested (staff, funding, etc.) and environmental results.

TASK 3: IDENTIFY CHANGES NEEDED TO IMPROVE PROGRAM EFFECTIVENESS

The results of the Base Program Analysis present findings on the overall management framework for the estuary, based on a synthesis of the institutional analysis and consideration of crosscutting issues. The heart of this synthesis is an analysis of management changes that are necessary to improve the coordination and application of existing programs.

Table 3.3: Information collected from organizations during the Base Program Analysis

Name of Program
Priority Problem Addressed
Implementing Organization
Program Authorities (laws and ordinances)
Program Description:
  I. Purpose
  II. Functions
      A. Regulatory
      B. Resource Management
      C. Finance Mechanisms
      D. Voluntary Initiatives/Economic Incentives
      E. Public Education/Technical Assistance
      F. Planning
  III. Geographic Jurisdiction
  IV. Resource or Activity Managed
  V. Funding
      A. Source of Funding
      B. Funding Rationale
      C. Allocation of Funding
      D. Proposed Budget and Actual Funding
      E. Other Resources Available
  VI. Administration
      A. Organizational Structure
      B. Decision-Making Process
      C. Linkages to Cooperating Agencies
      D. Total Staff

Source: NEP Guidance, Base Program Analysis. EPA, 1993.

Table 3.4: Question guide for institutional analysis

- What is the organization's mandate, resource trends, and scope of jurisdiction or influence?

- What are the most successful aspects of this organization—things that work well and should be capitalized upon in the future?

- What innovative aspects of this organization's programs or approaches could serve as models for future activities?

- Are there any gaps in existing resources or authorities that limit the organization's ability to take action on one or more of the priority problems?

- What kinds of problems has this organization experienced? For example:
    - unclear goals, responsibilities, or procedures?
    - conflicting efforts by other programs?
    - difficulties in coordinating with other organizations?
    - drastically insufficient resources?

- Do other activities duplicate any of this organization's efforts?

- Are there complementary organizations that could enhance this organization's effectiveness?

- Are there organizations that impede this organization's effectiveness?

- How much support does the organization enjoy from the public and the legislature?

- What specific actions could improve the effectiveness of the institutional framework?
    - What current activities should be accelerated or expanded?
    - What new efforts should be instituted? Are new authorities or entities required?
    - What obstacles to effectiveness must be overcome?
    - What should be the Management Conference's action priorities?

- For each action suggested, what are the appropriate tasks, actors, and timing?

- What are the potential barriers to redirection? How can support be generated?

Based on EPA's *National Estuary Program Guidance: Technical Characterization in the National Estuary Program* (1994)

FROM CHARACTERIZATION TO PLAN DEVELOPMENT

The ultimate goal of the Technical Characterization and Base Program Analysis is to establish the status and trends of estuarine resources, identify impacts being experienced, determine the likely causes of those impacts, and describe and evaluate the institutional environment. However, the Technical Characterization and Base Program Analysis are not an endpoint. The Technical Characterization combined with the results of the Base Program Analysis set the stage for the formulation of the Management Plan. To be useful, they must lead to the development of an effective Management Plan.

IDENTIFYING PROBLEMS AND SOLUTIONS: EXAMPLES

▶ *Example 1: Use of worksheets to determine relative importance of estuary resources*

Worksheets, like the one shown below (**Figure 3.3**), can be used to develop a graphical representation of the overall relative importance of the estuary's resources. The Santa Monica Bay Restoration Commission used forms of this worksheet as workshop tools to stimulate discussion among participating managers and technical experts.

Figure 3.3: Worksheet used to establish relative importance of an estuary's resources
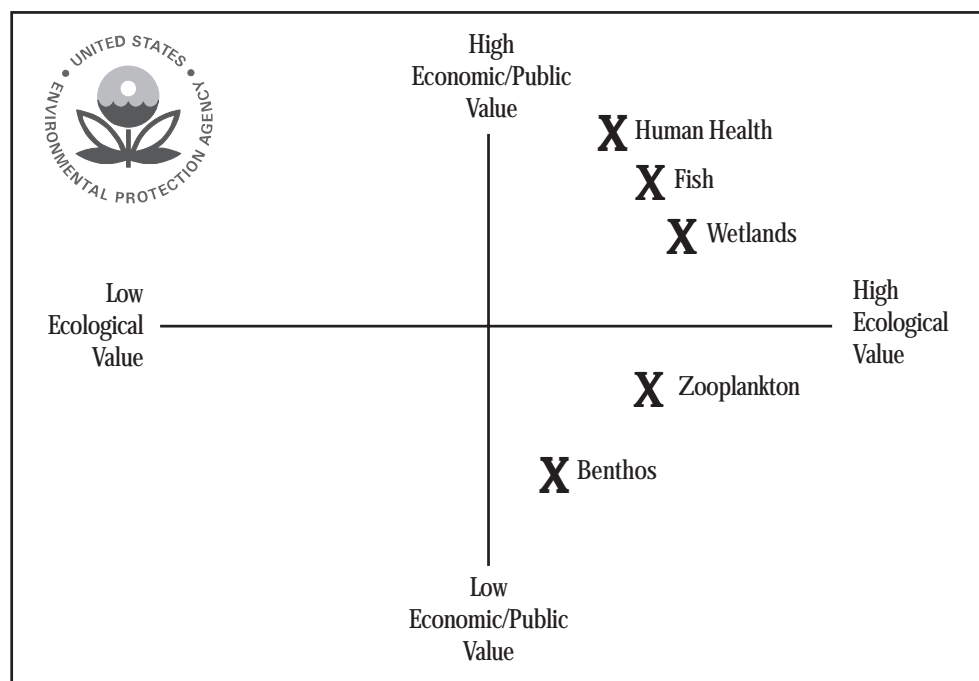
From EPA's *National Estuary Program Guidance: Technical Characterization in the National Estuary Program* (1994)

Environmental managers and regulators were asked to position the valued resources along the Public Value axis while 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. For additional information, see www.santamonicabay.org.

▶ *Example 2: Data collection to identify priority problems and develop monitoring protocols*

Photo: Steve Delaney

The Sarasota Bay NEP used continuous monitors to evaluate diurnal fluctuations in dissolved oxygen levels. Previous sampling in Sarasota Bay was conducted during the mid-morning to early afternoon, thus eliminating data collection in early morning—the lowest dissolved oxygen period. The Sarasota Bay NEP used the continuous datasets to evaluate the extent of hypoxia (low oxygen), the potential impact of hypoxia on fisheries, and to reevaluate monitoring programs. Based on the results of this monitoring effort, it was determined that elevated hypoxia levels did not have an adverse impact on juvenile fish counts. Because temperature was not an important driver in the system, Sarasota Bay's monitoring program focuses on nutrients and light-related parameters. For additional information, see www.sarasotabay.org.

▶ *Example 3: Narrative description of estuarine processes*

The Puget Sound Action Team used a narrative approach to describe the estuary in its "State of the Sound Report." Qualitative and thorough descriptions of the estuarine processes were combined with simple diagrams illustrating 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 concise, simple matrices helped illuminate potential management solutions. For additional information, see www.psat.wa.gov.

▶ *Example 4: Relationships of priority problems*

Nitrogen is the limiting nutrient for algal productivity in Sarasota Bay. Studies conducted showed a correlation between seagrass coverage and nitrogen loads in Sarasota Bay. The Sarasota Bay NEP found that reductions in nitrogen inputs (47 percent) significantly increased seagrass coverage. Examined together, water clarity, light, and seagrass coverage appear to be good indicators of system health. Through these efforts, it was demonstrated that significant increases in seagrass habitat can be achieved with relatively small increases in water clarity of 1.5 feet in shallow water systems like Sarasota Bay. For additional information, see www.sarasotabay.org.

Photo: Steve Delaney

▶ *Example 5: Identification of data gaps through Technical Characterization*

The Technical Characterization report developed by the Lower Columbia River Estuary Partnership stated that the development of long-term solutions to the problems identified in the Lower Columbia River would require ongoing data collection and analysis. The characterization report identified four basic problems: toxics in sediment and fish tissue; decline in species; threats to wildlife and fish; and loss of habitat. The report also recommended the following studies and long-term monitoring and evaluation to address data and information gaps:

- Problem confirmation and source identification;
- Fate and transport assessment;
- Criteria and standards development;
- Ambient monitoring and assessment;
- Fish and wildlife monitoring and assessment; and
- Human health monitoring and assessment.

For additional information, see www.lcrep.org.

▶ *Example 6: Data gathering and action formulation*

In addition to developing technical issue papers and offering advice and guidance on scientific issues affecting the estuary, the Lower Columbia River Estuary Partnership's Science and Technical Work Group helped bridge the gap between data gathering and action formation. Members of the Technical Work Group played a key role assisting the Management Committee in the comparative risk ranking of potential actions. The ranking was used to select actions based on the most significant problems in the estuary, including perceived risks to public health, ecological health, and quality of life. The program's risk ranking exercises are described in Chapter 4 of its Management Plan. For additional information, see www.lcrep.org.

▶ *Example 7: Contribution of Base Program Analysis to Management Plan action plans*

The purpose of the Base Program Analysis conducted by the Barataria-Terrebonne NEP was to provide members of the Management Conference with information they could use to develop actions for the Management Plan. The seven priority problems identified in the Barataria-Terrebonne Conference Agreement were used to provide information about the types of program changes needed in the future. A database was developed containing programs, monitoring stations, laws, and the research and reports relevant to the project area. The report lists 84 federal programs and 63 state programs according to their primary management tools and their relation to the seven priority problems. An analysis identified the types of strategies and regulations that lead to program effectiveness and prototypes were recommended for the action plans in the Management Plan. In addition, some strategies were identified that could be implemented prior to final Management Plan approval. For additional information, see www.btnep.org.

Photo: Steve Delaney