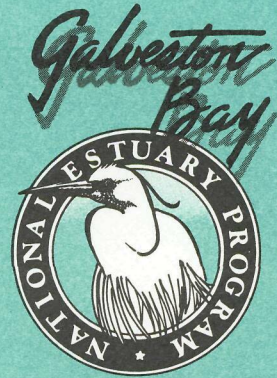


Fiscal Year 1993 Annual Work Plan



Galveston Bay
National Estuary Program

GBNEP-17
August 1992

Galveston Bay National Estuary Program Fiscal Year 1993 Annual Work Plan



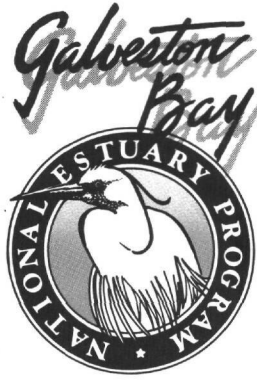
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**Galveston Bay National Estuary Program
Fiscal Year 1993 Annual Work Plan**

The Galveston Bay National Estuary Program

Publication GBNEP-17
August, 1992

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement # CE-006550-01 to the Texas Water Commission. The contents of this document do not necessarily represent the views of the United States Environmental Protection Agency or the Texas Water Commission, nor do the contents of this document necessarily constitute the views or policy of the Galveston Bay National Estuary Program Management Conference. The information presented is intended to provide background information for Management Conference deliberations in drafting of official policy in the Comprehensive Conservation and Management Plan (CCMP). The mention of trade names or commercial products does not in any way constitute an endorsement or recommendation for use.



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Preface

This document is written to meet Environmental Protection Agency requirements for an Annual Work Plan for award of National Estuary Program grants (40 CFR Part 35, Federal Register Vol. 54, No. 190, Oct. 3, 1989). The information presented here serves as an agreement between the State of Texas and the U.S. EPA for work to be carried out by the Galveston Bay National Estuary Program (GBNEP) in state fiscal year 1993 (September 1, 1992 through August 31, 1993). Work described in this plan is for year four of a five-year effort to create and implement a Comprehensive Conservation and Management Plan (CCMP) for Galveston Bay.

This Work Plan is also written for members of the Management Conference, as well as for the wider Galveston Bay Community with an interest in the estuary and in our efforts to improve its management. Enough information has been included to give the reader at least a fair understanding of our goals, what has already been accomplished, and what remains to be accomplished.

First, the Introduction includes a summary of the estuarine problems that lend urgency to our work, some general goals framed to solve these problems, and the results we expect to accomplish through our effort. Second is a Review of Fiscal Year 1992, organized according to categories required by federal guidance, to demonstrate our progress so far. Third is a more detailed summary of the projects conceived by the GBNEP since our beginning in 1989. Fourth is a plan for additional projects in the coming year, described in sufficient detail to facilitate funding of the GBNEP for another year. Fifth, and finally, is a review of the anticipated sources of funding for the coming year, including estimates of the substantial resources volunteered to the program by individuals and organizations.

Through these initiatives, the members of the GBNEP Management Conference propose to eventually begin coordinated management of Galveston Bay at the ecosystem level. It is our hope that anyone with a desire to improve the stewardship of this important Texas and American resource join us in the endeavor.

Frank S. Shipley, Ph. D.
Program Director

I. Introduction

Three years of work by the Galveston Bay National Estuary Program have established a strong foundation for improved management of this nationally significant resource. In the remaining two years of the five-year process, the work already accomplished will become the foundation for an ecosystem-level comprehensive management plan. This Fiscal Year 1993 Annual Work Plan outlines year four: a year that will position the Management Conference for attainment of its estuarine management goals (see box on next page).

Year four will see the culmination of numerous scientific studies in a single *Galveston Bay Environmental Characterization Report* which will describe the problems faced by the estuary, trends related to those problems, and their probable causes and management implications. A related public document, *The State of the Bay*, will publicize findings and document the imperative nature of improved Bay management. Each of these documents will be "under construction" throughout the year.

While scientific work to characterize Galveston Bay for comprehensive planning will be scaled back during the coming year, some scientific needs remain. Design of a coordinated and systematic effort to monitor conditions in the estuary and to measure the effect of the management plan (when implemented) will be a high priority for the Scientific/Technical Advisory Committee. In addition to Bay-wide monitoring, several additional projects will fill in knowledge gaps identified earlier in the program, to round out our technical requirements for management planning. Work on the *Environmental Characterization Report* will be facilitated by convening of a major symposium in Fall, 1992, with the theme of identifying probable causes of estuarine problems. This conference will be a key element in drafting the *Environmental Characterization Report*.

Drafting of Bay management initiatives will dominate the work of the Management and Policy Committees in the coming year, and program resources are progressively being shifted to this task. Guidance in this use of resources continues to come from the *Galveston Bay Priority Problems List* (Table 1). These problems were further defined in the *Galveston Bay Ecosystem Impact Matrix* (Figure 1). Together, these tools have helped establish a conceptual basis for organizing the CCMP.

Sixteen Action Plan Task Forces were convened by the Program Director to address elements of the *Action Plan Topics List*. The lead task force among these, the Framework for Action Task Force, has already begun to guide the efforts of these task forces to draft action plans which will compose the CCMP. This work was initiated two and a half years prior to the final draft of the CCMP to allow successive cycles of Management Conference and public review and revision.

Also contributing to the management planning effort in the coming year will be

Program Goals

The Galveston Bay Estuary System is a public asset of immense value and is worthy of preservation and improvement to realize its full potential in enriching the lives of the citizens of Texas and the United States. In developing goals for the Comprehensive Conservation and Management Plan, consideration should be given to development of responsible, compatible uses of this resource with utmost respect for its natural biological systems. The challenge is to manage the human interaction with the bay, including municipal, commercial, industrial, agricultural, and recreational uses so that the utility and long-range value of this resource can be maximized. Accordingly, an important goal is to determine the capacity of the bay to accept and tolerate human interaction, e.g. pollutants, consistent with maintenance and improvement of its biological systems.

Goal I. *It shall be the long-term goal of the State of Texas to maintain and enhance the water quality in the Galveston Bay system, and to reduce and ultimately eliminate harm resulting from the entry of pollutants to the water and sediments, including harm resulting from the alteration of natural estuarine gradients.*

Goal II. *It shall be the long-term goal of the State of Texas to maintain and enhance the living resources in the Galveston Bay system, including commercial, recreational, and ecologically significant species populations, and also including the habitats upon which these species depend.*

Goal III. *It shall be the long-term goal of the State of Texas to prevent increases in human health risks associated with the Galveston Bay system, and to minimize and eventually eliminate human-induced health risks and losses to commerce and recreation due to harvest or contact restrictions.*

several specific Management Committee projects. These include preliminary estimations of the cost of implementing the CCMP, a support project to facilitate the work of drafting and revising the CCMP at the task force level, and a similar support project for the characterization effort. Perhaps the most significant project of the Management Committee in the coming year will be a determination of the economics of natural resources and their use in Galveston Bay. This work takes advantage of recent advances in the field of natural resource economics, to overcome well-known problems that arise in applying traditional economics to publicly-owned resources.

Public participation in FY 1993 will become more important than in any previous year, leading to even greater emphasis in FY 1994. While CCMP action plans are being drafted, participation by the key industries, user groups, local governments, and general public is more important than ever. A renewed emphasis is planned for the Local Governments Advisory Committee, and for public involvement by means of a series of public participation initiatives: Bay Day; the Galveston Bay Speaker's Bureau; the Galveston Bay Public Forum; *BayLine* (our newsletter);

Table 1. Galveston Bay Priority Problems ¹

A. REDUCTION/ALTERATION OF LIVING RESOURCES

1. Loss of Physical Habitat
 - * wetlands and sea grasses
 - * oyster reefs
 - * shallow bay bottom (unvegetated)
2. Alteration of Salinity Gradients
 - * impoundment, diversion, and interbasin transfer of fresh water inflow
 - * bathymetric and circulatory changes (salinity intrusion)
 - * ungaged inflows from rainfall in coastal watersheds
3. Alteration of Nutrient and Organic Loading
 - * eutrophication and hypoxia
 - * point and nonpoint sources
4. Bathymetric and Circulatory Changes
5. Land Subsidence and Sea Level Rise
6. Chemical and Pathogenic Contamination (biotic impairment)
 - * point and nonpoint sources
7. Increased Turbidity and Sedimentation

B. PUBLIC HEALTH ISSUES

1. Discharge of Pathogens to Bay Waters
 - * point and non-point sources
2. Chemical Contamination of Water, Sediments, and Living Organisms
 - * point and nonpoint sources
3. Restriction of Contact Recreation
 - * chemical and pathogenic contamination

C. RESOURCE MANAGEMENT ISSUES

1. Regulatory Problems
2. Fish and Wildlife Resource Depletion
3. Marine Debris
4. Public Access to Resources

D. SHORELINE EROSION

1. Land Subsidence and Sea Level Rise
 2. Bathymetric and Circulatory Change
 3. Loss of Buffer Vegetation (Wetlands)
 4. Use of Littoral Property
-

¹ Within the List, the four major problems (identified by letters A-D) are ranked in order of importance and are considered to be independent. The second order problems within each major problem (identified by number) area are interdependent and may contribute to or interact with problems of equal or higher category.

new educational initiatives; and Citizen's Monitoring of the estuary. These are some of the projects of the Citizen's Advisory Steering Committee.

With so many representatives of the Galveston Bay community "at the table" as a result of the Management Conference, ideas for early management actions will continue to arise and be implemented. Some ongoing actions relate to the creation of a Citizen's Pollution Reporting Hotline; the previous creation of two coastal preserves, creation of wetland habitat through cordgrass plantings, and an initiative to prevent pollution in the Houston Ship Channel. An additional action plan demonstration project is anticipated for the coming fiscal year.

Administration of the GBNEP will continue in FY 1993 with very little change. As in previous years, a Management Conference Workshop will be scheduled for Spring, 1993, as a focus for consensus-building and an opportunity to approve plans for Fiscal Year 1994. The substantial administrative work effort to coordinate the sixteen Action Plan Task Forces will require major emphasis. Logistics related to meetings, mailings, and participant coordination for more than 200 individuals now involved with the GBNEP remain an ever-present challenge for program administration.

Figure 1.
Galveston Bay Impact Matrix
Revised 3/26/92

Sources of Perturbation	Valued Ecosystem Components															
	Water Quality	Circulation	Sediment	Phytoplankton	Zooplankton	Oysters	Shellfish	Other Benthos	Finfish	Birds	Marine Mammals	Sea Turtles	Human Health	Submerged Wetlands	Plants	Aesthetic Shoreline 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
 [Patterned Box] = Possible management priority

Milestone Publications Planned for the Galveston Bay National Estuary Program

1. *Galveston Bay Environmental Characterization Report*. This report is to be a summary of ecological and other technical findings from the Galveston Bay characterization effort. The report is to be written for managers, decision-makers and scientists, but in plain English to the greatest extent possible. The report is written in an ecosystem management context, with the primary goal of conveying complete information about the Priority Problems and related environmental status and trends. The report will be drafted by program staff, with possible contract help. Target publication date: Fall, 1993.

2. *Framework For Action: The Governance of Galveston Bay*. This report is to be a summary of management evaluation findings, based on the Bay-wide Regulatory Survey and Regulatory Evaluation projects, and including lessons learned from the Coastal Preserves management studies. The report will contain findings and policy analyses concerning Bay jurisdictions and management efforts, including gaps, overlaps, and weaknesses in the current regulatory system. The report will be drafted by the Principal Investigator of the Bay-wide Regulatory Evaluation Project, and will include recommendations that will contribute to drafting of the CCMP. Target publication date: Winter, 1993.

3. *The State of the Bay*. This is a public document for wide distribution. Contents will combine summaries of the ecological and regulatory findings of the two preceding reports, with the primary goal of highlighting Galveston Bay's problems and defining the need for a CCMP. The publication will be written by the Program staff in plain English, will be well illustrated, and will be designed to help the public learn more about the Bay and its problems, and to better appreciate the need for improved management. Target publication date: Fall, 1993.

4. *Comprehensive Conservation and Management Plan*. The management plan is to be a series of simplified action plans of no more than several pages each (with detailed supplemental information included as appendices). Each action plan describes a problem, and answers "who, what, when, where, why, and how much questions in a direct way. These action plans are designed for legislators and elected public officials, managers, and the public to easily understand. The CCMP will have implementation and funding strategies associated with recommended actions. Target publication date: Fall, 1994.

II. Review of Fiscal Year 1992

The *EPA/State Management Conference Agreement* (Publication GBNEP-1, October, 1989) established a plan for the five years of work leading to creation of a CCMP in 1994. Below are listed elements of work accomplished by the GBNEP in relation to the *EPA/State Management Conference Agreement*,.

Identification and Ranking of Priority Problems

All work relating to this element has been successfully accomplished. Creation of the *Priority Problems List* was accomplished ahead of schedule and in accordance with the *EPA/State Management Conference Agreement* (as described in previous annual work plans). In conjunction with the *Ecosystem Impact Matrix* and the *Action Plan Topics List* (presented in the Introduction) the Program has successfully focused on agreed-upon goals, often in the face of potentially strong distractions.

Two recent projects have helped increase both the understanding of and emphasis upon the problems facing the Bay. First was a *Galveston Bay Ecosystem Conceptual Model*, now nearing completion and fully described more completely as a scientific project in Section III. The conceptual model includes the important habitats in Galveston Bay, their inter-relationships, and the effects of human uses of Galveston Bay. A multi-tiered approach allows use by the public, as well as by scientists and managers.

Second was recent completion of a video production describing the significance of the Galveston Bay ecosystem in both its structure and function. The video has proved to be a valuable visual tool to help express the complexity of the natural ecosystem function and human alterations. The video also serves as a companion to the *Ecosystem Conceptual Model* in encouraging an understanding of the more complex aspects of the ecosystem.

Program Inventory

All work relating to this element has been successfully accomplished. As described by the *EPA/State Management Conference Agreement*, the Program Inventory had a two-fold purpose: identification of existing agency data sets related to Galveston Bay, and compilation of existing management jurisdictions and activities by governmental agencies. The GBNEP determined that these purposes were best accomplished by separate projects: a *Data Base Inventory* and a *Bay-wide Management Survey*.

The *Data Base Inventory* contains complete descriptions and specifications for existing Bay-related data sets. The inventory consists of an electronic-searchable data base of data set descriptions, including access information. The *Coastal Preserves Regulatory Surveys* and the *Coastal Preserves Regulatory Evaluations* identified, described, and evaluated all management jurisdictions and activities

within the Christmas Bay and Armand Bayou Coastal Preserves. These projects were expanded in a *Bay-wide Management Survey*, which identified and described jurisdictions on the ecosystem scale.

Base Programs and "Action Now" Implementation

Work under this element continues. Approach to this item involves evaluation of existing agency management activities and early corrective actions where possible. Opportunities have been identified throughout the Program for management improvements prior to formal approval of the CCMP in 1994. These initiatives are summarized below.

One GBNEP initiative created two Texas Coastal Preserves in ecologically unique portions of Galveston Bay: Christmas Bay and Armand Bayou. The designations occurred in FY 1991 under a joint program of the General Land Office and Texas Parks and Wildlife Department. In FY 1992, ongoing work included *Coastal Preserve Regulatory Evaluations*, *Coastal Preserves Management Plans* and implementation of management. These activities involve key inter-agency initiatives for water quality and habitat conservation, and were designed to serve as a "test case" for similar future CCMP initiatives on the bay-wide scale, and therefore were coordinated at the Policy Committee level.

A second early management initiative involved identification and correction of illegal discharges along portions of the Bay shoreline. The *Shoreline Survey for Point Source Discharges* identified unregulated or illegal discharges to the Bay. These cases were submitted to appropriate agencies, and enforcement reports were received detailing actions taken to bring discharges into compliance. In general, violations did not contribute substantial pollutant loading to the Bay. Many of the violations, however, involved discharges to tributaries with limited circulation.

A significant project entitled the Citizen's Pollution Reporting Hotline was established in FY 1992. The Citizen's Advisory Steering Committee previously identified needs for increased public awareness about point and nonpoint source pollution, easier pollution reporting for citizens, improved cost-effective monitoring of the Bay, and an assessment of the effectiveness of current agency response. The Hotline (1-800-3 OUR BAY) was established in February, 1992, and receive a major publicity push in Spring, 1992.

Following opening of the Hotline, public and resource agency response was immediate and positive. Early call tracking indicates a call rate of up to several thousand per year. Citizens are generally grateful to have a single phone number to contact; they would otherwise have to know that spills in the water should be reported to the General Land Office, spills on land should be reported to the Texas Water Commission, and pollution from underground should be reported to the Texas Railroad Commission.

Data and Information Management System (DIMS)

Work under this element continues. Although a DIMS was not specifically required by federal NEP guidance, such a system was deemed necessary by the Management Conference and was therefore included in the *EPA/State Management Conference Agreement*. Commitments were made and carried out for identification of DIMS requirements, a feasibility study and report, and choice and implementation of the best DIMS alternative. The *DIMS Strategy* incorporates centralized information but decentralized data processing.

Components of the DIMS Strategy were detailed in previous annual work plans. These include: creation of a *Galveston Bay Information Center*; drafting of a written and electronic *Galveston Bay Literature Survey*; creation of a written and electronic *Data Base Inventory*; development and use of NOAA's *Coastal Ocean Management, Planning, and Assessment System* (COMPAS); utilization of the Texas Natural Resource Information Center (TNRIS) as a data archive; use of the EPA Ocean Data Evaluation System as an additional data archive; and acquisition of maps, aerial photography, and satellite imagery.

While initial creation of these DIMS tools has been largely accomplished, most are of an ongoing nature and will continue into the future. The Galveston Bay Information Center is well established, with a firm commitment by Texas A&M University and the Texas Institute of Oceanography for this Center to become permanent. Some technical aspects of data handling are not yet fully developed, pending state-wide agreement on data protocol (for example, agreement on a state-wide geographic information system protocol). An FY 1993 project to manage monitoring data will round out the efforts of the GBNEP to assure that data handling in the future is efficient, and "connects" managers to vital information about the resources they manage.

Characterization of Historical Trends, Current Status, and Human Impacts on Galveston Bay

Characterization of estuarine problems and their probable causes is now culminating. Numerous individual projects have been developed to a draft final stage. Review by the Management Conference and final report publication in the GBNEP Publication Series is proceeding for many of the key studies begun early in the program. Delays have resulted from some slow responses by resource agencies to provide information, Principal Investigator delays in meeting project schedules, and from the lengthy time required for the Management Conference review of final reports.

Work on the Characterization Report has begun, even though some characterization projects have not reached final Management Conference approval. A scientific symposium and other support projects planned for the coming year will fulfill this element, resulting in publication of the *Galveston Bay Environmental Characterization Report* by Fall, 1993.

Comprehensive Conservation and Management Plan

The CCMP was begun in Fiscal Year 1992, with accomplishment of the following elements:

1. Agreement on the *Action Plan Topics List* to provide the organizational structure for the CCMP and to provide guidance for the task force process being utilized for drafting of action plans.
2. Convening of sixteen Action Plan Task Forces to develop the action plans themselves. The Task Forces will have completed two rounds of meetings in FY 1992, and will produce initial action plan outlines for public review during the coming year.
3. Drafting of and agreement upon a *CCMP Outline* to encompass the sixteen Action Plan Topics, and including the following additional sections: Environmental Characterization Summary; Regulatory Framework for Action Summary; Financial Plan; Public Review Summary; and Federal Consistency.
4. Drafting of and agreement upon a *CCMP Time Line*, encompassing a start-to-finish plan for the three years of work to draft, review, and revise the CCMP.
5. Drafting of and agreement upon an *Action Plan Format* as a standard guide for all task forces, contractors, and staff to facilitate the development of the individual Action Plans that will constitute the CCMP.
6. Agreement on an approach to financial planning, including convening of a task force of the Policy Committee to coordinate the CCMP Financial Plan. A CCMP Costing Project (see Part IV of this document) will directly contribute to this process in FY 1993.
7. Creation of a work scope for a project to result in a CCMP monitoring strategy (detailed in Part IV).

In total, these efforts address the *Management Conference Agreement* requirements for a CCMP which includes a financial plan, management alternatives development, and a monitoring program.

Redirection of Program Activity

The greatest challenges and strengths in meeting program commitments have changed little from those identified in the first year of work (see Publication GBNEP-5, pages 14-16). Most challenges result from the ambitious expectations of the program, the short time available for accomplishing these expectations, and the consensus approach required for the work of the Program to have lasting effect. The Program is quickly approaching a stage in which attitudes of citizens and government leaders will have a greater bearing on success than will factual findings or administrative procedures.

During FY 1992, the greatest departure from original plans have resulted from time extensions for individual projects. These delays have not affected the overall anticipated schedule for the CCMP, rather they relate to the characterization of the Bay's problems and the completeness of our understanding of these problems during early drafting of the CCMP. The Characterization Report is now expected to be delayed by at least six months beyond the original commitment in the *EPA/State Management Conference Agreement*.

Among the reasons for project delays are:

1. Delays by project Principal Investigators which result from slowness of agency responses to requests for data and information. Some agencies responses in supplying data were greater than six months.
2. Delays by project Principal Investigators resulting from logistical or technical problems encountered only after work began--problems which could not have been anticipated in advance during project scheduling.
3. Delays resulting from lengthy review by the Management Conference. Review has delayed final publication of some characterization studies, but will not prevent the Management Conference from utilizing draft final reports during drafting of Action Plans.

III. Summary: Projects of the Galveston Bay National Estuary Program

This section is a comprehensive project-by-project summary of GBNEP projects initiated since the Program began in 1989. Most project results are (or will be) published in the GBNEP publication series.

What are Galveston Bay's Problems, and Which are Most Important?

Recognizing and Ranking the Problems

The Galveston Bay Priority Problems List

Bringing the Bay's problems into focus and agreeing upon them was one of the Program's first goals. This process of reaching consensus began in the Spring of 1989, with a preliminary *Priority Problems List*, public meetings, and extensive committee discussions. After many revisions, consensus was successfully reached identifying and ranking these problems. The *Priority Problems List* was then approved by the Policy Committee in November, 1989, as a tool to guide the work of the GBNEP. Many times since then, the List has helped keep the program "on track" in the face of diverging opinions and differing values among the many involved with Galveston Bay. The *Priority Problems List* is reproduced on page 3 of this document.

Human Disturbance of Valued Bay Resources

The "Ecosystem Impact Matrix"

The identified problems in Galveston Bay were further defined by development of an "Ecosystem Impact Matrix" which highlights the relationships between valued estuarine resources and human and natural disturbances (see page 4). The Matrix facilitates agreement on which Bay resources are most valued, identifies which of these are at greatest risk, and which cannot be evaluated because of "knowledge gaps." Because the ecosystem is so complex, the Matrix helps depict relationships between man and the Bay not possible to characterize in the Priority Problems List.

Building a Common Understanding of the Bay

Ecosystem Conceptual Model

Because Galveston Bay is so complex (as are all ecosystems), everyone has a different idea of how it works. With the human influences on the Bay added to all the natural complexity, different people involved with the Bay are left with scant common understanding as a basis for problem-solving. This project results in a

model of the Bay consisting of a series of diagrams and a narrative report which has three levels of complexity: a simple non-technical tier understandable to the public; a simple but technical tier useful to resource managers, decision-makers and informed bay users; and a detailed scientific tier incorporating a full range of structural and functional complexity.

A key aspect of the project is a consensus-building approach to building the model--that is, it will be built upon the joint understanding of many experts. The core of the model will be the key Bay habitats: open Bay water; open Bay bottom; emergent marsh wetlands; algal flats; seagrass meadows; and oyster reefs. The ecological and human-caused processes related to these will be incorporated to yield an "ecological manual" that will simplify the real ecosystem while preserving its essential features.

By contributing to a common understanding of the Bay, the model will: improve communication among decision-makers, advisors, and the public; help assure regulatory decisions are not at cross-purposes; aid in matching the scale of solutions to the scale of the problems; and help predict the secondary ecological effects of actions taken. Robert McFarlane (McFarlane and Associates) is the principal investigator for this GBNEP project.

Scientific Characterization of the Problems and their Causes

Threats to the Bay's Productivity **Wetland Habitat Survey**

Approximately 95% of all commercially important species in the Gulf of Mexico depend upon estuaries and their highly productive wetlands for life support. Wetlands are therefore widely recognized among the most valued resources of Galveston Bay and are known to be decreasing in the estuary as a result of human activity. This three-year study, begun in Spring of 1990, involves mapping of shoreline and submerged aquatic vegetation (seagrass) habitats based on aerial photo interpretation. Field studies of plant communities are being utilized to verify the findings. Aerial photo sets from 1956, 1979, and 1989 will determine the historical trends for losses of specific kinds of wetlands over this time period.

Computer mapping of project results for a geographic information system (GIS) will allow elaborate analyses of these historical trends for specific habitat types. Project publications will help draft habitat conservation initiatives in the CCMP. Publications will include a wetlands bibliography for Galveston Bay, a wetland plant community synopsis, detailed wetland maps, and a report characterizing habitat trends and probable causes for wetland losses. Principal investigators are E. G. Wermund, Bureau of Economic Geology, and Lawrence R. Handley, National Wetlands Research Center, U.S. Fish and Wildlife Service.

Known Sources of Pollution

Point Source Loading Studies

Some sixty percent of all wastewater discharged in Texas flows to Galveston Bay, making the Bay, in effect, the final step in most Texas wastewater treatment. These legally permitted wastewater discharges (and the resulting pollutants in river water entering the estuary) are the focus of this study. Concerns included selected nutrients, some toxicants, and traditional water quality parameters.

The approach taken for this study requires compilation and analysis of already-existing data, primarily from permit and surface water monitoring programs--for example those of the Texas Water Commission. Currently, discharge permits are granted based on the impacts to receiving waters only in the localized area ("segment") where the discharge is located. This study will contribute to a much broader understanding of the loadings of pollutants to the entire Bay system. The CCMP will be drafted from this cumulative ecosystem perspective, including the effects of all point and nonpoint sources of pollution throughout the entire Bay. Trends determined will also help identify causes for water quality changes.

Results of this projects will be published in a GBNEP publication by principal investigators Neal E. Armstrong (Department of Civil Engineering, University of Texas at Austin) and George H. Ward, (Center for Research in Water Resources, University of Texas at Austin).

Searching Out Unauthorized Polluters

Shoreline Survey for Point Source Discharges

Many citizens and environmental professionals have long suspected that substantial illegal sources of wastewater exist along the shorelines of Galveston Bay. This survey of 159 selected shoreline miles justified this concern, with some qualifications. Discharges were identified and documented using aircraft and shallow draft boat surveys.

In the study area, the number of illegal discharges discovered exceeded the 120 legally permitted discharges in the same area. Most were of apparently minor importance to the Bay. Discharges varied from flowing pipelines to apparently inactive sources. One management need identified by the study was the need for signs identifying permitted wastewater outfalls; such a requirement would make pollution survey and enforcement work much more feasible.

All unpermitted discharges identified in the study were reported to the appropriate regulatory agencies for further investigation and enforcement. In addition to substantiating a suspected impact on the estuary, the study also helped document the feasibility and need for extending the survey to some or all of the entire bay/tributary shoreline (2,491 miles). This work is published as report GBNEP-12 (August, 1991) by Roger R. Fay, Stephen Sweet, and R. J. Wilson of the Geochemical and Environmental Research Group, Texas A&M University.

Wastes that Wash off the Land

Nonpoint Source Loading Study

Nonpoint source pollution is massive, diffuse, and as yet largely unregulated. For example, studies indicate that storm water washing off a single metropolitan area in a year can contribute oil and grease to nearby waterways amounting to about half the volume of the Exxon Valdez spill. This study documented substantial nonpoint pollution of Galveston Bay, and will contribute to CCMP initiatives to address the problem.

The GBNEP approached non-point source pollution by mapping watershed hydrology and land use using a Geographic Information System (GIS), allowing estimation of pollutant loading to Galveston Bay for several selected contaminants. Subwatersheds were then ranked for their pollutant contributions to the Bay, to allow geographic targeting of the problem by managers. The emphasis was on urban lands in the immediate watershed draining to bayous or the Bay--a principal source of the problem. Of secondary concern were drainage basins of the Trinity River, San Jacinto River and other tributaries with less immediate effect on the Bay, but which contribute substantial nutrient pollutants.

Findings indicated up to a billion pounds of sediments, oil and grease equivalent to a 130,000 barrel spill, and massive amounts of the nutrients nitrogen and phosphorus enter the Bay annually from diffuse sources. GBNEP Task Forces will utilize these results, (and results from point source and shoreline survey studies) to develop water quality improvements for Galveston Bay. Findings will be summarized in a report by Charles J. Newell, Hanadi S. Rifai, and Philip B. Bedient.

Contaminants Already in the Bay

Ambient Water/Sediment Quality Study

Many of the pollutants introduced into Galveston Bay tend to stay there because the pollutants attach to sediment particles and become incorporated in the bay bottom. Contaminants may also be dissolved, or can be concentrated in living plants and animals. Goals of this study are to characterize the existing water and sediment quality in the Galveston Bay complex, and to identify trends based on this data. Work will first screen the historical data for its usefulness for this purpose; then analyses will be conducted to determine historical and geographic trends in water and sediment quality related to human activity.

Results of this project will be used to make comparisons between actual contaminant levels and existing regulatory water standards. Future management of the Bay can then concentrate on "hotspots," where current regulation falls short, and where information gaps exist. Future monitoring of water and sediment quality will also utilize this Bay-wide analysis of past monitoring data. A report will be authored by George H. Ward (Center for Research in Water Resources, University of Texas at Austin) and Neal E. Armstrong (Department of Civil Engineering, University of Texas at Austin).

Concern for What Lives in the Bay
Living Resources Trend Study

Major habitat losses and a 2,000 percent increase in the total harvest of animals during the last 100 years (including offshore harvest of shrimp and menhaden) raise serious concerns for the living resources of Galveston Bay. Living plants and animals provide both a sustainable economic benefit to Texas and serve as indicators of the ecological health of the estuary. This study compiles historical data and information to determine trends for species which are commercially important or are critical in the food web or as indicators of environmental quality. Included are shrimp, speckled trout, red drum, flounder, and blue crab. Secondary emphasis is on forage fish species, plankton, birds, and benthic (bottom-dwelling) invertebrates. (Seagrasses, salt marsh species, and oysters are considered in other specific projects).

Project results indicate no wholesale decline in species populations--in fact the Bay is very much alive. However, apparent long-term declines indicated for striped bass and diamond back terrapins, and recent declines in white shrimp, blue crab, mottled ducks, northern pintail, blue-winged teal, and all colonial water birds (except olivaceous cormorants) provide ample reason for concern.

GBNEP publications resulting from this project will include a major status and trends report for the species selected for the study and a second report detailing probable causes for declines and other findings. The work is being accomplished by a project team coordinated by Albert W. Green, Resource Protection Division of the Texas Parks and Wildlife Department.

A Keystone Species
Bay-Wide Oyster Survey

Of the thousands of species which depend upon Galveston Bay, oysters perhaps best typify our concerns for human influences on the Estuary. Oysters are a commercial species; they are sensitive indicators for the critical mixing of river water and salt water from the Gulf of Mexico; they are a good gauge of contamination by sewage and toxic chemicals; they are at the heart of dredging project controversies; and they create shell reef habitat (the only significant hard substrate habitat in the estuary). Perhaps most important, oysters can't move: they can't escape human-caused, or natural changes in the estuary.

This project makes use of state-of-the-art navigation and sonar technology to survey and map oyster reefs throughout the Bay system. Results are compiled in a Geographic Information System (GIS) to provide a basis for assessing human impact to this critical species. During the survey, sampling at selected locations will establish the health of individual oysters and the reef communities, including incidence of disease, parasitism, and predation. Reef maps, and findings from existing data and literature compiled during this three year project will appear in a report by Eric N. Powell (Department of Oceanography, Texas A&M University).

Can I Eat the Seafood?

Survey of Toxicants in Aquatic Organisms

No subject concerns the public more than cases in which fish and shellfish are dangerously contaminated with toxicants. For example, dioxin contamination recently resulted in a fishery closure of upper Galveston Bay. The lack of a systematic seafood inspection program compounds this problem. This project was created to determine if toxic contamination in seafood organisms is an ecosystem-wide problem in Galveston Bay.

The approach involved collection of five commercial/recreational fish and shellfish species from each of four widely separated locations in Galveston Bay, for analyses for 126 specific contaminants in edible tissue. State-of-the-art laboratory analytical procedures were utilized to determine contaminant concentrations, for use in a specialized procedure called "risk analysis".

Results of the project show generally higher tissue contamination levels in the upper portion of Galveston Bay near the Houston Ship Channel. However, a risk analysis revealed that none of the average concentrations of trace metals or trace organic contaminants pose a risk to human health. While these results highlight a relatively "clean" part of the ecosystem, they suggest that contamination, where present, is likely to be a "hot spot" phenomenon rather than a systematic problem. GBNEP will publish a project report by James M. Brooks (Geochemical and Environmental Research Group, Texas A&M University).

Does the Bay Pose Human Health Risks?

Public Health Synopsis

More than half of Galveston Bay is closed (either provisionally or permanently) to the taking of shellfish, due to the risk from human disease-causing bacteria polluting the Bay. Some portions of the Bay have such high levels of bacteria that even water contact activities pose a risk. Other areas have been closed to fishing activity due to toxic chemical contamination, for example by dioxin. This project will help determine the extent and sources of these public health problems.

One objective of the study is to compile an historical synopsis of shellfish bed closures ordered by the Texas Department of Health, including locations and reasons for the closures. A second concern is to quantify the sources of bacterial contamination by documenting large-scale processes from: existing resource agency data; calculation of the contamination resulting from a typical one-inch rainfall and the identification of indicator bacteria associated with runoff; and hydrographic conditions in different portions of the Bay. Regulatory water quality standards for contact and non-contact recreation exist for the waters of the Bay; this study will also determine the historical trends in violation of these standards.

Results of the project will help determine future management of the aspects of Galveston Bay which affect public health. Results will be published in a report authored by principal investigator Paul Jensen of Espey, Huston, and Associates.

Defining Toxic Hotspots in the Bay

Survey of Toxicants in Sediments and Bottom Creatures

Almost a million pounds per year of toxic substances are discharged to the Houston Ship Channel alone. Oysters transplanted to the Houston Ship Channel from "clean" portions of the Bay increase by 15 times their tissue concentration of highly carcinogenic PAHs (Polycyclic Aromatic Hydrocarbons) and by 28 times their tissue concentration of PCBs (Polychlorinated Biphenyls). The Houston Ship Channel also periodically exceeds EPA and State toxicity criteria, and samples of water from throughout the Channel produce toxic responses in live test animals. Because most toxic materials tend to become associated with sediments, this project concentrates on the toxicity of sediments and related effects on bottom communities and test animals in the laboratory. The overall aim is to determine the extent of toxic "hotspots" in Galveston Bay.

Based on existing data, about 15 sites were chosen corresponding to suspected problem areas and comparison with "clean" locations. At each location, sediment analysis for a range of toxic contaminants is conducted; the number and kinds of animals occurring in the natural bottom-dwelling community are determined (a good supplementary test for toxicity problems); and toxicity tests on living test animals are conducted. These three lines of evidence (termed a "triad" approach) characterize toxic contamination. Results of the project, directed by R. Scott Carr of the U. S. Fish and Wildlife Service, will be available in a GBNEP Publication.

Fishery Losses Incidental to Bay Uses

By-Catch Studies

Shrimpers working off the Texas coast take an estimated 600 million pounds of non-targeted fish each year, and serious concerns have been raised for the welfare of some non-target species. In Galveston Bay, even rough estimates of by-catch are lacking, and no one knows if non-target Bay species are suffering declines incidental to human activity in the Estuary. Several particular activities are of concern; GBNEP by-catch studies will address three of these concerns.

First, the magnitude of by-catch resulting from shrimp trawling in Galveston Bay will be determined. Trawl studies scaled to the level, timing and location of commercial trawling in the Bay will determine species, numbers, and growth stages of by-catch. Results will highlight implications for key fishery stocks in the Bay. The project is directed by James Nance, National Marine Fisheries Service. Second, by-catch from recreational fishermen (that is, fish of unintended species caught by sport fishing) pose an unknown influence on the living resources of the Bay. This aspect of by-catch will be investigated by Gary E. Saul, FTN Associates, Ltd. Third, incidental mortality will be estimated for activities other than fishing. These activities include impingement (the mortality resulting from water intake structures like industrial cooling water intakes); dredge operations; seismic exploration; pipeline activity; and oil and gas operations. Principal Investigator for this portion of the by-catch investigation is Victor Palma of Jones and Neuse, Inc.

Human Alteration of Circulation, Salinity, and Habitat **Dredge/Fill Impacts Study**

The greatest human physical alterations to Galveston Bay result from construction of navigation channels and other dredge and fill operations, making dredging projects among the most controversial human activities associated with the estuary. These projects contribute major economic benefits to the state from shipping, but also redirect circulation and alter the salinity of the Bay in ways that can affect long-term productivity and ecological integrity. This project compiles historical Army Corps of Engineers data from the mid-1940s to present to provide an overview of dredge/fill activity and effects on the Bay.

Specific information to be addressed for permitted projects includes: quantity of material dredged; disposal locations by habitat type and resulting alterations; and extent of salinity and circulation alterations. Information to be compiled concerning the permit process itself includes: number of permits issued and number involving habitat modification; estimates of resulting habitat area lost or gained; number and area of private channels constructed; and justifications for the projects permitted. GBNEP will publish a report prepared by principal investigator George Ward, Center for Research in Water Resources, University of Texas at Austin.

Scientists Contribute to Bay Management **Characterization Workshop**

In February, 1991, scientists gathered to share research findings and information concerning Galveston Bay. Their contributions helped successfully accomplish four broad goals: first, to identify scientific work on Galveston Bay being conducted by institutions other than the GBNEP; second, to promote peer interaction among the principal investigators involved in this research; third, to improve our understanding of estuarine problems in need of management solutions; and finally, to encourage project coordination in an ecosystem context. The workshop drew better-than-anticipated participation.

Several important themes were recognized that affect management of the Bay. One is a realization of the abundance of good information on the Bay (more than anyone thought existed). Another is the fragmented nature of this information and the lack of cohesiveness of the ongoing work, particularly for resource agencies charged with managing the estuary. Finally, a significant loss of historical data suggests a need for an ongoing, organized system to maintain Galveston Bay data and information.

Many other findings were presented for some twenty Bay topics. A published proceedings, edited by Frank Shipley and Russell Kiesling of the GBNEP, contains 56 scientific contributions (Publication GBNEP-6). This publication will contribute to future similar scientific meetings and the publication of the *Environmental Characterization Report* for Galveston Bay, a summary of all scientific findings related to the recognized problems in the Bay.

Managing the Flood of Data and Information

Bringing Order to Chaos

A Data and Information Strategy

Available resources for improving Bay management include results of the projects listed here, numerous historical projects, and many old data sets and publications. Without a strategy to handle and utilize these resources, they create a nightmare for both managers and citizens seeking specific information. Based on a workshop in July, 1989, a user survey, outside speakers, and committee and subcommittee deliberations, a Data and Information Management Strategy was adopted in January 1990.

Components of the strategy include: a Galveston Bay Data Base Inventory consisting of an electronic searchable index of descriptions of all data sets pertaining to the Bay; an electronic, searchable Galveston Bay Bibliography of published and unpublished reports concerning the Bay; a Galveston Bay Information Center for the permanent housing of reports, maps, photos, videos and other resources; and COMPAS, the National Oceanic and Atmospheric Administration's Coastal Ocean Management, Planning, and Assessment System. In addition to these projects (detailed individually below), coordination is being sought via a Memorandum of Understanding with the Texas Natural Resource Information System and by agreement with EPA's Ocean Data Evaluation System for permanent archiving of bay data.

Assessing the Historical Data Resource

Data Base Inventory

Effective estuary management requires review of historical data in order to scientifically document trends and to chart a future course to solve problems. The required data is scattered throughout local, state, and federal agencies in situations ranging from dusty files to elaborate computer data bases (when it is saved at all). The first step in integrating all this information for the benefit of the Bay is to identify the data and determine what portion is available.

For this project, a survey of local, state, and federal agencies and other organizations was conducted for data sets related to the Galveston Bay Priority Problems List. Next came design and compilation of an electronic, searchable, microcomputer-based data set index. The goal of this index was to enable anyone with a specific data requirement to determine where (and whether) the historical data exist, and how to access them.

Results revealed the data resource to consist of a great many small and obscure data sets and a few large ones. However, gaining access to the data was problematic: the response by agencies in providing information was generally poor, and management of older data prior to 1980 could only be described as a shambles. As a result, most of this older data appears irrevocably lost, and the factors which led to their loss are still operating today. These factors include: low

priority assigned to archiving and preservation of older data; mission-specific agency operation and the perception of old data as "obsolete;" personnel turnover with poor documentation; agency instability (i.e., government reorganization); natural calamities like fires and floods, combined with poor housing; changes in data management technology (creating such problems as obsolete and unreadable files); and a proprietary attitude toward data by those contacted.

In spite of problems with the historical data, the Data Base Inventory has become a valuable tool for current work in developing a management plan, and many recommendations have been developed to improve data management in the future. The Data Base Inventory is a DBASE system compiled by George Ward, Center for Research in Water Resources, University of Texas at Austin.

A Bay Community Resource

The Galveston Bay Information Center

In order to develop an effective management plan, the Galveston Bay National Estuary Program required that existing information concerning the estuary be assembled and accessible. Because this information has previously been so scattered, other organizations and individuals with an interest in the Bay also favor a central location for key information resources. These needs led to establishment of the Galveston Bay Information Center at the Jack K. Williams Library on the Galveston Texas A&M Campus.

The Galveston Bay Information Center includes a special collection of published and unpublished agency reports, journal articles, maps, films, videos, slide programs, and aerial photos. All GBNEP publications will be available, as well as several powerful information tools. A project called COMPAS (Coastal Ocean Management, Planning, and Assessment System) will provide a MacIntosh-based interactive information system pertaining to particular Bay resources. The electronic, searchable Galveston Bay Bibliography and Data Base Inventory will be available at the Information Center.

The Information Center is intended to become a permanent resource managed as an activity of the Texas Institute of Oceanography at the Texas A&M Galveston Campus. This GBNEP project is currently directed by William Evans, of the Texas Institute of Oceanography, with library help from Natalie Wiest, at the Jack K. Williams Library.

A key to printed resources

Galveston Bay Bibliography

No one knows for sure how many articles, reports, and other printed resources have been written about Galveston Bay. Many of these (for example, government agency reports) were never formally published or widely distributed, but contain information vital to improving management of the Bay. This project has identified more than four thousand citations and assembled them in a user-friendly bibliography designed to facilitate both research and management

activities related to Galveston Bay.

The *Galveston Bay Bibliography* will exist in two forms. First, a document of some 1,500 pages will be published by the GBNEP listing all Bay-related works, with suitable indices to support location of material on key topics. Second, an electronic, searchable version of the Bibliography will enable users to electronically search by title, author, subjects, or key words. This user-friendly computer system will represent an extremely powerful tool for resource managers, scientists, students, and the public seeking information on particular topics. The system will be accessible by telephone link with user personal computers.

The *Galveston Bay Bibliography* was designed from the beginning to utilized topics of particular concern in managing the estuary, and so will contribute to the drafting and implementation of the CCMP. The *Galveston Bay Bibliography* will become a permanent resource of the Galveston Bay Information Center, managed by Natalie Wiest at the Jack K. Williams Library.

Two Critical Coastal Preserves: Christmas Bay and Armand Bayou

A Mandate for Conservation

Nomination for Preserve Status

Christmas Bay and Armand Bayou are two critical, irreplaceable components of Galveston Bay (see the Fall, 1989 *BayLine*). Preservation of these two areas was identified as a high early priority of the GBNEP. Special funding was sought and received from the EPA for actions to designate each area as a Texas Coastal Preserve, under a new and innovative program jointly administered by the Texas General Land Office and the Texas Parks and Wildlife Department. This project took the first step toward this goal: compiling critical information for nomination of these areas as Coastal Preserves by the Texas School Land Board and Texas Parks and Wildlife Commission.

Based on substantial background research, a slide presentation and report were created emphasizing: protection of fragile biological communities including important bird rookeries; protection of unique coastal features; recognition of preservation and enhancement opportunities; and the active involvement of all concerned and knowledgeable persons and organizations. Based on this work, supervised by E. G. Wermund of the Bureau of Economic Geology, the two sites were successfully designated as Texas Coastal Preserves in February, 1990 at a ceremony attended by Senator Lloyd Bentsen.

Coastal Preserve Boundary Survey

Tide Gauge Installation

Coastal Preserve status for Christmas Bay and Armand Bayou triggered leasing of state-owned lands by the School Land Board to the Texas Parks and Wildlife Department for preserve management. Establishment of the preserves under this lease required boundary surveys to determine the extent of state-owned lands, which extend to mean high tide. The tide gauges therefore were needed for boundary determination, and also contribute critical management information concerning freshwater inflow, subsidence and erosion control. This project occurred in two phases:

Phase I: Site Reconnaissance and Tide Gauge Purchase. Installation sites were surveyed, and two fully automated water level measurement systems were purchased. These gauges were acquired to become part of a coast-wide network of instruments coordinated by the Blucher Institute at Corpus Christi State University in Corpus Christi.

Phase II: Installation, Maintenance and Operation. Gauges were installed and activated. Data generated by the gauges are part of a telemetry system of the Blucher Institute, which is coordinated with tide data systems of the General Land Office, Texas Water Development Board, and National Oceanic and Atmospheric Administration. Data are being compiled according to a detailed Quality Assurance Project Plan. This project was under the direction of Ms. Lanell Aston, Texas General Land Office.

Identifying Management Needs

Environmental Inventories

In order to draft a management plan for each new Coastal Preserve, critical environmental concerns must be defined. The Environmental Inventories in Christmas Bay and Armand Bayou compiled existing information on such concerns as endangered species, permitted point sources of wastewater discharge, dredging activities, agricultural practices in the drainage basins, and monitoring data concerning water quality and living resources.

Christmas Bay is an exceptional finfish and shellfish nursery area and harbors eight endangered or threatened species. Seven waterbird nesting colonies surround this shallow, relatively pristine Bay. The greatest concern for Christmas Bay is habitat loss. Fringing marsh wetlands have declined 8.4% between 1956 and 1979 (less decline than the rest of the Bay). Three of four submerged seagrass species found in Christmas Bay are nowhere else in the Galveston Bay system, and even though this Bay is a last refuge for sea grasses in Galveston Bay, the seagrass meadows in this system have declined 36 percent from 1956 to 1987. Preserving the seagrasses--composing the most valuable and productive habitat of the Bay--is recommended as a high priority.

Armand Bayou is a bottomland hardwood bayou on the western shore of the Bay with a relatively undeveloped watershed (considering its urban setting). The Bayou has been drastically altered by land subsidence of up to nine feet, due to groundwater and petroleum withdrawal. As a result, all 275 acres of wetlands present in 1956 have been lost, with minimal natural establishment of new wetlands. Water quality is a critical concern, with both point and non-point sources of wastewater increasing 35 percent over the last decade. Concerns include effects of development of the forested watershed and wastewater discharges that exceed the assimilative capacity of the Bayou.

Findings of these two environmental inventories were published in the GBNEP publication series (GBNEP-7 and GBNEP-8). Dr. Robert McFarlane is the author of these reports, resulting from a project grant to the Galveston Bay Foundation.

A Framework for Management

Regulatory Surveys

Just as environmental conditions in the Preserves require attention for successful management, so do regulatory authorities and activities. The Regulatory Surveys describe existing limits of jurisdiction for numerous agencies, focusing on regulatory gaps and overlaps, and on potential avenues of interagency coordination. The project concentrated on four topics: point sources of pollution, nonpoint sources of pollution, natural and living resources, and public health.

A complex regulatory framework was described for Christmas Bay, composed of nine federal and 13 state agencies, as well as five local governments. Twenty-nine activities were recognized as potentially of direct concern for management. As a result of the fragmented governmental jurisdictions, many gaps were recognized

in the current governance of this portion of Galveston Bay.

The governance of Armand Bayou is equally complex, with eight federal and 12 state agencies, five local governments, and two special districts. For Armand Bayou, 32 activities of special concern were inventoried. As for Christmas Bay, many of these activities created regulatory gaps, and raised issues of governmental coordination to be addressed in the preserve management plans.

These regulatory surveys have significance beyond improving the management of the two Coastal Preserves--they also serve as a microcosm and testing ground for similar concerns at the bay-wide level. The process of drafting management plans based on this project will therefore contribute to the Bay-wide CCMP. Project results are published in two reports (GBNEP-9 and GBNEP-10) prepared under the direction of Carl Masterson, of the Houston-Galveston Area Council.

Groundwork for Problem Solving **Regulatory Evaluations**

The comprehensive summaries of regulatory activities from the Regulatory Surveys (above) led to this next step toward integrated management of Coastal Preserves. This project determined how well the identified jurisdictions address the priority problems of the Bay, developed criteria to adequately evaluate current management, and, most importantly, developed recommendations for enhanced regulatory efforts under the management plans to be drafted. The approach taken was a series of confidential interviews of agency staff, addressing adequacy of current programs and identification of internal and interagency barriers to regulatory effectiveness.

For Christmas Bay, findings and recommendations resulted for seven concerns: point source discharges; wetlands protection; habitat protection; recreational cabins; agricultural runoff; landfill siting and inspection; and on-site sewage disposal. Similar findings resulted for Armand Bayou concerns: point source discharges; storm water runoff; wetlands protection; habitat protection; and illicit waste disposal. The recommendations are summarized in two reports to be published by the GBNEP, prepared by the project investigators Carl Masterson and Gary Mitchell of the Houston-Galveston Area Council and Duane Windsor, Rice University.

Agreeing on Critical Actions **Drafting the Coastal Preserves Management Plans**

Management of Christmas Bay and Armand Bayou should preserve and enhance water quality, habitat, and living resources. The Plans are based on the Environmental Inventory and Regulatory Survey and Evaluation projects (above), in addition to efforts under this project. The effort is also seen as a pilot-scale opportunity to develop cooperation and consensus among the agencies and user groups which must ultimately implement a similar but much larger plan for the entire estuary, the CCMP.

The Texas Parks and Wildlife Department, as the agency with statutory responsibility for Coastal Preserve Management, undertook the project of drafting these Management Plans. Advisory groups were convened for a series of actions to be undertaken for each Coastal Preserve. These groups sought consensus on the issues, followed by draft Management Plans being submitted for review by the GBNEP. A key feature of this approach is utilizing the GBNEP to solve problems that extend beyond the jurisdiction of the TPWD, through coordination with member agencies and user groups. Management Plans for each Preserve will be published by the GBNEP, for use by TPWD managers of these Preserves. Project work on behalf of the Texas Parks and Wildlife Department was coordinated by Larry McKinney.

Beyond Recommendations

Implementing Management

Implementation of the Management Plans will address problems related to water quality, site-specific needs, and problems related to habitat and living resources. The approach will focus on resource use, including point and non-point wastewater discharges, fisheries, petroleum, and recreation.

Involving the Public. The high degree of public interest in these two areas has already been encouraged by public meetings concurrent with designation of the Preserves. This effort will be continued to receive comments on the draft Management Plans.

Balancing Act: a Coastal Preserves Video. A video production is one way of stimulating public involvement concerning these Coastal Preserves. This video focused on the things that make Christmas Bay and Armand Bayou worth preserving. Topics include the seagrasses and prime nursery habitat of Christmas Bay and the uniqueness and educational values of Armand Bayou.

Early Actions Toward a Healthy Bay

Planting New Wetlands Around the Bay

Shoreline Erosion and Estuary Enhancement

Shoreline erosion is among the serious problems affecting Galveston Bay. Traditional erosion control methods such as bulkheads, groins, revetments and riprap, are expensive to construct and maintain, and are ecologically intrusive. This project was designed to create vegetated marshes as an affordable and environmentally superior alternative to costly shoreline stabilization structures. As a bonus, the created marshes contribute to the productivity and overall health of the estuary.

For this project, sprigs of *Spartina alterniflora* (a native marsh cordgrass) are transplanted along eroding shorelines in Galveston Bay to help stabilize shorelines and restore fringing wetland habitat. Specific objectives are to: 1) demonstrate to local landowners, organizations, and state and Federal agencies that the technique is feasible; 2) develop erosion control standards and specifications for Gulf Coast marsh areas for establishment of vegetative erosion control methods; and 3) demonstrate vegetative shoreline erosion control measures under different shoreline and environmental conditions.

The project is being conducted under a contract to the U.S. Soil Conservation Service, Eddie Seidensticker and Bob Nailon, Principal Investigators.

Reducing Toxic Contaminants in the Ship Channel

Pollution Prevention Planning

Galveston Bay is the final destination for wastewater from some seven million people, nearly half the petrochemical industry in the United States, and nearly a third of the refining. The Houston Ship Channel alone has some 550 permitted discharges equaling 13.4 percent of the State total. This large number of discharges in a confined area creates a tremendous potential for toxic substance contamination of the HSC in particular, and of Galveston Bay in general.

This project will focus on decreasing the amount of pollution entering the Houston Ship Channel by educating and working closely with some of the biggest industrial dischargers. The approach will include specific use of industrial waste audits, waste recovery methodologies, and waste exchange programs. The Texas Water Commission will carry out specific training of industry employees to reduce pollution by planning and development of waste recovery before the wastes get to the Bay. One goal is participation in waste exchange programs for hazardous waste generators and toxic material users who discharge directly into Galveston Bay. The industries will be selected based on an assessment of the risks facing Galveston Bay, including identification of the specific industrial processes creating the risks.

The Texas Water Commission will carry out this GBNEP project, coordinated by Priscilla Seymore, on the Pollution Prevention and Conservation staff.

Management Planning: Steps Toward a Comprehensive Plan for the Bay

Defining the Jurisdictions Involved with Galveston Bay **Bay-Wide Management Survey**

Decades ago, the natural resilience of Galveston Bay allowed many contrasting uses of the estuary with only limited damages to resources of the ecosystem. A "piece-meal" approach to management of the Bay seemed sufficient to prevent major damages. The various governmental agencies proceeded in diverse directions with incomplete coordination at the ecosystem level. But as the population around the Bay boomed, serious degradation resulted, and the fragmented management has failed to conserve the vital Bay resources.

This project took the first Bay-wide step to coordinate and improve the various management activities. Work identified existing regulatory and management activities occurring within the estuary, in order to make a careful assessment of each agency's effectiveness (see "Bay-Wide Management Evaluation," below). Findings produced a staggering array of some six hundred entities with authorities affecting the Bay. The abundance of local utility districts, river and water quality authorities, and agencies, combined with the fragmented statutes and regulations governing their activity is a challenge unique to Texas. Project findings compiled by Susan Hadden, University of Texas L.B.J. School of Public Affairs, will be available in a GBNEP publication.

How Does Current Management Fall Short? **Bay-Wide Management Evaluation**

Galveston Bay's problems include water pollution, habitat losses, and public health concerns--all issues identified in the *Galveston Bay Priority Problems List*. But not all problems are environmental--some relate to the way that existing agencies collectively address (or fail to address) these problems. Regulatory problems are not necessarily anyone's fault; the separate mandates of the various agencies (described in the Bay-Wide Management Survey, above) were not created to solve problems in an entire watershed or ecosystem. The level of coordination required is simply not built into the traditional system.

The purpose of this project is to produce a written analysis entitled *Framework for Action* which, combined with the scientific and technical characterization findings, will serve as the foundation for drafting improvements to regulatory and management activities by agencies. In accomplishing this purpose, this project will provide a substantial impetus for the CCMP.

Objectives of the project include initial identification of standards by which to evaluate management effectiveness, followed by a program-by-program review of both technical and policy elements of Bay management. Of particular interest are the root causes of gaps and overlaps identified in current regulatory activity. Are the Priority Problems agreed upon by the Bay user community being adequately

addressed by the current regulatory structure in Texas? The Framework for Action, to be authored by Susan Hadden of the University of Texas L.B.J. School of Public Affairs, will address this question. The findings of this work will be reviewed by the GBNEP Management Conference during the drafting of the CCMP.

Demarking the Bay for Management **Segmentation of Galveston Bay**

The diverse geography of Galveston Bay (and the variety of human influences) means different problems occur in different areas. Managing the Bay as an ecosystem doesn't mean treating the entire Bay alike: the problems must be carefully targeted. Segmentation (subdivision) of the estuary into smaller geographic units helps better define the Bay's problems and benefits specific management activities under the CCMP. Segmentation also helps establish the right number of routine Bay monitoring stations in the most effective locations. As a result, monitoring can give us an accurate description of the geographic variation in conditions within the estuary, as well as the overall "big picture" of estuarine health.

Segmentation of Galveston Bay was based on a variety of natural conditions, including the shape and current patterns of the Bay, its biology, and its salt and fresh water mixing processes. For practical reasons, past boundaries drawn by various agencies for management were also taken into account. The result was a map and a rationale to aid in the creation of effective monitoring or management units in the Bay. For example, one segment might include critical oyster reefs, another a navigation channel, and another a high concentration of industrial discharges. Using the findings, management can be improved by making site-specific actions under the CCMP. Project results will be available in a report prepared by Jones and Neuse, Inc., project contractor to the GBNEP.

Chronicle of the Resource **The History of Natural Resource Utilization**

The scientific projects of the GBNEP compile data to define problems to be addressed by the CCMP. However, these data only reach back a few decades. Data do not tell us much about conditions in the Bay's "pristine" state, and the data fall far short of describing the history of human interaction with the Bay--even in recent times. Therefore, this project was conceived to expand the consideration of estuary trends from the modern era of environmental management to a broader consideration of the estuary in human history--the resources it maintained and how they were used.

The project is based on old accounts in journals, fishery reports, and other documents, photos, and illustrations. Numerous interviews were conducted by trained volunteers with living elderly residents, and with representatives of historical societies and museums. Results summarize the archeology of the Bay, its early settlement by non-natives, and its previously abundant resources. What of the striped bass, tarpon, snook, ospreys, sea turtles (with a commercial fishery

in the Bay), and the extensive sea grass meadows? These are some of the abundance the Bay has yielded in former times.

Principal investigator for this project is Cynthia Howard; findings will be published in a GBNEP summary document.

Social Trends Affecting the Estuary

The Socioeconomics of Bay Utilization

Regulatory agencies have periodically used economic data to make estimates of the dollar values of various Bay uses. This information has never been brought together in a single study, and more importantly, the social trends underlying use of the Bay have never been adequately described. The most important aspect of this study, therefore, was to characterize social trends affecting the Bay system, as a tool to help determine possible effects of the CCMP on various populations associated with the Bay.

The elements of this study were: a demographic analysis utilizing the latest (1990) census data; identification of user groups and their dependence upon the Bay and one another; social trends for employment; and estimation of economic values of Bay uses based on previous studies. Specific elements of interest included: recreational fishing, boating, shipping, wastewater receiving, commercial fishing, land values, and oil and gas production. The "external costs" of using the bay were considered--those costs not paid directly by users, but which effect the resource.

This project resulted in a report compiled by Roger Durand, University of Houston--Clear Lake, to be published by the GBNEP. Results will strengthen a subsequent economic project entitled "Natural Resource Economics of Bay Use" to help determine the values of the Bay for management.

How Can We Pay for Stewardship?

Funding Source Inventory

Comprehensive management of Galveston Bay will require improved agency coordination, new enabling legislation, new programs, and higher efficiency for existing programs. This project will gather information needed to draft a Funding Strategy for these and other elements of CCMP implementation. Existing information on current local, state, and federal revenue sources will be drawn together to identify alternative ways to pay for improvements in management of the Bay.

The project is the first of four steps leading to a CCMP Funding Strategy. The remaining three are: (1) estimation of the costs for management alternatives proposed by the CCMP Task Forces; (2) establishment of a Financial Planning Committee under the Authority of the Policy Committee to rank funding sources and establish a strategy; and (3) drafting of the CCMP Financial Strategy itself for incorporation in the CCMP.

Public finance information and funding recommendations will be drawn together by Susan Hadden, University of Texas L.B.J. School of Public Affairs, and published in a report for use by the GBNEP in drafting the CCMP Funding Strategy.

The Grass Roots Effect: Public Participation

Observation and Coordination

Volunteer Bay-Watchers: A Citizen's Monitoring Plan

Water quality is a foremost concern in Galveston Bay because of its important relationships with public health, commercial fishing and wildlife populations, the conditions of habitat in the Bay, and the general quality of living on the coast. One of the fastest-growing grass roots environmental efforts in the country is citizen's water quality monitoring, pioneered in the Galveston Bay area by GBNEP in the Armand Bayou Coastal Preserve.

Economic reality, coupled with an increasing desire by government to be more responsive to citizens has encouraged this unique approach to environmental monitoring. Environmental agencies like the U.S. EPA and the Texas Water Commission realize that properly trained volunteers can be the "eyes" of the agency, reporting unusual occurrences and identifying trends before they become major problems to a water body. Citizens' interest is high because they can directly measure environmental quality, either to compare to, or to augment agency information. Because citizens live where the problems are, and have a stake in water quality in their community, their daily observations are increasingly valuable for long-term data gathering.

This project, begun in FY 1990, was developed by the Citizen's Monitoring Committee and is coordinated with the Texas Water Commission's "Texas Watch" program. The funds provide planning, training and limited equipment for environmental monitoring of the Armand Bayou watershed immediately adjacent to Galveston Bay. Certified volunteer monitors collect samples according to EPA and TWC protocols. This data is then utilized as a supplement to existing data collected by state and federal agencies. The program's success in its first two years has led to plans to expand the monitoring Bay-wide in FY 1993.

Response to Citizen Concerns

Pollution Reporting Hotline

Because citizens rarely know whom to contact when they witness pollution or activities that degrade the Galveston Bay watershed, the pollution reporting hotline was developed as a centralized reporting mechanism. Established in 1992, the hotline (1-800-3OUR BAY) is a demonstration project that enables the citizen to make one call and see results without being transferred to multiple persons and agencies.

Residents and visitors in the five counties surrounding Galveston Bay--Brazoria, Chambers, Harris, Galveston and Liberty Counties--may call the hotline to report any type of pollution they perceive as a problem. This includes land and water debris, oil and hazardous substance spills, fish and bird kills, bilge pumping, air emissions, storm drain dumping, improper waste disposal, and any other activities that may produce pollution. Trained volunteer operators take the calls

and make a detailed report. In emergency situations the proper authorities are dispatched immediately, otherwise, the hotline staff follows up with the appropriate agency and keeps track of each call's resolution. The citizen caller will receive written communication regarding the action taken.

Data on the pollution reports will be collected and assembled into an annual report to the Texas Legislature detailing problem areas, as well as gaps and overlaps in the environmental regulatory/enforcement structure. Information learned through the hotline will enhance recommended solutions to be incorporated into the CCMP. The Hotline is a project of the GBNEP Program Office in cooperation with the Citizen's Advisory Steering Committee.

Getting the Word Out **BayLine Newsletter**

BayLine is a quarterly newsletter, produced by the GBNEP staff with articles contributed by a variety of organizations and individuals in the Bay area. *BayLine* includes updates on the progress of CCMP development, summaries of published GBNEP reports, requests for public involvement with volunteer projects, and requests for information and input on specific issues that affect the estuary.

Each issue of *BayLine* usually utilizes a "theme" approach, highlighting a critical, and timely Bay topic. *BayLine* addresses all elements of the Priority Problems list and describes how the Management Conference is developing solutions.

Approximately 6,500 copies of *BayLine* are distributed to Management Conference and Public Forum members, business and industry in the Bay area, environmental groups, and elected officials representing jurisdictions around the Bay.

Spokespersons for the Bay **Speaker's Bureau and Portable Information Display**

The size and diversity of the five-county area around Galveston Bay makes communication with the community a challenge. The size of the geographic area makes it difficult for people to attend public meetings at any given location. Hundreds of newspapers and broadcast stations in the area create an atmosphere of "information overload" which busy citizens often tune out. For these reasons, plus a genuine desire for face-to-face communication with the public, the GBNEP staff and Management Conference volunteers have been "taking the show on the road."

Slide programs addressing the Priority Problems List and CCMP development are presented regularly by staff and trained volunteers. They speak at environmental and civic group meetings, professional and trades organizations, and educational institutions. Slides are supplemented by handouts about the program. Many new Public Forum members and newsletter subscribers are recruited at these

meetings.

In addition, a portable information display (approximately 8' wide by 8' tall) and supplementary materials were acquired for large audience education at trade shows, festivals and conferences. The display features current literature regarding the Bay and the GBNEP, and a short video production and eye-catching posters and displays to capture the interest of passers-by. The display is usually staffed by volunteers answering questions and distributing materials, but it can also be left unattended at a trade show or in a public place such as a library.

Both the Speaker's Bureau and Information Display are scheduled through the Program Office.

Documenting our Efforts

The GBNEP Publication Series

The GBNEP Publication Series produces Management Conference documents that serve a variety of functions to support drafting the CCMP. All of the GBNEP project reports are published in a "green cover" series and are made available to libraries and the public on request. These include the technical and scientific characterization studies of the Bay. Planning documents such as the *EPA/State Management Conference Agreement*, Membership Directories and Annual Work Plans are also part of the Series.

Future milestone publications include: an overall summary of technical findings, the *Galveston Bay Environmental Characterization Report*, a management evaluation entitled *Framework for Action: the Governance of Galveston Bay*, a public summary of our knowledge of the estuary to be used in the CCMP, *The State of the Bay*, and finally, the *Comprehensive Conservation and Management Plan* itself. A more complete description of these four milestone documents is provided in the introduction of this work plan.

Sharing the Message with the Public

Public Information Publications and Videotapes

Public information and education is vital to citizen participation in the improvement of Bay management, and a variety of printed materials and video productions are available for all ages. These include brochures, an informational poster about man's affects on the Bay, and (in the future) fact sheets summarizing the scientific and management topics for the general public.

The *Galveston Bay Recreational User's Handbook* is a guide to recreational activities around the Bay, including parks, fishing, boating and birding. It includes information that will help people use the Bay safely and responsibly, and promotes a general awareness of the recreational value of the estuary.

The *Galveston Bay Area Residents' Handbook* details many of the simple things Bay area residents can do to protect the Bay. It addresses the single greatest

cause of pollution in Galveston Bay: nonpoint source pollution. Nonpoint source pollution comes from diverse sources and in most cases results from the daily living activities of Bay Area residents. The handbook includes tips on lawn care, native plants, household hazardous wastes, boat and automobile care, and proper septic system maintenance.

Five videotape programs produced by GBNEP are available for loan to schools and organizations. They include: *Conflicting Uses of Galveston Bay*, *Oyster Harvesting and Conservation in Galveston Bay*, *Oil Spills—Marine Resources at Risk*, *Balancing Act—Christmas Bay and Armand Bayou Roles in Bay Conservation*, and the newest video, *Understanding the Galveston Bay Ecosystem*, a 30 minute program produced for high school marine science students, but suitable for many audiences. These videos encompass a variety of target audiences, and help the public to understand and to become involved with management of the Bay.

An Annual Celebration of Awareness **Bay Day**

Bay Day is a two-day event held every spring at Sylvan Beach Park, an historically significant bay-front recreation area in LaPorte. Bay Day is a festival in celebration of the Bay, as well as a spotlight on the significance of the estuary and need for wise use.

Bay Day is a cooperative venture of the GBNEP and the Galveston Bay Foundation, and is planned by an independent steering committee established for this purpose. The festival includes music, an arts and crafts market, children's games and activities, rides, a boat show, industrial, environmental, and heritage exhibits. There are boat races, helicopter rescue demonstrations, a fireboat demonstration, and fishing contests. Recreational interests are represented, as are business and industry in the Bay area. A major Saturday night concert on the main stage climaxes with a spectacular fireworks display over the water.

This family festival, intended to become an annual affair, is designed to increase public awareness of the Bay's value and diversity of uses. By focusing on the commercial as well as the ecological aspects of the Bay, Bay Day reinforces to the public the need for comprehensive management of the Bay. The event is volunteer intensive, and the GBNEP Public Forum is involved with staffing the event.

The GBNEP exhibit at Bay Day provides the opportunity to further increase the *BayLine* mailing list and the list of Public Forum volunteers who may want to participate in other activities.

Foundation for the Future **Youth Education and Outreach**

Educating the next generation is an important component of Bay conservation and preservation. The success of the CCMP over the next several decades depends directly on public understanding of, and concern for the Bay's resources.

The GBNEP works with existing formal and informal educational institutions (museums, nature centers, etc.) to develop programs about the Bay, using their staff and facilities. The education subcommittee of the CASC also plans educational projects to reach a wide range of students in school systems throughout the five county area around Galveston Bay. Past and present projects include:

- Bay Area Calendar Art Contest for school children
- Book covers for students to increase awareness of the Bay and nonpoint source pollution
- Teacher Training Program in environmental education, supported by the Galveston Bay Foundation, and facilitated by a University of Houston Professor
- Judging and support for local science fairs, with winners of the Regional Science Fair being honored at Bay Day
- Sponsorship of a local school district to develop a pilot project for Bay related environmental education
- Materials to accompany the Galveston Bay Ecosystem video

Future projects are also being considered. These include:

- Support for a Galveston Bay docent program, developed by the Galveston Bay Foundation Education Committee and a local science museum, to send trained docents—with educational materials—to local schools
- Essay contest for local middle school students.

In Touch with the Public at Large

Public Meetings

Public meetings provide formal interaction between program participants and the general public, and are a necessary part of the CCMP development process. Public meetings are scheduled when milestone publications are released, or when issues emerge that require extensive public input. In this way a continuing dialogue on important issues concerning the Galveston Bay System is maintained. Past public meeting topics include: Priority Problems in Galveston Bay; Oil and Hazardous Materials Spills; and Citizen Monitoring.

IV. Program Activities for Fiscal Year 1993

Management Assessments

In the coming year, the Management Conference will have available the results of the Bay-wide management evaluation project entitled *Framework for Action--The Governance of Galveston Bay*. These results will be utilized by the Action Plan Task Forces for drafting the CCMP. In particular, the Framework for Action Task Force will be translating the findings of this project into specific initiatives. Four projects to be contracted this year in support of this program are described below.

CCMP Action Plan Costing. This project is the second step of four initiatives leading to a CCMP Funding Strategy: (1) A Funding Source Inventory scheduled for completion in August, 1992; (2) CCMP Action Plan Costing to estimate costs of management alternatives proposed by the CCMP Task Forces (this project); (3) Establishment of a Financial Planning Committee to rank funding sources and establish a strategy; and (4) Drafting of the CCMP Financial Plan by Spring, 1993.

Management alternatives will first be developed at a broad level by Action Plan Task Forces during Spring, Summer, and early Fall, 1992. These alternatives would be communicated to the contractor late Fall, 1992, and the contractor would produce cost estimates based on the best information available by this time. Because the management alternatives developed by this time would not be final, the estimates could involve a fairly wide variance. The purpose of this project is to make estimated costs of various management alternatives available to the Financial Planning Committee to be appointed by the Policy Committee. The work is ultimately required for cost estimates in the CCMP itself (produced in FY 1994) to enable an implementation plan.

Funding Requirement 60 K

CCMP Task Force Support. Contract support for sixteen Action Planning Task Forces convened to facilitate drafting of the action plans which will constitute the CCMP. This work involves technical information compilation and writing. Specific objectives include: attendance at approximately 50 task force meetings, and recording of task force deliberations and findings on lap-top computer; compilation of these findings in the format specified by the GBNEP Management Conference; background research and incorporation of findings in the developing action plans; delivery of action plan revisions to the Program Office, coordinated for distribution to task forces; compilation of decision briefs to facilitate review of action plans by task forces and the management conference; and general integration and coordination support for the task forces.

Funding Requirement 70 K

Bay Characterization Support. Contract support for drafting a Galveston Bay Characterization Report due August, 1993, including coordination with authors attending a related symposium during Fall, 1992. Work will involve coordination of multiple authors' contributions to the Characterization Report to be published in a format specified by the GBNEP Management Conference. Specific elements include: drafting of preliminary introduction and overview sections of document in concert with Program Office staff; distributing chapter "assignments" to authors in a specified format; coordinating author contributions and presentations at the "State of the Bay Symposium" to facilitate development of the Characterization Report in the specified format; compiling/editing the draft Characterization Report; coordinating several rounds of review/revisions by GBNEP Management Conference participants and outside technical experts; compiling final approved document in camera-ready format for delivery to printer.

Funding Requirement 70 K

Natural Resource Economics of Bay Use. A natural resource and economic valuation study organized by human use categories, which emphasizes the overall value of Galveston Bay as a sustainable human life-support system. This project would expand on a previous GBNEP socioeconomics study, but would involve non-traditional natural resource economics to overcome the well-recognized problems of traditional economics applied to natural resources. This project would help establish a realistic estimate of the value of Galveston Bay to Texas and the Nation. Secondary benefit of project would provide synopsis of uses of Galveston Bay, to comply with the language of Section 320 of the WQA: "Assess the trends in water quality, natural resources, and uses of the estuary." A report will be produced for wide distribution which will help communicate the overall value of this estuary to help scale the management initiatives proposed under the CCMP.

Funding Requirement 100 K

Program Office/Overhead. Expenditures in this category support the Program Office and GBNEP Staff through salaries, related fringe and indirect costs, travel, capital items like computer software, and other items associated with work under this element. The equivalent of two full time staff are allocated for this element.

Funding Requirement 154.1 K

Scientific/Technical Assessments

This element reflects primarily the "Characterization" guidance item in the EPA/State Management Conference Agreement, and is accomplished under the direction of the Scientific/Technical Advisory Committee. Drafting of the *Galveston Bay Environmental Characterization Report* will occur during the coming year. This effort will be accomplished with a combination of staff, Management Conference, and contract support efforts. Numerous project principal investigators and STAC scientists will help author the document, and a symposium will be closely tied to this effort. Other work coordinated by the STAC will include filling in knowledge gaps concerning untreated effluent impacts and Bay debris, and a planning initiative for monitoring. Specific projects requiring funds and described in this work plan will address: the Galveston Bay Literature Survey; Bay-wide Monitoring/Data Management; Untreated/Partially Treated Effluent Study; Characterization of Bay Debris; and the State of the Bay Symposium.

Bay-wide Monitoring and Data Management Strategy. This project will develop an integrated, ecosystem-level monitoring plan for Galveston Bay. The plan will unify current resource agency efforts into a statistically appropriate, quality-assured plan to measure eventual effectiveness of GBNEP CCMP Action Plans and to provide baseline information on the health of the estuary. Development of the monitoring strategy will utilize National Academy of Science recommendations, progressive monitoring plans from other estuaries, emerging new technology from EPA EMAP and NOAA National Status and Trends studies, NEP monitoring guidance, and the GBNEP Segmentation Study. The project will include a data management component to assure the resulting data are efficiently compiled and converted to meaningful and timely information for resource managers and the public.

Funding Requirement 100 K

Untreated/Partially Treated Effluent Loadings. This project will develop a document which characterizes the magnitude and potential effects associated with raw or partially treated sewage entering the Bay. Existing information on sources of untreated effluent such as sewage bypasses, overflows, and exfiltration outflows will have previously been compiled. Additional information regarding sources of partially treated effluent from septic tank systems will also have been compiled. The effort to compile the above information will have been completed by a variety of federal, state, and local entities. The purpose of this project is to summarize this information in a single document for inclusion in the GBNEP Publication Series.

Funding Requirement 10 K

Characterization of Bay Debris. Marine debris has been identified as a concern throughout the Gulf of Mexico. Within Galveston Bay, debris (including shoreline, floating, and submerged) has specifically been identified as a Priority

Problem and consequently must be characterized to facilitate future management efforts. This study would attempt to characterize the magnitude and potential impacts to Galveston Bay associated with debris, by carrying out a volunteer "clean-up" primarily designed to quantify the debris problem. The study will be developed and conducted primarily by cost share contributions by the STAC, Texas Parks and Wildlife Department, General Land Office, and members of the Citizens Advisory Steering Committee, with collection of data by a volunteer force during Summer, 1992. This funded portion of the study is for a contract for compilation of data, statistical analysis, and report writing.

Funding Requirement 9.5 K

State of the Bay Symposium. An integral step in developing the GBNEP Characterization Report will be a technical symposium to be held Fall, 1992. An initial workshop convened February, 1991 focused on Bay research currently underway, and drew together management-related work from a variety of disciplines. This meeting will utilize a similar unifying theme, but in a much more focused format. The agenda for this workshop will closely mirror the outline for the Characterization Report, and invited speakers will specifically address the "State of the Bay" for Priority Problems and their related status, trends, and probable causes. Information from these discussions, combined with written, peer-reviewed contributions drafted in a common format by Symposium authors, will form the core of the characterization report. An additional emphasis will be on identifying information gaps related to comprehensive estuary management, to strengthen the Research CCMP Action Plan.

Funding Requirement 10 K

Galveston Bay Literature Survey. During FY 1993, the Galveston Bay Information Center is expected to continue support of GBNEP Scientific/Technical efforts. Several specific technical roles for the Information Center and Literature Survey are planned. One project element is an update of the electronic literature survey and a 1993 supplement to the printed bibliography. This updated bibliography would contain all citations identified in GBNEP Characterization reports including annotated bibliographies supplied by some contractors. Having this information available in an electronically searchable form will provide valuable support for the CCMP task forces and the characterization effort. Continued acquisition of works cited in the Bibliography will enhance the reference collection. Additional work will include support for the Data and Information Management Strategy (DIMS), including archiving of GBNEP Characterization Study results. Public accessibility elements will be administered through the Citizen's Advisory Steering Committee, rather than as a technical function.

Funding Requirement 35 K

Program Office/Overhead. Expenditures in this category support the Program Office and GBNEP Staff through salaries, related fringe and indirect costs, travel, capital items like computer software, and other necessary expenditures. The

equivalent of one and a half full time staff are allocated to this element.

Funding Requirement 99.3 K

Public Participation

This element is an ongoing activity affecting all work carried out by the GBNEP, and is accomplished by initiatives of the CASC. Increased emphasis is planned for this element in comparison to previous years, as the completion of the CCMP approaches. In general, public participation will become more focused on management initiatives related to the CCMP, taking advantage of momentum from successful projects accomplished during the first three years. Specific projects requiring funds are: BayLine Newsletter; Publication Series; Speaker's Bureau/Public Meetings; Portable Information Display; Citizen's Monitoring; Bay Day; Pollution Awareness and Reporting; Education; Galveston Bay Information Center; Media Relations; Local Government Advisory Committee; and Staffing Increase.

Galveston Bay Information Center (GBIC). The GBIC is a Bay area center to house the special reference collection of Galveston Bay literature and media for use by the scientific community and general public. This project includes two major components. First is creation of a five-year strategic plan for the GBIC, providing a clear vision for the future of the Center. It would describe the long-term maintenance and acquisition plans for the Center. Second is development of User's Guides describing all aspects and features available for public use. Continued library support for CCMP Action Plan Task Forces and for drafting of the Characterization Report would also be a part of this project. This would include support for GBNEP staff, CCMP Action Plan Task Forces, and Conference members--support such as inter-library loans and reference material check-out for Conference use.

Funding Requirement 10 K

BayLine Newsletter. *BayLine* is produced by the staff with articles contributed by a variety of organizations and individuals in the Bay area. *BayLine* will include: Updates on the development of the CCMP, summaries of the published GBNEP reports, requests for public involvement with volunteer projects, and requests for information and input on specific issues that affect the development of the CCMP. The main topics vary depending on the current information and issues. *BayLine* addresses all elements of the Priority Problems List. The GBNEP newsletter will be produced on an as-needed basis with a minimum of three issues annually. The Program will continue to expand the mail list and identify additional alternative distribution channels.

Funding Requirement 15 K

Publication Series. Publication and distribution of program reports and other printed materials. Results of projects contributing to development of the CCMP will continue to be published by the Program. Distribution channels will be carefully targeted and increased through publication placement in appropriate bookstores, nature centers and educational institutions to develop the maximum participation in CCMP development and general awareness of the Bay.

Publications will include:

"Green cover" project report series

State of the Bay - a major publication for wide distribution

Topical fact sheets targeted to specific audiences

Reprints of various GBNEP publications, as necessary

Bay user group literature translated into appropriate languages

Miscellaneous Publications

Funding Requirement 117 K

Speaker's Bureau/Public Meetings. This project represents a central element of public involvement with CCMP development. The primary thrust of this project will be in Speaker's Bureau development to take the program message to existing audiences associated with outside groups. The Speaker's Bureau was greatly strengthened in FY 1992, representing an improvement over the public meeting approach utilized early in the Program. Public meetings will continue to be utilized at key points in the Program, particularly for the CCMP review cycle. Related activity will include: use of postage-paid Public Forum feedback forms for audiences; maintenance of contact with targeted groups to ensure continuity of involvement with the developing CCMP; and message development and target marketing for key themes like release of the "State of the Bay" publication. Funding will be used to improve presentation resources available to staff and volunteers, including slide shows/maps/graphics, equipment maintenance, and other incidental costs.

Funding Requirement 14 K

Portable Information Display. The display will be updated to reflect citizen involvement in GBNEP projects and CCMP development as needed. Consideration will be given to rotating elements of the exhibit to target the intended audience. Increased use of the display will be accomplished by placing it in public places for several week intervals (i.e., libraries, court houses, club houses). Funding will be used for shipping, maintenance, photo print updates, and space rental.

Funding Requirement 2 K

Citizen's Monitoring. Through this project, citizens from the Bay area continue to have the opportunity to directly support Galveston Bay management through a "hands-on" activity. The Citizen's Monitoring project has a three-year history under contract to the Texas Water Commission. During development, key aspects of the program were established: a monitoring manual; QA/QC training protocol and sessions; standardized forms; and establishment of a Citizen's Monitoring organization for the Armand Bayou pilot phase. This project will now fund an outside contractor to initiate Bay-wide Citizen's Monitoring. Elements include: attracting and coordinating volunteers; selecting sites throughout the Bay; providing staff support; and purchasing additional equipment. The project will

also include continued coordination with the Texas Water Commission for training and data management, and GBNEP staff development of a Citizen's Monitoring brochure.

Funding Requirement 28 K

Bay Day. A major annual festival was established by previous work under this project, in cooperation with the Galveston Bay Foundation. This project will continue this festival with the third annual Bay Day, and will help assure the event becomes a permanent, self-sustaining endeavor. The purpose of Bay Day is to call attention to Galveston Bay, and all aspects of its management and uses, by providing Bay-oriented family activities for all ages. The event is volunteer-intensive with heavy involvement by the GBNEP Public Forum and volunteers from outside organizations. Many activities are education-oriented, with numerous booths and educational activities. In addition, GBNEP's exhibit at Bay Day will provide opportunity to further increase the BayLine mailing list and the list of Public Forum volunteers who may want to be involved in other projects.

Funding Requirement 25 K

Pollution Awareness and Reporting Campaign. This project is designed to increase awareness of pollution, to stimulate increased reporting, and discourage illegal pollution activities. The project will be closely coordinated with the Pollution Reporting Hotline, an effort established in FY 1992 for the five-county area surrounding the Bay, but will not duplicate the efforts identified in that project. The program will also focus on nonpoint source pollution prevention. One goal of the project is an increase in the public concern for the Bay that will contribute to implementation of pollution prevention, reporting, and enforcement actions under the CCMP.

Funding Requirement 25 K

Youth Education and Outreach. GBNEP will continue to work with existing educational institutions (museums, nature centers, etc.) to develop programs about the Bay to promote general awareness of estuarine conservation that will strengthen the CCMP and improve its acceptance. For example, nonpoint source pollution reduction will be a major element of the CCMP, and must include a strong educational emphasis. Some specific strategies include: specific cooperative programs with such organizations as Partners for Houston; an essay contest for area middle-school youngsters; an awards program to encourage science projects related to Galveston Bay; continuation of the highly successful Galveston Bay Calendar Art Contest; and student book covers with an educational message about the Bay.

One special element of the education project utilizes trained volunteers for school teaching programs. The Galveston Bay Docent Program will involve contracting with an organization to implement a program and activities designed specifically for students. This program will focus on the Galveston Bay ecosystem and will

involve docents (trained volunteer teachers) for classroom presentation utilizing a special curriculum. Coordination with area schools for wide Bay-area exposure to topics that will be included in the CCMP is an element of this effort.

Funding Requirement 40 K

Media Relations. The success of the GBNEP is directly related to the public support and enthusiasm generated by the program to ultimately lead to public support and funding for the CCMP. To this end, active media participation in all aspects of the GBNEP is invited and encouraged. This project addresses the need for the GBNEP to educate and work with the media in the Galveston Bay area for this purpose, and includes: television and/or radio public service announcements; reporting on the progress of CCMP development and soliciting public input (work done with outside contractors where appropriate); and press tours and conferences.

Funding Requirement 15 K

Staffing Increase. The GBNEP Management Conference has made the decision to keep most elements of public participation as staff projects, as opposed to outside contracts to public relations firms. This requires a staffing increase to elevate a public participation secretary position from half time to full time.

Funding Requirement 13.4 K

Local Government Advisory Committee. The CASC will assist the LGAC in establishing strong local involvement in the development of the CCMP. This project will provide minimal funding to facilitate this process. Specific projects could include hosting a conference for Local Government officials in the Galveston Bay area. This idea was recently approved in concept by the Management Conference as one element of changes proposed to increase the participation of the LGAC in activities related to the CCMP. The theme and agenda for this conference would be determined by the Management Conference at a future time.

Funding Requirement 10 K

Program Office/Overhead. Expenditures in this category support the Program Office and GBNEP Staff through salaries, related fringe and indirect costs, travel, capital items like computer software, and other items associated with work under this element. A decision was made early in the Program to conduct most Public Participation projects from the Program Office, rather than via outside contract. The equivalent of two and a half full time staff are allocated to this element. This will be increased to three in FY 1993 based on the Staffing Increase noted separately above. An additional staff member has been present in FY 1992 as Hotline Coordinator, under separate funding. Results from the Hotline demonstration year (FY 1992) will determine whether the Hotline Coordinator

position will be funded by the Texas Water Commission in FY 1993.

Funding Requirement

145 K

Program Administration

A Program Director and support staff will continue to guide the GBNEP toward the goals of the Management Conference. Roles of the Program Office continue to include staff support of committees, program planning, project contract procurement and coordination, interagency coordination and communication, and administrative coordination with EPA. These activities have been refined throughout the first three years of the program.

Management Conference Workshop. Each year of the GBNEP Management Conference, a spring workshop has been convened involving all members of all committees. This Workshop has been highly successful in contributing to consensus-building, since it is the only occasion all members of the Management Conference meet in one place. The agenda, as in the past, will include individual committee meetings, each scheduled to allow members of other committees to sit in. In addition, plenary sessions with outside speakers are planned, and a final Policy Committee meeting to which the entire Management Conference is invited.

Funding Requirement 10 K

Program Office/Overhead. Expenditures in this category support the Program Office and GBNEP Staff through salaries, related fringe and indirect costs, travel, capital items like computer software, and other routine items associated with work under this element. The equivalent of one and a half full time staff are allocated for this element. In addition, this element includes all expenses related to office space lease, equipment repair, meeting room rental, telephone charges, and outside copy services.

Funding Requirement 200.9 K

Action Plan Demonstration Projects

In Fiscal Years 1990, 1991, and 1992, funds were sought and received from the EPA for Action Plan Demonstration Projects. These projects are designed to initiate early actions in management implementation of the sort that will eventually be implemented Bay-wide under the CCMP. In 1990, a two year project was funded which successfully created two new Texas Coastal Preserves for Christmas Bay and Armand Bayou. In 1991, a project was implemented to restore fringing salt marsh habitat for living resource benefits and erosion protection. In 1992, a project was initiated to reduce toxicity in the Houston Ship Channel by working cooperatively with the industries having the greatest potential contributions to this problem. Also in 1992 a Pollution Reporting Hotline was successfully initiated to enable one-call reporting by citizens.

Table 2. Fiscal Year 1993 Project Summary and Budget¹

Program Element	Project	Funding
MANAGEMENT ASSESSMENTS	CCMP Action Plan Costing	60,000
	CCMP Task Force Support	70,000
	Bay Characterization Support	70,000
\$ 454,140	Natural Resource Economics of Bay Use	100,000
	Program Office/Overhead	154,140
SCIENTIFIC/ TECHNICAL	Bay-wide Monitoring/Data Management	100,000
	Untreated/Partially Treated Effluent Loadings	10,000
	Characterization of Bay Debris	9,500
\$ 263,823	State of the Bay Symposium	10,000
	Galveston Bay Literature Survey	35,000
	Program Office/Overhead	99,323
PUBLIC PARTICIPATION	Galveston Bay Information Center	10,000
	BayLine Newsletter	15,000
	Publication Series	117,000
\$ 459,402	Speaker's Bureau/Public Meetings	14,000
	Portable Information Display	2,000
	Citizen's Monitoring	28,000
	Bay Day	25,000
	Pollution Awareness and Reporting	25,000
	Education	40,000
	Media Relations	15,000
	Local Government Advisory Committee	10,000
	Staffing Increase	13,400
	Program Office/Overhead	145,002
ADMINISTRATION	Management Conference Workshop	10,000
\$ 210,880	Program Office/Overhead	200,880
TOTAL		1,388,245

¹ This allocation has been agreed upon by the GBNEP Management Conference, and will be formalized in the FY 1993 Cooperative agreement Work Plan. Although changes are not anticipated in this allocation, some minor adjustments may result as the program budget is completed prior to the grant award itself via the FY 1993 Cooperative Agreement between the Texas Water Commission and EPA Region 6.

Table 3.
Project Status Table, Fiscal Year 1993

Project	Management	Responsible Organization	Cost (1,000s)				Product(s)/ Results	Date
	Conference Purpose ¹		1990	1991	1992	1993		
<i>Management Assessments</i>								
Bay-Wide Management Survey	4-5	University of Texas at Austin			60		Report	8/92
Bay-Wide Management Evaluation	4-5	University of Texas at Austin			175		Report	8/91
Segmentation of Galveston Bay	4-5	Jones and Neuse, Inc.		25			Report, Map	8/91
History of Resource Utilization	4	University of Houston-Clear Lake		15			Report	8/91
Socioeconomics of Bay Utilization	1,4	University of Houston-Clear Lake		50			Report	8/91
Natural Resource Economics	1,4	NOT AWARDED				100	Report	8/93
Funding Source Inventory	4-6	University of Texas at Austin			25		Report	8/92
CCMP Action Plan Costing	4-6	NOT AWARDED				60	Report	8/93
Bay Characterization Support	1-3	NOT AWARDED				70	Report	8/93
CCMP Task Force Support	4-6	NOT AWARDED				70	CCMP	9/93
<i>Scientific / Technical</i>								
Point Source Loading Study	1-3	University of Texas at Austin		60			Report	8/91
Shoreline Survey for Point Sources	3	Texas A&M University, GERG	30				Report	8/91
Nonpoint Source Loading Study	1-3	Groundwater Services, Inc.		125			Report, GIS	8/91
Untreated Effluent Loadings	1-3	NOT AWARDED				10	Report	8/93
Ambient Water/Sediment Quality	1-3	University of Texas at Austin		100			Report	8/91
Dredge/Fill Impacts	1-3	University of Texas at Austin			25		Report	8/92
Toxicants in Aquatic Organisms	1-3	Texas A&M University, GERG	140				Report	8/90
Toxicants in Sediment and Benthos	1-3	U. S. Fish and Wildlife Service			100		Report	8/92
Oyster Survey	1-3	Texas A&M University	80		30		Report, GIS	8/92
Living Resources Trends	1-2	Texas Parks and Wildlife Department		125	40		Report	8/91
Trawling By-Catch	1-3	National Marine Fisheries Service			65		Report	8/92

Table 3 (Cont.)

Project	Management Conference Purpose ¹	Responsible Organization	Cost (1,000s)				Product(s)/ Results	Date
			1990	1991	1992	1993		

Scientific/Technical (Cont.)

Recreational By-Catch	1-3	FTN Associates, LTD			10		Report	8/92
Non-Fishing Incidental Mortality	1-3	Jones and Neuse, Inc.			15		Report	8/92
Wetland Habitat Survey	1-2	Bureau of Economic Geology	40	151	50		Report, GIS	8/92
Ecosystem Conceptual Model	1-4	McFarlane & Associates			15		Report, Diagrams	8/92
Bay Debris Survey	2	NOT AWARDED				9.5	Report	8/93
Public Health Synopsis	1-3	Espey, Huston & Associates			40		Report, Maps	8/92
Monitoring/Data Management	6	NOT AWARDED				100	Bay-Wide Strategy	8/92
Data Base Inventory	2,4	University of Texas at Austin	57.5				Report, Database	8/90
Galveston Bay Information Center	4	Texas A&M at Galveston; TIO	135	100	60	45	Facility; Collection	Ongoing
Galveston Bay Bibliography	4	Texas A&M at Galveston; TIO	(within above project)				Report, Database	8/92
Acquisition: 1930 Aerial Photo Set	4	TOBIN	16.3				Photo Set	8/90
Characterization Workshop	1-3	GBNEP Program Office	(within overhead funding)				Meeting; Proceedings	2/91
State of the Bay Symposium	1-3	GBNEP Program Office				10	Meeting; Report	11/92

Coastal Preserves

Nomination for Preserve Status	1-6	Bureau of Economic Geology	15				Slides, Maps	2/90
Tide Gauge Recon/Purchase	1-6	General Land Office	23.7				Tide Gauges	8/90
Tide Gauge Installation	1-6	General Land Office		27.5				8/91
Environmental Inventories	1-2	Galveston Bay Foundation	28				Two Reports	8/90
Regulatory Surveys	4-5	Houston-Galveston Area Council	22				Two Reports	8/90
Regulatory Evaluations	4-5	Houston-Galveston Area Council	22				Two Reports	8/90
Phase I Management Plans	4	Texas Parks and Wildlife Department	5					
Phase II Management Plans	4	Texas Parks and Wildlife Department		30			Management Plans	8/91
Phase I Management Implementation	5	Texas Parks and Wildlife Department		6				
Phase II Management Implementation	5	Texas Parks and Wildlife Department			30.5		Implementation	8/92
Public Participation for Preserves	4	GBNEP Program Office	1.6					

Table 3 (Cont.)

Project	Management Conference Purpose ¹	Responsible Organization	Cost (1,000s)				Product(s)/ Results	Date
			1990	1991	1992	1993		
<i>Public Participation</i>								
Citizens' Monitoring I	1-3	Texas Water Commission	25				Monitoring Plan	8/90
Citizens' Monitoring II	1-3	Texas Water Commission		25	25		Establish Pilot	
Citizens' Monitoring III	1-3	NOT AWARDED				25	Expand Bay-Wide	8/93
BayLine Newsletter	All	GBNEP Program Office	8	10	10	15	Newsletters	Ongoing
Portable Information Display	All	GBNEP Program Office	1.5	2	2	2	Traveling Display	Ongoing
GBNEP Publication Series	All	GBNEP Program Office	26.6	54.8	88.1	117	Publications	Ongoing
Video: Public Service Announcement	All	Texas Water Commission	7.5				PSA	8/90
Video: User Conflicts	All	University of Houston	12.7				Video	8/90
Video: Oyster Conservation	All	University of Houston	13				Video	8/90
Video: Galveston Bay Ecosystem	All	Texas Water Commission		17			Video	8/91
Video: 3-4 Minute Promotional	All	Texas Water Commission		2.5			Video	8/91
Bay Day	All	Galveston Bay Foundation	4.5	25	25	25	Annual Festival	Ongoing
Youth Education/Outreach	All	GBNEP Program Office	3	25	30	40		Ongoing
Pollution Awareness/Reporting	All	GBNEP Program Office				25		
Media Relations	All	GBNEP Program Office	3			15		Ongoing
Special Kickoff Events	All	GBNEP Program Office	4.8				Kickoff Ceremonies	
Consensus-Building Survey/Training	All	University of Houston-Clear Lake	5.4				Report; Training	8/90
Local Government Advisory Comm.	All	GBNEP Program Office				10		
Speakers Bureau/Public Meetings	All	GBNEP Program Office	11.5	17	7	14		Ongoing
Promotions	All	GBNEP Program Office		5	10			
<i>Administration</i>								
Management Conference Workshop	All	GBNEP Program Office	8.8			10	Annual Workshop	Ongoing

Table 3 (Cont.)

Project	Management		Cost (1,000s)				Product(s)/ Results	Date
	Conference Purpose ¹	Responsible Organization	1990	1991	1992	1993		
<i>Early Action / Demonstration</i>								
Shoreline Erosion/Habitat Creation	5	U. S. Soil Conservation Service		130			Created Wetlands	
Ship Channel Pollution Prevention	5	Texas Water Commission			133.3		Industry Education	
Pollution Hotline Campaign	5	Texas Water Commission		9.5				
Pollution Hotline Reporting System	5	Galveston Bay Foundation		20			Hotline Plan	8/91
Pollution Hotline Implementation	5	Texas Water Commission			133.3		Operational Hotline	Ongoing

¹ The Water Quality Act of 1987 has outlined seven purposes for National Estuary Programs:

- Purpose 1. Assess trends in water quality, natural resources, and uses of the estuary.
- Purpose 2. Collect, characterize, and assess data on toxics, nutrients, and natural resources within the estuarine zone to identify the causes of environmental problems.
- Purpose 3. Develop the relationship between the in place loads and point and nonpoint loadings of pollutants to the estuarine zone and the potential uses of the zone, water quality, and natural resources.
- Purpose 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, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected.
- Purpose 5. Develop plans for the coordinated implementation of the plan by the States as well as Federal and local agencies participating in the conference.
- Purpose 6. Monitor the effectiveness of actions taken pursuant to the plan.
- Purpose 7. Review all Federal financial assistance programs and Federal development projects in accordance with the requirements of Executive Order 12372, as in effect on September 17, 1983, to determine whether such assistance program or project would be consistent with and further the purposes and objectives of the plan(s) prepared under this section.

V. Fund Sources

Funding for the GBNEP is based upon cooperative agreements between the State of Texas (represented by the Texas Water Commission) and the EPA (represented by Region 6). The cooperative agreements are revised annually to reflect the annual planning/funding cycle.

Since the TWC is the recipient of all federal monies for the GBNEP, funding is simplified in comparison to many other estuary programs, in which multiple entities are funded by EPA. The 25 percent required match for federal funds under the NEP is assured for the GBNEP by a rider in the Texas appropriations legislation. This rider specifies that all federal funds available to the GBNEP shall be matched.

Table 4. Source of Funds for Fiscal Year 1993¹

Source of Funds	Amount	Type of Award
U.S. EPA	1,000,000	Clean Water Act Section 320 (Nat. Estuary Prog.)
Texas Legislature	333,333	General State Revenue
Total Funds	1,333,333	

EPA share = $1,000,000 / 1,333,333 = 75\%$
Rec. share = $333,333 / 1,333,333 = 25\%$

Since its beginning, the GBNEP has sought and received contributions of time and money by the people and organizations involved with Galveston Bay. As a result of the high levels of commitment and generosity among these cooperators, substantial additional work has been accomplished, beyond what is formally defined in each year's budget. Much of this additional work results specifically from time, travel, and salary contributions by Management Conference members (Table 5). Active financial support has been received from contractors as well, since many contracts are awarded at least in part on the basis of the level of cost sharing in proposals. Table 5 is a partial accounting of in-kind contributions, representing approximately three fourths of GBNEP cooperators. For many of the contributions, there has been no remuneration other than rewards which may accrue from improving the stewardship of Galveston Bay.

Table 5.
Partial Summary of Cost Share Contributions to the GBNEP
Anticipated for Fiscal Year 1993

Cooperator	In-Kind Contributions
State Agencies	335,597
Federal Agencies	308,783
Private	130,934
Local Government	21,635
Total	812,206