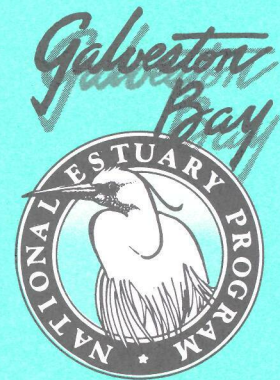


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Fiscal Year 1992 Annual Workplan



Galveston Bay
National Estuary Program

GBNEP-11
August 1991

**Galveston Bay National Estuary Program
Fiscal Year 1992 Annual Workplan**

**Galveston Bay National Estuary Program
GBNEP Publication - 11
March 1991**

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PREFACE

This document is written to meet EPA program 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 Office of Wetlands, Oceans and Watersheds for work to be carried out by the Galveston Bay National Estuary Program (GBNEP) in state fiscal year 1992 (September 1, 1991 through August 31, 1992). Work described in this plan is for year three 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. The Introduction includes a discussion of the activities accomplished during the previous (second) year of the Program, Fiscal Year 1991, as well as a setting forth of activities for the coming Fiscal Year 1992. Following the Introduction is a discussion of program funding for FY 1992, including a summary table detailing funding sources, and a projected annual budget. Finally, projects proposed for FY 1992 are individually detailed, including current status and previous and projected funding levels.

--Frank S. Shipley
Program Director

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I. Introduction

September, 1991 marks the beginning of the third year of work by the Galveston Bay National Estuary Program toward creation of a Comprehensive Conservation and Management Plan for the estuary. In pursuit of this goal, the GBNEP has become firmly established, well known throughout the Galveston Bay Community, and has elicited a high commitment level from resource agencies and user groups.

The main thrust of program activities during the preceding year has been to characterize the estuary's problems--problems recognized by consensus early in the program and enumerated in the "Galveston Bay Priority Problems List". (See Table 1) In the coming year, emphasis will shift toward management solutions to these problems. This shift in emphasis will involve additional scientific work to determine probable causes of problems, as well as continuation of key characterization studies.

Increasingly in the coming year, the governance of Galveston Bay will be an issue before the GBNEP. A major project to evaluate current estuary management will be initiated, with findings to eventually play a major role in drafting of the CCMP. Scientific issues and issues of governance fit together, as described by several key anticipated milestones for the GBNEP. These milestones, for which work in the coming year will be critical, are:

- 1. Galveston Bay Environmental Characterization Report.** This report is to be a summary of ecological and 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: February, 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 of 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: February, 1993.
- 3. The State of the Bay Publication.** 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

Table 1.
Galveston Bay Priority Problems List

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

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

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: June, 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 politicians, managers, and the public to easily understand. The CCMP will have implementation and funding strategies associated with recommended actions. Target publication date: September, 1994.

Work by the GBNEP to reach these milestones will continue to utilize the consensus-building approach that has become a hallmark of the National Estuary Program. The work will not be guided only by scientists and environmental managers; anyone with an interest in Galveston Bay can be part of the program. Industry, shipping, business, development, fishing, environmental, and community interests are active partners in all ongoing efforts of the program. Comments, questions and suggestions about this work are welcomed at the Program Office at any time.

Review of Fiscal Year 1991

The EPA/State Management Conference Agreement (Publication GBNEP-1, available from the Program Office) outlines the five years of work leading to creation of a CCMP in 1994. The commitments made in that agreement were structured to provide a long-term flexible planning framework for individual annual work plans like this one. This Annual Work Plan therefore strives to be consistent with the Management Conference Agreement, while at the same recognizing new and better approaches not identified when the Management Conference Agreement was drafted.

Identification and Ranking of Priority Problems

Creation of the Priority Problems List was accomplished ahead of schedule and in accordance with the Management Conference Agreement, as described in the FY 1991 Annual Work Plan (Publication GBNEP-5). The Priority Problems List continues as an extremely useful guide for the GBNEP. The list has continued to help identify and scope projects and eliminate approaches which will not directly contribute to the CCMP.

One challenge noted in the original creation of the Priority Problems List was the difficulty of summarizing the complex problems of the estuary in an ecosystem context. In effect, the linear nature of the list did not lend itself completely to defining ecosystem impacts occurring in multiple dimensions in time and space. The complex relationships present in Galveston Bay and the insight needed for identification and solution of the problems required additional work.

Figure 1.

Galveston Bay Impact Matrix

Revised 8/21/91

Valued Ecosystem Components

Sources of Perturbation	Water Quality	Circulation	Sediment	Phytoplankton	Zooplankton	Oysters	Shellfish	Other Benthos	Finfish	Birds	Marine Mammals	Sea Turtles	Human Health	Wetlands	Submerged Plants	Shoreline	Aesthetic Appeal
Northerns		**		?	?	*			**								
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
 [shaded box] = management priority

Therefore, two additional efforts were undertaken which, in concept, are extensions of the Priority Problems List. The first is an Ecosystem Impact Matrix (Figure 1). This approach expands the problems to two dimensions, with individual cells of the matrix suggesting impacts with both scientific and management implications (Managing Troubled Waters: the Role of Marine Environmental Monitoring, National Research Council, 1990). Knowledge gaps become quite evident with this approach (the question marks in the matrix). The matrix suggests what problems require attention, but gives little indication where they occur or how they can be solved.

The second effort is creation of an ecosystem conceptual model, fully described below as a scientific project for the coming year. The conceptual model will become a paradigm for determining both ecosystem function and human interference with key ecosystem processes. While significantly more complex than a list or matrix, the model will allow descriptions of complex processes that occur in time and space at the ecosystem level. The multiple-tier approach will allow use by the public, as well as by scientists and managers.

Program Inventory

As described by the 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 Regulatory 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. This project provides an invaluable tool for future work of the program, and the principal investigators have gone beyond the requirements of the project to track down and acquire the data when it can be found. During this process a major problem was identified. For various reasons (detailed in: Proceedings. Galveston Bay Characterization Workshop, February 21-23, 1991, publication GBNEP-6) up to eighty percent of the historical data is missing and presumed permanently lost. This problem has implications for future data and information management, particularly the future commitment to archiving.

The **Coastal Preserves Regulatory Survey** and the **Coastal Preserves Regulatory Evaluation** identified, described, and evaluated all management jurisdictions and activities within the Christmas Bay and Armand Bayou Coastal Preserves. These activities have prepared the way for the **Bay-wide Regulatory Survey**, now being conducted, and the **Bay-wide Regulatory Evaluation**, an FY 1992 project. Evaluations of agency management are to be linked to the simple base program descriptions specified by the Management Conference Agreement for this element, and state and local entities are to be included in addition to the federal programs required by EPA guidance. Results of all above projects excepting the Bay-wide Regulatory Evaluation are either complete, or are scheduled for completion by August 31, 1991.

Base Programs and "Action Now" Implementation

The Management Conference Agreement specifies an evaluation of existing agency management activities. This evaluation was then to be the basis for improvements recommended in a "Base Programs Action Plan" in July of 1991 prior to the CCMP.

The current approach accomplishes these objectives within the framework of the activities summarized above. The **Coastal Preserve Regulatory Evaluations** lead to **Coastal Preserves Management Plans** by Fall, 1991, that specify changes in regulatory activities to better protect and enhance these two subsystems of Galveston Bay. The Management Plans will be approved prior to a CCMP as an early model to be used in similar efforts for work on the bay-wide scale. The Regulatory Evaluations and Management Plans for coastal preserves will be steps toward fulfillment of the requirements for a Base Programs Action Plan. This process will become complete with completion of the "Bay-Wide Management Evaluation" project.

In addition, the **Shoreline Survey for Point Sources** 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.

Data and Information Management System (DIMS)

Although a DIMS was not specifically required by NEP guidance, such a system was deemed necessary by the Management Conference and was therefore included in the 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. These elements were detailed in the FY 1991 Annual Work Plan.

The Galveston Bay Data Base Inventory, an FY 1990 project, is now functional as an electronic searchable data base of data set descriptions, containing sufficient information for program participants and project contractors to acquire relevant data from appropriate agencies. Other components of the DIMS Strategy include use of EPA's Ocean Data Evaluation System (ODES) for data formatting and archiving, use of the Texas Natural Resource Information System (TNRIS) as a data archive and distribution facility, and purchase of remote imagery of Galveston Bay taken in 1930. The GBNEP Convened a special DIMS meeting on January 15, 1991 to provide annual review and revision of the DIMS strategy.

The Galveston Bay Information Center was a specific funded project in FY 1991:

Galveston Bay Information Center

Funding:	\$100,000
Performing Organization:	Texas A&M University at Galveston
Principal Investigator:	Ms. Natalie Wiest
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	All; depends on topic

The Information Center was initiated in FY 1990 at Jack K. Williams Library on the Galveston Texas A&M Campus. Work in FY 1990 was been primarily to compile a Galveston Bay Bibliography; work in FY 1991 emphasized continued entries in the Bibliography and acquisition of a special collection of published and unpublished agency reports, journal articles, maps, films, videos, slide programs, and aerial photos. The bibliography now contains more than 3000 citations and is on line at the Information Center (soon to be available by modem). Several major private collections have been donated to the Center, containing rare and unobtainable documents concerning the Bay. Establishment of the Information center, and opening the doors to the Galveston Bay user community, occurred in FY 1991. Although the Center is funded as a Scientific/Technical Project, and will be an on-line source of information for resource managers and the entire Galveston Bay community.

Accomplishments:

1. Collection building. This included acquisition, cataloging and classifying, and processing of materials to be added to the Information Center.
2. Building and maintaining a local area network (LAN) which is designed to link the Galveston Bay Bibliography, COMPAS, Galveston Bay Data Inventory, and the Aquatic Sciences and Fisheries Abstracts.
3. Provision of reference and information services for the Information Center.

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

The Management Conference Agreement specifies that characterization projects be tied to Priority Problems, that they address management needs, that they utilize existing data, and where gaps exist, that new data be gathered for specific purposes. These criteria continue to be used for selection and scoping of characterization projects.

Activities to achieve these goals in FY 1991 included initiation of additional specific projects, and convening of a major Galveston Bay Characterization Workshop. The Workshop was successful in accomplishing four purposes: 1) identification of scientific work being conducted by institutions other than the GBNEP; 2) promotion of peer interaction among all principal investigators involved in Galveston Bay research; 3) improvement in understanding of estuarine problems which suggest a need for improved management; and 4) encouragement of project

coordination in an ecosystem context. Fifty-six papers were submitted for the Workshop, of which fifty-one were verbally presented. All contributions were published in a proceedings.

Characterization projects initiated in FY 1991 or continued from FY 1990 include:

Trends and Status for Wetlands and Aquatic Habitats.

Funding:	\$151,000
Performing Organization:	University of Texas - Bureau of Economic Geology
Principal Investigator:	Dr. Jerry Wermund
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Resources

This study, begun in FY 1990, involves mapping of shoreline and submerged aquatic vegetation (seagrass) habitats based on aerial photo interpretation and field verification. The work includes digitizing of maps for a computer geographic information system (GIS). Comparisons are made with previous maps from 1956 and 1979 to determine trends; further investigations determine causes for major trends/losses of critical habitat types. FY 1991 work under this project involved digitizing the newest (1989) photos, combined with field investigations to characterize habitat to a level of detail corresponding to plant species associations. The project will require additional work in fiscal year 1992.

Accomplishments:

1. Mapping, verifying, and digitizing 1989 Aerial Photographs. Aerial photographs were utilized to map apparent distinct habitat types. Maps were produced at an approximate scale of 1:24,000 which incorporate all habitat and feature determinations. Habitat categories mapped followed the USFWS National Wetland Inventory Classification system. Portions of the digitizing were delayed beyond the end of FY 1991.
2. Perform detailed ground truth surveys. Ground truthing studies were conducted to determine or verify habitat classifications identified from photographs. Plant communities were also characterized by prevalent species associations.
3. Digitized mapped habitats. Mapped habitats were digitized for use on a GIS system. Data sets developed were compatible with ARC/INFO.

Segmentation of Galveston Bay

Funding:	\$25,000
Performing Organization:	Jones and Neuse, Inc.
Principal Investigator:	James Patek
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Resource Management Issues

Characterization studies, eventual management activities under the CCMP, and design of an effective monitoring program all are served by segmentation (subdivision) of the estuary into smaller units. This project determined a rationale for segmentation based on physico-chemical, hydrologic, biological, and geo-political considerations in relation to estuarine management. Consideration was given to cell geometry in current modeling efforts by the Texas Water Development Board, U.S. Army Corps of Engineers, and Texas A&M University. The project recommended an appropriate scale (segment size) to enable increased resolution compared to current segmenting schemes. A primary benefit of segmentation will be for future monitoring of the Bay. The final product of this project is a published report to be utilized in drafting the CCMP.

Accomplishments:

1. A survey was conducted of existing segmentation schemes used by various state and federal agencies in Galveston Bay. Segmentation information from Guidelines for Clean Water Act (CWA) Segmentation, and segmentation activities from other National Estuary Programs were utilized.
2. Natural features and anthropogenic influences were determined. The entire estuary was reviewed for natural boundaries in physico-chemical features and within-bay circulation and biology including fishery resources. Information included influences on water quality, habitat, and geomorphology.
3. Segmentation criteria were determined based on the above information. Criteria were drafted to segment Galveston Bay into geographical units producing the greatest possible number of end uses for future Bay management by resource entities, including monitoring of water quality, habitat, and living resources.
4. Drafting Boundaries. Segments were mapped based upon an integration of results determined for objectives 1-3, above, and based on coordination with the Management Committee of the GBNEP.

Point Source Loading Characterization

Funding:	\$60,000
Performing Organization:	University of Texas
Principal Investigator:	Dr. Neal Armstrong; Dr. George Ward
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

Estimates were made for pollutant loadings to the estuary from major tributaries and permitted point source wastewater discharges. Parameters included were selected nutrients and toxic elements and compounds. The primary sources of information were: 1. Texas Water Commission permit criteria, compliance monitoring data, permittee self-reporting data, and

waste-load evaluation studies; 2. Texas Railroad Commission permit criteria and permittee self-reported data (for oil field produced water discharges), along with existing data from special studies concerning average produced water constituent concentrations; and 3. Texas Water Commission and other available ambient monitoring data (for tributaries). Results of the study constitute a cumulative loading study of permitted pollutant loading for the bay system.

Accomplishments:

1. Long-term point source loadings data were compiled from various state and federal agencies as well as other applicable sources.
2. Historical and existing quality control systems were assessed, including sampling methodology, and determinations were made regarding the reliability of data sets based on these assessments. Gaps were identified in existing data which impede adequate appraisal of water/sediment quality. Problems with existing monitoring methodology (both in laboratory and field) were documented which impede the use of monitoring data for trend analyses.
3. Existing permitted point source loading and historical trends in the Galveston Bay complex were described from reliable historical data, utilizing graphical displays, statistical time series analysis, and descriptive statistics (e.g., ANOVA, means, ranges, etc.). These assessments were conducted for each Texas Water Quality Segment within the Galveston Bay watershed below Lake Livingston and Lake Houston. Comparisons between segments were made to determine spatial trends.
4. Existing loadings were compared to regulatory criteria/standards and waste load allocations (where present) for each segment and potential problem areas were identified. A cumulative loading assessment of permitted pollutant loading to the Bay system was completed, and recommendations were made.

Non-Point Source Characterization

Funding:	\$125,000
Performing Organization:	Groundwater Services, Inc.
Principal Investigator:	Charles Newell
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

This project was created to determine non-point source pollutant loadings to Galveston Bay from storm water runoff, emphasizing urban runoff. The problem of non-point runoff is one of the greatest future challenges to effective management of Galveston Bay. Chesapeake Bay studies indicate Washington D.C. runoff alone contributes conservatively up to 5 million gallons of oil and grease per year to the Chesapeake, or, on the order of half the volume of the Exxon Valdez spill each year. The Houston urban area, being larger and more industrialized, may have a greater impact on its smaller estuary. Because the problem is massive and diffuse, simple

solutions do not exist. This project takes a Geographic Information System (GIS) approach to this difficult problem. The surrounding watershed is divided into subwatersheds and loadings for pollutants and determined for each subwatershed. Overall loadings are ranked according to this geographic approach, so sources of pollutants may be targeted for management actions. A final report and atlas of maps are the final result of this project.

Accomplishments:

1. Literature and data were reviewed. The review encompassed non-point source information potentially having a bearing on the study area: that portion of the Galveston Bay watershed downstream of Lakes Houston and Livingston.
2. A geographic analysis was conducted on non-point sources. The analysis was conducted to create maps and geographic information system overlays for watershed hydrology, and land use related to NPS sources and impacts. The effort included estimates of NPS loading by land use types and NPS parameter categories, a ranking of subwatersheds based on NPS loadings, and a determination of possible influences of the upper watershed outside the main study area.
3. A final report and accompanying atlas of maps was produced for use in drafting the CCMP.

Ambient Water/Sediment Quality Characterization

Funding:	\$100,000
Performing Organization:	University of Texas
Principal Investigator:	Dr. George Ward Dr. Neal Armstrong
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

Objectives were to characterize the existing water and sediment quality in the Galveston Bay complex, and to identify trends based on a graphical and statistical time series treatment of existing data. Work screened existing data sets and reports for applicability and reliability prior to analyses. Results were then compared to existing criteria, standards, and designated uses. Problem areas were identified, as were information gaps preventing effective appraisal of ambient water and sediment quality. Work was coordinated with the point and non-point source loading investigations (above) to yield recommendations for future management under the CCMP, and future monitoring approaches that can measure water and sediment improvements. The final result of this project is a published report.

Accomplishments:

1. Long-term water and sediment quality data from various state and federal agencies were compiled.

2. Historical and existing quality control measures were assessed and reliability of data sets were determined. Gaps in existing data were identified which impede adequate appraisal of water/sediment quality. Problems were identified for existing monitoring methodology (both in laboratory and field) which impede the use of monitoring data for trend analyses.
3. Existing water/sediment quality was described and historical trends in the Galveston Bay complex were noted utilizing graphical displays, statistical time series analysis, and descriptive statistics. These assessments were conducted for each Texas Water Quality Segment within the Galveston Bay watershed below Lake Livingston and Lake Houston.
4. Existing water quality was compared to regulatory criteria/standards for each segment and problem areas were identified.
5. General circulation patterns and flushing rates for the Galveston Bay system were recognized and probable mechanisms for observed spatial and temporal patterns in water/sediment quality parameters were described.
6. A final report was drafted for GBNEP review and publication.

Living Resource Characterization

Funding:	\$125,000
Performing Organization:	Texas Parks and Wildlife Dept.
Principal Investigator:	Al Green
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Resources

The objective was to determine status and trends in populations of ecologically or economically significant organisms in Galveston Bay. Species were chosen for which historical (i.e., fishery) data sets exist, or which are critical in the food web. Species included penaeid shrimp, speckled trout, red drum, flounder, and blue crab. Secondary consideration was given to forage fish species, phytoplankton, birds, and benthic organisms. (Seagrasses, salt marsh species, and oysters were considered in other projects). Multivariate and time series analyses were applied to data sets, with correlations sought between identified trends and possible controlling variables imposed by human impacts on the Bay. Critical missing information was identified for future work.

Accomplishments:

1. Data bases were selected for analyses. Data bases containing living resource information pertinent to Galveston Bay were reviewed as part of the selection process.
2. Selected data bases were analyzed. Appropriate data bases identified were analyzed to determine trends in temporal abundance of the selected species.
3. Studies were identified and described that would permit definitive conclusions on patterns of change in the Galveston Bay ecosystem. Recommendations were made for modifications

in sampling and monitoring activities which would provide improvement of analyses for detecting temporal changes in the bay ecosystem.

Socioeconomics of Galveston Bay Utilization

Funding:	\$50,000
Performing Organization:	University of Houston-Clear Lake
Principal Investigator:	Dr. Roger Durand
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Resource Management Issues

The socioeconomics of Galveston Bay utilization was characterized, including recreational fishing, boating, shipping, wastewater receiving, commercial fishing, land values, oil and gas production, and others. Direct and indirect dollar estimates were determined for activities based upon best available existing data. Resource values were estimated for some specific uses, for example value of salt marsh productivity; value of trawl by-catch mortality; value of shellfish lost to harvest due to closures. Influences of Galveston Bay on selected segments of the local community were investigated.

Accomplishments:

1. Using the latest available census tracts, demographic trends which affect bay use such as urban-rural population shifts, family income, type of employment and ethnic composition were characterized for the four counties surrounding the bay.
2. User groups were identified e.g. commercial fishermen; recreational boaters; conservationists; industry employees etc. These groups were characterized by: (1) the nature of the dependence of these groups on the bay system and (2) the inter-relationships (inter-dependence and competition) between the different groups.
3. Social trends which affect bay resources were identified. Such trends include bay related employment (such as decline in traditional occupations and introduction of new ones); tourism; boating; shipping; development, agriculture, etc.
4. Economic values of Bay Activities were determined through the collection and synthesis of existing data on economic value of the following bay system related activities: shipping, oil and gas drilling and leasing, wastewater treatment, commercial and recreational fishing, agriculture, realty (land use/values), navigation, manufacturing, recreational boating, tourism and other users identified in the course of this project.
5. The final report will codify and synthesize the above information for use by the conference to (a) predict future trends in bay use and (b) predict potential impact of a CCMP on the surrounding communities and other user groups. It will also identify gaps in information and include recommendations for additional research pertaining to the social and economic importance of the Galveston Bay system to its surrounding communities.

Public Participation

In FY 1991, Public Participation activities were undertaken both through Program Office projects and outside contracts. Projects described below were conceived to meet three overall objectives: determination of citizen concerns and perceptions related to Galveston Bay; public education and awareness concerning the function and importance of the estuary; and direct involvement of citizens in determining estuarine management. In addition to the projects summarized, the Galveston Bay Information Center (above) was conceived to be a benefit to the public.

BayLine Newsletter

Funding:	\$10,000
Performing Organization:	Program Office
GBNEP Project Coordinator:	Kevin Hamby
Priority Problem:	All, depending on topic

The GBNEP newsletter continued to be produced on a quarterly basis. BayLine is produced by the staff, with articles contributed by a variety of organizations and individuals in the Bay area. BayLine includes: Management Conference updates, NEP news, requests for public involvement, and information on specific issues that affect the estuary. BayLine has continued to utilize the "theme" approach of highlighting a relevant Bay topic in each issue.

Publication Series

Funding:	\$54,800
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All, depending on topic

The results of most GBNEP projects have continued to be published in a special series and have been made available to conference members and the public (Table 1). Publications included technical and scientific reports, planning documents, membership directories, and results of GBNEP work.

Education

Funding:	\$25,000
Performing Organization:	Program Office
Principal Investigator:	Marie Nelson
Project Coordinator:	Kevin Hamby
Priority Problem:	Public Health; Resource Mgmt. Issues

The Education Subcommittee of the CASC initiated several projects for students, including: 1. Water Education Teams (WETs) - groups of students complete a series of water quality tests in the Bay Area to learn about man's activities and impact on the local environment from a problem-solving perspective; 2. Calendar Contests - students submit Bay-related art work for selection for publications like calendars, posters, and coloring books; 3. Science Fairs - the GBNEP sponsored special environmental categories and awards for Bay-related projects.

Video Production

Funding:	\$12,000
Performing Organization:	not awarded
Principal Investigator:	not awarded
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

A short video presentation was produced to inform the public concerning the uniqueness of the Bay system; the importance of conserving the Bay; the need to become involved in the Bay's future; and the purpose of the GBNEP. Serving an educational purpose, the video will be used in classrooms to supplement the Speaker's Bureau program, as a resource for persons requesting information about the Bay and the Program. The video was also designed to be viewed with the Educational Display (below) at meetings and expositions.

Table 2.

Publications List

Galveston Bay National Estuary Program

Revised August 5, 1990

<u>Publication Title</u>	<u>Date</u>	<u>Number</u>	<u>Status</u>
BayLine (Program Newsletter)			
1. Program Overview	Apr. 1989	--	Out of Print
2. Galveston Bay: an Economic Resource	Jul. 1989	--	Available
3. Coastal Preserves	Nov. 1989	--	Out of Print
4. Non-Point Source Pollution	Mar. 1990	--	Available
5. Attacking Bay Problems; Project Summary	Aug. 1990	--	Available
6. Estuary Programs: A National Perspective	Oct. 1990	--	Available
7. Bay Day	Apr. 1991	--	Available
8. Science in Bay Management	Aug. 1991	--	Available
Report Publication Series			
EPA/State Management Conference Agreement (Five-year Basis for the GBNEP)	Oct. 1989	GBNEP - 1	Available
Fiscal Year 1990 Workplan	Oct. 1989	GBNEP - 2	Available
Member Directory	Oct. 1989	GBNEP - 3	Out of Print
Member Directory	Aug. 1990	GBNEP - 4	Available
Fiscal Year 1991 Workplan	Aug. 1990	GBNEP - 5	Available
Proceedings: Galveston Bay Characterization Workshop, February 21-23, 1991	Feb. 1991	GBNEP - 6	Available
An Environmental Inventory of the Christmas Bay Coastal Preserve	Mar. 1991	GBNEP - 7	Available
An Environmental Inventory of the Armand Bayou Coastal Preserve	Mar. 1991	GBNEP - 8	Available
Regulatory Survey for the Christmas Bay Coastal Preserve	Mar. 1991	GBNEP - 9	Available
Regulatory Survey for the Armand Bayou Coastal Preserve	Mar. 1991	GBNEP - 10	Available
Fiscal Year 1992 Workplan	Aug. 1991	GBNEP - 11	Avialable
Shoreline Survey for Unpermitted Discharges to Galveston Bay	Aug. 1991	GBNEP - 12	Avialable

Special Publications

Galveston Bay National Estuary Program

(Brochure)	Dec. 1989	--	Available
Galveston Bay, A Home (Brochure)	Mar. 1990	--	Available
What Galveston Bay Means to Me (Fourth Grade Art Calendar, 1991)	Oct. 1990	--	Available
Galveston Bay Recreational User's Handbook	May 1991	--	Available
Protection Through Education (Brochure)	July 1991	--	Available
Household Tips - Protecting Galveston Bay (Handbook for Non-Point Source Reduction)	August 1991	--	Available

Videos

Balancing Act (Christmas Bay, Armand Bayou, and Roles in Bay Conservation)	Oct. 1990	--	Released
Public Service Announcement: "Don't Get Dumped On"	Oct. 1990	--	Released
Oil Spills: Marine Resources at Risk (in cooperation with TWC)	April 1991	--	Released
GBNEP Promotional Video	July 1991	--	Released
Conflicting Uses of Galveston Bay	August 1991	--	
Oyster Harvesting and Conservation in Galveston Bay	August 1991	--	
Understanding the Galveston Bay Ecosystem	August 1991	--	

Most publications are available free of charge while supplies last. Videos may be viewed at the Galveston Bay Information Center, Jack K. Williams Library, Texas A&M University at Galveston, and are distributed on a limited basis. For copies of publications or information about videos or other projects, contact:

Galveston Bay National Estuary Program

Bay Plaza I
711 Bay Area Boulevard
Suite 210
Webster, Texas 77598

Phone: (713) 332-9937

Video Public Service Announcement

Funding:	\$7,500
Performing Organization:	TWC
Principal Investigator:	N/A
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Video PSAs produced in FY 1990 were followed up with one more in FY 1991. The aim was to reach the general public at its most general, least informed level.

Portable Educational Display

Funding:	\$2,000
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

A display backboard and supplementary materials were acquired in FY 1990 for large audience education at various trade shows, festivals, and other exhibits. In FY 1991, this project provided for display maintenance (to keep display information current), transportation, and exhibit fees.

Speaker's Bureau

Funding:	\$2,000
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

Management Conference volunteers and program staff continued to provide programs for interested organizations in the Houston/Galveston area using the Speaker's Bureau to fill requests for presentations. The Bureau was coordinated from the Program Office, with slide presentations, video materials, publications, and equipment made available to the volunteer speakers.

Citizen's Monitoring Plan

Funding:	\$25,000
Performing Organization:	Texas Water Commission
Principal Investigator:	Catherine Albrecht
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Citizens from the Bay area had the opportunity to directly support Galveston Bay management through this plan. The Citizen's Monitoring Plan, drafted under the FY 1990 portion of this project, involved a Citizen's Monitoring Committee to coordinate with the Texas Water Commission to begin volunteer citizen field monitoring of water quality and other estuary conditions. The FY 1991 portion of this project involved implementation of this plan. Data is being gathered to supplement the existing monitoring data collected by agencies, expanding the amount of information available to managers. Armand Bayou was selected in FY 1990 as a pilot project for this effort. Citizen monitoring is seen as a significant component of community involvement in the welfare of the estuary, and this project will expand in future years.

Public Meetings

Funding	\$15,000
Performing Organization:	Program Office
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Galveston Bay Public Forum meetings continued to support interaction between Program participants and the public. Comments received at these meetings were used to help direct all aspects of the Program. These meetings were held in Galveston, Central Houston, Clear Lake and Baytown. Three sets of meetings were held on Coastal Preserves, Oil Spill Concerns and Citizen's Monitoring. Over 125 people attended each series of meetings.

Bay Day

Funding:	\$25,000
Performing Organization:	Galveston Bay Foundation
Principal Investigator:	Bay Day Steering Committee
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

This springtime event was the first of what is hoped to become an annual event for citizens in the Houston-Galveston area. Bay Day was conceived as a festival in celebration of the Bay, as well as a means for highlighting the significance of the estuary and need for wise use. Plans called for a consultant for ten months, with support by a Steering Committee, Social Committee, Finance Committee, and Volunteer Committee. A GBNEP staff member committed 10 percent time to the event in the first year; ultimately the goal is for a growing, self-sufficient event management group.

Pollution Reporting Hotline

Funding:	\$ 45,000
Performing Organizations:	not awarded
Principal Investigators:	Galveston Bay Foundation
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

The Pollution Reporting Hotline developed out of Management Conference discussion concerning who to list as an official contact in public service announcements discouraging pollution. The Policy Committee requested that the Management Conference develop a system that would enable the average citizen to easily report pollution violations. The CASC proposed to develop a workscope that would develop a communications tree and a coordinated package for publicizing the hotline. This project was not in the original workplan for FY 1991, but is an example of flexibility in plans required for an effective response to changing needs. The project was funded with funds originally earmarked for a Public Information and Education project, determined by legal review to be non-procurable under Texas law.

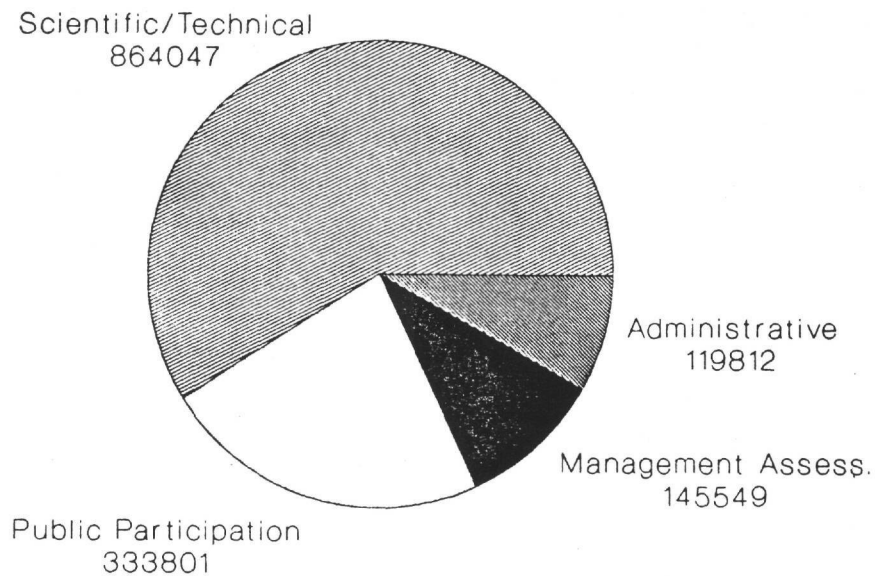
Table 3. Galveston Bay National Estuary Program Fiscal Year 1991 Budget

Program Element and Total Budget	Category	Budget
Management Assessments \$145,549	Salary Indirect Fringe Travel Capital Supplies Other Contracts	34,170 18,578 8,050 4,250 0 1,250 1,500 77,750
Scientific/ Technical \$864,047	Salary Indirect Fringe Travel Capital Supplies Other Contracts	47,472 25,811 11,184 6,750 300 4,250 1,000 767,280
Public Participation \$333,801	Salary Indirect Fringe Travel Capital Supplies Other Contracts	60,024 32,635 14,142 9,000 0 2,750 165,250 50,000
Administrative \$119,812	Salary Indirect Fringe Travel Capital Supplies Other Contracts	47,610 25,886 11,217 5,000 2,250 1,250 2,600 24,000
Action Demo	Contracts	130,000
Program Total		1,593,209

Figure 2. GBNEP FY 1991 Budget By Work Element and by Budget Category Pie Charts

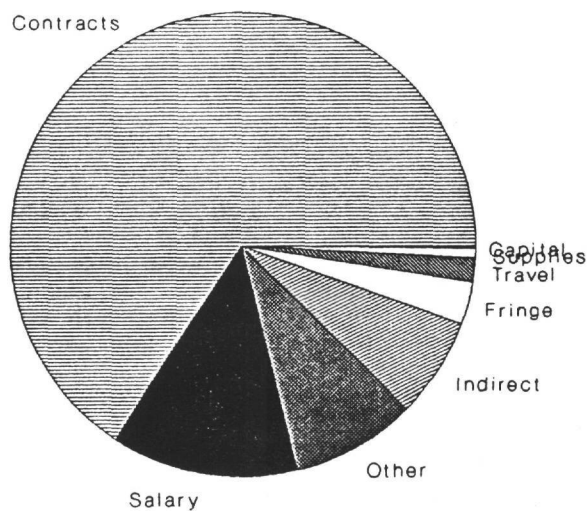
GBNEP FY 1991 BUDGET BY WORK ELEMENT

Revised April 26, 1990



GBNEP FY 1991 BUDGET BY BUDGET CATEGORY

Revised April 26, 1990



Program Activities for Fiscal Year 1992

Work to be undertaken by the GBNEP in FY 1992 falls into five key program areas:

1. Management Assessments. This element reflects primarily "Program Inventory" and "Base Programs Action Plan" items in guidance provided by the EPA Office of Marine and Estuarine Protection. The approach to this element in FY 1992 will involve a Bay-wide Management Evaluation that will eventually contribute directly to drafting of the CCMP. This evaluation will be expanded from the completed regulatory evaluation project concerning the two designated State Coastal Preserves, Christmas Bay and Armand Bayou. Management Assessments will ultimately determine "how" we manage the estuary; whereas the Scientific/Technical Assessments, below, will determine "what" we need to manage. The results of this work will be published as a "Framework for Action," which, combined with the Environmental Characterization Report (below) will be the basis of the CCMP.

2. Scientific/Technical Assessments. This element reflects primarily the "Characterization" guidance item in the Management Conference Agreement. Critical existing historical data will be evaluated for environmental trends and to determine causes of Priority Problems, and new studies will be initiated where gaps exist in historical data. Study goals will target four broad categories corresponding to Priority Problems: Reduction/Alteration of Living Resources; Public Health Issues; Resource Management Issues; and Shoreline Erosion. The emphasis on scientific/technical projects in the coming year will be on determining probable causes for observed trends, and systematically compiling synoptic information from the numerous studies--information that will be of direct use to managers. The results of this work will contribute to the Environmental Characterization Report which, with the results of the Management Assessments, will be the basis of the CCMP.

3. Public Participation. Public participation is a key element in consensus-building. Citizen educational and involvement activities will maintain continuity with programs begun over the last two years. Components include publication of the newsletter, convening of public meetings, slide and video presentations, and special events. A Five-year Public Participation Plan drafted in FY 1990, as well as the specific activities listed in Part III of this document provide a detailed planning perspective for this program area.

4. 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 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 two years of the program. The projected budget details an administrative component for each of the three other key program areas, above, as well as for this program-wide component.

5. Action Plan Demonstration Projects. In FY 1990 and FY 1991, 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.

Creation of the preserves involved environmental and management assessments and drafting of a Management Plan. In 1991, a project was implemented to restore fringing salt marsh habitat for living resource benefits and erosion protection. This project involved the planting of smooth chord grass, *Spartina alterniflora*, in selected areas. In FY 1992, a project was proposed and approved to reduce toxicity in the Houston Ship Channel by working cooperatively with the industries having the greatest potential contributions to this problem. This project is further described in Appendix I of this report.

Looking at the program as a whole, our thrust in the coming year will involve a wrapping up of the most significant characterization studies in the form of final project reports, and a pooling of results from these different projects into ecosystem-level syntheses that emphasize probable causes. This compilation of characterization results in the form of synoptic information in the Environmental Characterization Report will take place throughout the year, even though the final publication release will not occur until FY 1993. The goal of this activity is creation of an information base that is useful for drafting action plans. In pursuit of this goal, the GBNEP has chosen to increase staffing at the Program Office, rather than utilizing outside contracts. Members of the Management Conference felt Program Office staff were in the best position to synthesize characterization results, by virtue of having coordinated projects since the Program began.

Beyond characterization, the Program will be in a transition between information-gathering activities and action-planning activities. In the coming year, Management Conference members will begin the conceptual jump from studying the problems of Galveston Bay, to setting very explicit goals for a series of action plans that will eventually evolve into the CCMP. In other words, we will begin drafting the CCMP long before year five. Starting early has several benefits. We will face the challenge of setting explicit goals and proposing explicit actions in a context of incomplete information--a context certain to remain even at the end of the program. "Getting down to brass tacks" early will give us time to deal with controversies that are sure to arise as planning and information gathering are translated into action.

II. Fund Sources

Funding for the GBNEP is based on a single annual cooperative agreement between the State of Texas (represented by the Texas Water Commission) and the EPA (represented by Region 6). More than one cooperative agreement may be in effect at any one time, since agreements may be extended without loss of federal funds.

Since the TWC is the recipient of all federal monies for the GBNEP, funding is simplified in comparison to many other estuary programs. The TWC has procured for FY 1992 a Texas legislative appropriation of general revenue sufficient to meet EPA state matching requirements. Additional funding for the GBNEP also may be acquired due to the Program being considered critical by the Texas Legislature, resulting in appropriations being granted beyond state match levels. Also, active financial support is sought by the Program Office from contractors, via cost sharing and coordination with other programs. Cost sharing will continue to expand program capability in FY 1992. Table 3 details funding sources (excepting cost sharing); Table 4 presents the projected FY 1992 annual budget.

The sources of funds for FY 1992 (Table 3) are based on a Program commitment to match, at a 25% level, the \$1,000,000 in federal funds anticipated for the year. However, the GBNEP will likely undertake additional work on this Program not involving federal participation. These additional projects are described in this document as well, in order to contain all work planned by the GBNEP in this single document.

Table 4. Source of Funds for Fiscal Year 1992

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

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

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

*Contingent on legislative appropriations

Table 5.

**FY 1992 Draft Budget
Galveston Bay National Estuary Program**

April 1, 1991

Following is a draft budget for the coming fiscal year. This budget will be made final when the FY 1992 Cooperative Agreement Annual Work Plan is approved in final version. Costs for the program office move, final determination of projects and perhaps other influences could affect these figures. The total budget is a figure committing to a match of the EPA Section 320 funds of \$1,000,000.

	<u>FY 1991</u>	<u>FY 1992</u>
Management Assessments		
Fixed Costs	73,911	97,333
Project Costs	77,750	210,000
Total	151,661	307,333
Scientific/Technical		
Fixed Costs	95,092	116,420
Project Costs	756,000	452,445
Total	851,092	568,865
Public Participation		
Fixed Costs	117,704	114,925
Project Costs	175,500	187,135
Total	332,954	302,060
Administrative	135,341	155,075
TOTAL BUDGET	1,463,209	1,333,333

Notes:

Fixed costs include salaries, indirect, fringe, travel, supplies, office space and necessary capital expenditures for the Program Office

III. Fiscal Year 1992 Projects

Projects planned for FY 1992 consist of both continuance of work begun earlier, and conception of new projects. These projects are briefly described below, with detailed technical descriptions available from the Program Office in the form of work scopes and work plans for each project. Projects with full federal participation are committed to under the full terms of the National Estuary Program. Additional projects without federal participation (denoted *) are not funded with federal monies, and are listed as possible projects in addition to the commitments of this Work Plan.

Management Assessments

Bay-wide Management Evaluation. This project is the main effort leading to regulatory changes later under the CCMP. The purpose of the Bay-wide Management Evaluation will be to produce a written analysis entitled "Framework for Action," which, combined with the scientific and technical characterization publications, will serve as the foundation for drafting the CCMP. The Bay-wide Management Evaluation is expected to lead to significant improvements in the effectiveness of the regulatory/management framework for Galveston Bay. The Evaluation is expected to fulfill and go beyond the federal requirement for a "Base Programs Analysis."

The process utilized to conduct the Bay-wide Management Evaluation will include: 1. Identification of objective standards by which to evaluate management effectiveness; 2. Program-by-program resource agency review of technical elements of management influenced by policy; 3. Identification of gaps and overlaps in current management activity; 4. Identification of shortcomings in current management activities, as these activities actually affect recognized estuarine problems; and 5. Drafting of recommendations for changes in the current regulatory/management framework.

Support for Characterization Reporting. This funds a full-time temporary position and/or contract help to support the Program Office in drafting two characterization reports: An Environmental Characterization Report and a State of the Bay publication. The intent of this commitment is to effectively draw together the results of the different characterization projects into a synthesis at the ecosystem level. The findings will be summarized for both managers and for the general public.

Funding Source Inventory. This project will gather information essential for drafting a financial plan for funding implementation of the CCMP. Existing information on current local, state, and federal revenue sources will be drawn together for the purpose of generating alternative funding mechanisms for implementation of the CCMP. This work will fall under the purview of a Financial Advisory Committee, to be appointed and convened in FY 1992.

Scientific/Technical Projects

Information Center. The Information Center was initiated in FY 1990 at the Jack K. Williams Library on the Texas A&M at Galveston Campus. Work in FY 1990 was primarily to compile a Galveston Bay Bibliography. FY 1991 work emphasized acquisition of a special collection of published and unpublished agency reports, journal articles, maps, films, videos, slide programs and aerial photos. Establishment of the Information Center and opening the doors to the Galveston Bay user community will take place in FY 1992. Although the Center is funded as a Scientific/Technical Project, and will be a source of information for resource managers, it is created for the entire Galveston Bay community, and is perceived by the public as the single most beneficial GBNEP project.

Wetland Habitat Survey. This is the third and final year for this project which involves mapping of shoreline and submerged aquatic vegetation (seagrass) habitats based on aerial photo interpretation and field verification. The work includes digitizing of maps for a computer geographic information system. Comparisons are made with previous maps from 1956 and 1979 to determine trends; further investigations determine causes for major trends/losses of critical habitat types. FY 1992 work focused on digitizing the newest photos, combined with field investigations to characterize habitat to a level of detail corresponding to plant species associations. FY 1991 work will involve wrap-up of this project including synthesis of results, cause determination and developing the final report.

Living Resources Probable Causes. This is the second and final year for this project. The objective is to determine status and trends in populations of ecologically or economically significant organisms in Galveston Bay. Species were chosen for which historical data sets exist, or which were critical in the food web. Multivariate and time series analyses were applied to data sets, with correlations sought between identified trends and possible controlling variables. Critical missing information has been identified for this final year's work. During FY 1992, probable causes will be determined for trends and status as a result of FY 1991's work.

Oyster Survey. This is a continuation of an FY 1991 project. The development of complete, accurate maps depicting the location and aerial extent of oyster reefs in Galveston Bay is of considerable importance to the development of a CCMP. The FY 1991 project provides for mapping East and West Bays first, followed by the remainder of the Bay. The current time-frame allows for the entire bay to be surveyed (including health assessments) but maps and GIS output would not be developed because of the lack of time and money. The maps and GIS output will be completed with the additional funding of this project in FY 1992.

Ecosystem Conceptual Model. This project will result in a diagrammatic representation of components of the Galveston Bay Ecosystem and the relationships among these components, as well as narrative descriptions of ecosystem structure and functions. The objectives of the conceptual model development are to 1) demonstrate the diverse habitat types, their susceptibility to climatically-based physical forcing and the complex history of anthropogenic perturbations to the estuary; 2) provide an "ecological manual" for the estuary that will simplify the real ecosystem while preserving essential features, and improve communication between decision-makers, advisors, and the public; 3) summarize the different management objectives of various agencies, and guide management and regulatory decisions to assure they are not at cross-purposes; 4) assist in the development of appropriate segmentation schemes; monitoring programs; assessment of cumulative impacts; and predicting, quantitative computer-based models which likely will be needed to meet program goals; 5) aid in matching the scale of a

problem to the scale of processes that result in altered ecological structure and rate of outputs, and determining the appropriate level of biological and ecological aggregation in addressing a specific environmental problem; and 6) codify knowledge and theoretical constructs regarding the estuary to achieve scientific consensus, improve communication, and transfer this knowledge to other users of the bay. The conceptual models are to be habitat-based and focus on the priority problems identified for the bay. Six habitats are to be incorporated into the model. The model is expected to help contribute to an integrated approach to characterization studies, but is not intended to be quantified as a simulation model.

Public Health Synopsis. The results of this work should identify the extent that shellfish harvesting areas have been affected by bacterial pollutants on a historical basis. All streams which impact Galveston Bay will be evaluated on a historical basis as to the extent of their being classified acceptable for contact or non-contact recreation, based on indicator bacteria criteria. The extent of areas in the Galveston Bay system which are deemed to be closed for public health reasons will be identified. Disease incidence from swimming and other forms of contact recreation in polluted water or ingestion of contaminated seafood will be addressed, with special reference to *Vibrio species* contamination. Both point and non-point sources of bacteria contamination will be included.

Survey of Toxicants in Sediments/Benthos. This project will characterize bay sediments utilizing a Sediment Triad Approach, i.e., coordinating chemical analyses, benthic community analyses, and sediment bioassays. The study design will build upon existing information collected by the Bureau of Economic Geology during the late 1970's, utilizing a number of the same sampling locations.

Human Induced Incidental Fish Mortality. There has been continuing concern over the magnitude of incidental fish losses associated with human uses of the Bay. This project would address five sources of incidental fish loss: 1) bycatch from commercial fishing; 2) impingement/entrainment on industrial intake structures; 3) recreational fishing mortality of non-target species; 4) dredge and fill project impacts; and 5) oil/gas exploration impacts. The project would gather both existing and new data to estimate the magnitude of these impacts and their possible implications for fish populations in the estuary.

***Dredge/Fill Impacts Study.** This is a relatively small information-gathering and synthesis project to strengthen the characterization effort by accumulating existing historical information regarding the impacts of dredge and fill operations within the estuary.

Public Participation

Bayline Newsletter. The GBNEP newsletter will be produced three times this year. Bayline is produced by the staff with articles contributed by a variety of organizations and individuals in the Bay area. Bayline includes: Management Conference updates, NEP news, requests for public involvement and information on specific issues that affect the estuary. The main topics vary depending on current information and issues. Bayline addresses all elements of the Priority Problems List.

Publication Series. All of the GBNEP products that are in report form will be duplicated and made available to the public upon request. The FY 1992 list will vary depending upon

deliverable arrival times and the number of copies needed. Publications include along with the technical and scientific reports, planning documents, membership directories, brochures, white papers and the conceptual model.

Speaker's Bureau. The Program Office will continue to coordinate outside speaking engagements by volunteer Management Conference members and staff. Invitations will be solicited from service and other organizations for programs involving slide presentations, video productions, and speeches. Funds for this project go toward slide duplication, equipment maintenance, and other incidental costs.

Portable Display. A display backboard and supplementary materials were acquired in FY 1990 for large audience education at various trade shows, festivals and other exhibits. FY 1992 funding is for shipping, photo print updates and space rental.

Public Meetings. Galveston Bay Public Forum meetings continue to support interaction between Program participants and the public. Comments received at these meetings will help direct all aspects of the Program. The Program is presently committed to holding public meetings quarterly. The topics vary and will include all elements of the Priority Problems List. Funding for this project provides advertisement, meeting space and other meeting expenses.

Citizen's Monitoring. This is a continuation of an FY 1991 project. Citizens from the Bay area will have the opportunity to directly support Galveston Bay management through this plan. A Citizen's Monitoring Committee has been appointed to coordinate with the Texas Water Commission to begin volunteer citizen monitoring of water quality and other estuary conditions. The data gathered will supplement the existing data collected by agencies, expanding the amount of information available to managers. Armand Bayou was selected as a pilot project for this effort. The FY 1992 project will involve volunteer citizens in the monitoring of the Galveston Bay estuary and watershed. The funds are to provide planning, training and limited equipment for environmental monitoring. Citizen monitoring is seen as a significant component of community involvement in the welfare of the estuary.

Bay Day. Bay Day is a continuation project. The purpose of Bay Day is to call attention to and celebrate Galveston Bay by providing bay-oriented family activities for all ages, thereby increasing public awareness of the Bay's value and diversity of uses. The first Bay Day will have been held May 25-26, 1991. Plans are to make Bay Day an annual event.

Education. This project includes: 1. Bay Area Calendar Contest; 2. Book covers for students to increase Bay awareness; 3. Sponsoring a school district to develop a pilot project for environmental education. GBNEP would provide equipment, materials and supplies; 4. Teacher Training Program in environmental education - work is being done to develop the program by a University of Houston professor and the Galveston Bay Foundation is supporting the effort; 5. Support for local science fairs; 6. Water Education Teams - support for Bay area schools; 7. Educational posters.

***Staffing Increase.** The Public Participation Program requires an intensive amount of direct involvement by staff members or outside consultants to adequately perform. Because all the projects planned for 1992 are considered important to building the foundation for public support of the CCMP, a part time Public Participation Staff member will be added.

***Promotions.** In order to increase awareness of the Bay and the activities of GBNEP, it is important to give the public something to take home to remember our brief contact. These specialty advertising items would serve as useful items to increase awareness of the Bay and the Program activities.

Administration

Administration of the GBNEP has been well refined since the beginning of the program and requires no substantial changes.

Action Plan Demonstration Projects

Shoreline Erosion and Estuary Enhancement. Awarded as the FY 1991 Action Plan Demonstration Project, the Shoreline Erosion and Estuary Enhancement will continue through FY 1992 and into FY 1993. Contractors will continue to plant *Spartina alterniflora* along eroding shorelines in Galveston Bay using techniques which have been previously developed and proven, in order to stabilize shorelines and restore fringing wetland habitat. This demonstration results in additions to critical habitat types in Galveston Bay and serves as an example alternative to concrete bulkheads and other expensive and ecologically intrusive shoreline structures designed to control erosion. This project requires no FY 1992 funding.

Ship Channel Toxicity Reduction. Appendix I of this report describes a cooperative effort by the Texas Water Commission and key industries on the Houston Ship Channel to reduce toxicant loadings to this stressed portion of the estuary. This project is being undertaken as an FY 1992 Action Plan Demonstration Project awarded to the GBNEP.

Table 6.
Galveston Bay National Estuary Program
Management Assessments Draft Project Budget
Amount = 210,000

Project	Cost	Cumulative Cost
Bay-wide Management Evaluation	175	175,000
Support of Characterization Reporting	75	185,000
Funding Source Inventory	25	210,000

Table 7.
Galveston Bay National Estuary Program
Scientific/Technical Assessments Draft Project Budget
Amount = 450,000

Project	Cost	Cumulative Cost
Galveston Bay Information Center	60,000	60,000
Status/Trends for Wetland/Aquatic Habitats	50,000	110,000
Status/Trends for Living Resources	40,000	150,000
Oyster Survey	30,000	180,000
Ecosystem Conceptual Model	15,000	195,000
Shellfish Closure/Path. Contamination	40,000	235,000
Bay Bottom Characterization	100,000	335,000
Human-Induced Incidental Fish Mortality	90,000	425,000
Dredge & Fill Impact Study	25,000	450,000

Table 8.
Galveston Bay National Estuary Program
Public Participation Draft Project Budget¹
Amount (Includes Publishing) = 125,975

Project	Cost	Cumulative Cost
Bayline Newsletter	10,000	10,000
Publication Series (73K not for CASC proj.) ²	19,975	29,975
Speaker's Bureau	2,000	31,975
Portable Information Display	2,000	33,975
Pubic Meetings	5,000	35,975
Citizen's Monitoring	25,000	60,975
Bay Day	25,000	85,975
Education	30,000	115,975
*Promotions	10,000	125,975

¹An additional one-half time student intern position is being created, not reflected in this tabble.

²Additional funds will be sought from state funds for a total of \$88,135.

Table 9.
Project Status Table, Fiscal Year 1992

Project	Management Conference Purposes	Products	Date
Coastal Preserves:			
Nomination Packages	1-6	Slides, Maps	2/90
Establishment	1-6	Tide Gauges	8/90
Environmental Inven.	1-2	Reports	8/90
Regulatory Surveys	4-5	Reports	8/90
Regulatory Evaluations	4-5	Reports	12/90
Management Plans	4	Plans	8/91
Management Implement.	5		
Informational Video	4	Video	8/90
Public Participation	4		
Management Assessments			
History of Res. Util.	4	Report	8/91
Regulatory Survey/Eval.	4-5	Report	8/91
Bay-wide Management Sur.	4-5	Report	8/92
Support for Characterization	1-3		8/92
Funding Source Inventory	4-6	Report	8/92
Scientific/Technical			
Data Base Inventory	2,4	Report, Database	8/90
Shoreline Survey	3	Report	8/90
Toxicants/Seafood Organisms	1-3	Report	8/90
Oyster Survey	1-3	Report, GIS	8/90
Information Center	4	Bibliog., Database	8/90
Wetland Habitat Survey	1-2	Report, GIS	8/92
Bay Segmentation	4-5	Report, Map	8/91
Point Source Loading	1-3	Report	8/91
Non-Point Source Loading	1-3	Report	8/91
Ambient Water/Sediment	1-3	Report	8/91
Living Resources	1-2	Report	8/91
Socioeconomics	1,4	Report	8/91
Ecosystem Conceptual Model	1,4	Report	8/92
Public Health Synopsis	1,3	Report, Maps	8/92
Bay Bottom Characterization	1-3	Report	8/92
Human Induced Fish Mortality	1	Report	8/92
Dredge/Fill Study	1-2	Report	8/92
Public Participation¹			
Public Perception Survey	4	Survey	8/90
Consensus Building	4	Report	8/90
Bayline Newsletter	4	Continuing 3 times/year	

Table 9. (cont.)
Project Status Table, Fiscal Year 1992

Project	Management Conference Purposes	Products	Date
Publication Series	4	Ongoing	
Education	4	Calendar	8/92
Video Presentations	4	Videos	8/90
Video PSA	4	Videos	8/90
Portable Display	4	Display	6/92
Speaker's Bureau	4	Ongoing	
Citizen Monitoring	4	Ongoing	
Public Meetings	4		8/92
Bay Day	4		8/92
Pollution Hotline Development	4		8/92
*Promotions	all		8/92

¹OMEP Guidance Item 4 also provides for Public Participation

Table 9. (Cont.)
Project Status Table, Fiscal Year 1992

Project	Cost (K)*			Responsible Organization
	1990	1991	1992	
Coastal Preserves:				
Nomination Packages	15			Bureau of Econ. Geology
Establishment	23.7	27.5		General Land Office
Environmental Inventories	28			Gal. Bay Foundation
Regulatory Surveys	22			Houston-Gal. Council
Regulatory Evaluations	22			Houston-Gal. Council
Management Plans	5	30		Texas Parks and Wildlife
Management Implementation	35.7			Texas Parks and Wildlife
Informational Video	10			Seagrant
Public Participation	1	1.4		Program Office
Management Assessments				
History of Res.Util.		15		U. of Houston-Clear Lake
Bay-wide Regulatory Survey			60	U. of Texas-Austin
Bay-wide Management Eval.			175	U. of Texas-Austin
Funding Source Inventory			25	U. of Texas-Austin
Scientific/Technical				
Data Base Inventory		57.5		Univ. of Texas-Austin
Shoreline Survey		30		Texas A&M, GERG
Toxics/Seafood Organisms		140		Texas A&M, GERG
Oyster Survey	80		30	Texas A&M
Information Center	135	100	60	Texas A&M at Galveston
Wetland Habitat Survey	40	151	50	Bureau of Econ. Geology
Bay Segmentation		25		Jones and Neuse, Inc.
Point Source Loading		60		U. of Texas-Austin
Non-Point Source Loading		125		Groundwater Services, Inc.
Ambient Water/Sediment		100		U. of Texas-Austin
Living Resources		125	40	Texas Parks and Wildlife
Socioeconomics		50		U. of Houston-Clear Lake
Ecosystem Conceptual Model			15	McFarlane & Associates
Public Health Synopsis			40	Espey, Huston & Associates
Bay Bottom Characterization			100	USFWS
Human Induced Fish Mortality			90	Jones & Neuse, Inc.
Dredge & Fill /Study			25	U. of Texas-Austin
Public Participation				
Bayline Newsletter	8	10	10	Program Office
Publication Series		54.8	88.1	Program Office
Education	3	25	30	Program Office
Video Presentations	25.7	12		U.of Hou; 91 Not Awarded
Video PSA	7.5	7.5		Texas Water Commission

Table 9. (Cont.)
Project Status Table, Fiscal Year 1992

Project	Cost (K)*			Responsible Organization
	1990	1991	1992	
Portable Display	1.5	2	2	Texas Water Commission
Speaker's Bureau	3	2	2	Program Office
Citizen Monitoring	25	25	25	Texas Water Commission
Public Meetings	8.5	15	5	Program Office
Bay Day	4.5	25	25	Galveston Bay Foundation
Pollution Reporting Hotline		37		
*Promotions			10	
Action Plan Demonstration Project				
Shore. Erosion & Est. Enh.	130			Soil Conservation Service
Ship Channel Toxicity Reduction			133	Texas Water Commission

* All project funds derive from EPA monies matched by Texas general revenue.

APPENDIX I

TEXAS WATER COMMISSION

ACTION PLAN DEMONSTRATION PROJECT PROPOSAL FOR GALVESTON BAY/HOUSTON SHIP CHANNEL SYSTEM

POLLUTION PREVENTION TO PROTECT PUBLIC HEALTH: REDUCTION OF CHEMICAL CONTAMINANTS TO THE GALVESTON BAY ESTUARY THROUGH INDUSTRIAL FACILITY AUDITS AND PLANNING

April 25, 1991

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SUMMARY

The Texas Water Commission (TWC) submits this document as a proposed National Estuary Program Action Plan Demonstration Project for FY91 funding. The proposed action plan is based on applying our demonstrated pollution prevention capabilities to the pollution problems facing the Galveston Bay. Specifically, in cooperation with select Galveston Bay businesses, TWC proposes to perform Industrial Waste Audit training, to work closely with businesses to reduce pollution, develop planning for waste recovery methodologies and encourage participation in waste exchange programs for hazardous waste generators and toxic material users who discharge directly and indirectly into Galveston Bay. TWC will select businesses based on the assessment of the risks facing Galveston Bay and the industrial processes creating the risks.

The Texas Water Commission is uniquely qualified to undertake the proposed project. Two groups within the Commission will be used in order to focus the efforts on this project; the Hazardous and Solid Waste Division's Waste Minimization Unit and the Water Quality Division.

The Commission's Waste Minimization Unit was created to develop and promote pollution prevention throughout Texas. This Unit has developed and implemented the state's highly successful Resource Exchange Network for Eliminating Waste (RENEW), and a state Recycling Directory. In addition, members of the Unit perform Waste Audits and conduct hazardous waste minimization training.

Coupled with the Waste Minimization Unit will be the Commission's Water Quality Division which is responsible for the state's efforts to prevent, control and abate water pollution in Texas. Designated by the Governor as the State water quality planning agency, the Texas Water Commission coordinates all water quality planning in the State to meet requirements set out in the Texas Water Code and the Federal Clean Water Act. This is achieved in cooperation with the appropriate local planning agencies, the U.S. Environmental Protection Agency (EPA), other state agencies and river authorities.

Together the Waste Minimization Unit and the Water Quality Division will provide for the timely and cost effective execution of the proposed project.

This proposal is presented in the format suggested by the EPA in its "Action Plan Demonstration Project Proposal Checklist", and specifically addresses the ten items required by the EPA. In summary the proposal is based on accomplishing five objectives. These objectives are listed below. Major emphasis (time and dollars) will be placed on objective (4) "Conduct Training" and objective (5) "Follow-up".

1. Define pollutants: - Based on analyses of risks, define the pollutants of concern in the Houston Ship Channel.
2. Define businesses: - Based on a review of TWC Hazardous Waste Generation data, define the businesses located near the channel most likely generating the pollutants found in the channel.

3. Select businesses: - Select and contact 5 to 10 businesses and make arrangements for them to voluntarily participate in a program focusing on the use of waste audits, waste recovery methodologies, and waste exchange programs.
4. Conduct training: - Conduct waste minimization training for the selected businesses, either as a group or at individual sites.
5. Follow-up: Follow-up with businesses in order to evaluate the success of the program and to provide technical assistance.

The objectives will be accomplished with 1.25 man years of professional time; 0.1 man years of supervisory time; and 0.1 man years of secretarial time. It is proposed that the estimated cost of \$133,000 be split, with \$33,333 (25%) being paid by the State of Texas and \$100,000 (75%) being paid by federal sources.

1. DISCUSSION OF THE PROBLEM, IDENTIFYING THE PROBABLE CAUSES AND SOURCES.

The Houston Ship Channel is part of the San Jacinto River Basin and is located in southeast Texas adjacent to the City of Houston and Galveston Bay. The 1,155 square mile (2,992 square kilometer) watershed encompasses most of Harris County and parts of Fort Bend and Waller counties. The Houston Ship Channel is a dredged channel created along portions of Buffalo Bayou and the San Jacinto River.

The City of Houston encompasses most of the Houston Ship Channel watershed. However, many other smaller towns and suburbs including Pasadena, Deer Park, Baytown, Galena, Jacinto City, South Houston, West University Place, Bellaire and Katy, lie within the watershed.

With nearly 50 percent of the total United States' chemical production, the Houston area is the major center of chemical production in the United States. In addition, 30 percent of the U.S. petroleum industry is located in the area adjacent to Galveston Bay. When this heavy industry is coupled with the more than seven million people that use Galveston Bay as a final destination for their wastewater, it is not surprising to learn that nearly 50 percent of wastewater discharges in the State are in the Galveston Bay watershed. The Houston Ship Channel alone contains nearly 550 permitted discharges or 13.4 percent of the State total.

The large number of discharges in this area creates a tremendous potential for toxic substance contamination of the Houston Ship Channel and Galveston Bay. A recent study by EPA-Region 6, in conjunction with the TWC, investigated the water quality and ambient toxicity of the Houston Ship Channel/San Jacinto River. Chemical-specific criteria exceedances were found for arsenic, copper, cyanide, lead and nickel. The study indicates that detectable amounts of toxicants at different monitoring stations are due to point source influence. An additional series of samples was collected from the Houston Ship Channel and Galveston Bay as part of the study. Chemical-specific criteria exceedances were found for nickel and copper in portions of Galveston Bay. The data indicated that a possible source of copper and nickel is the Texas City Ship Channel.

The Texas Department of Health analyzed additional data and issued a fish consumption advisory for the Houston Ship Channel and Upper Galveston Bay. These analyses were conducted in response to studies showing an exceedance of EPA's fish tissue level of concern for dioxin. Bleached kraft pulp and paper mill dischargers in the area are possible point sources of dioxin.

Past and ongoing efforts to improve the water quality of the Houston Ship Channel made by the Texas Water Commission have included;

1. More stringent wastewater permit requirements;
2. Expanded self-reporting requirements;
3. Intensive surveys;
4. Sediment studies;
5. Reaeration studies;
6. Water Quality evaluations;
7. Change in Segment Boundaries and Standards Criteria;
8. Addition of new segments;
9. Nonpoint source studies;

10. Instream aeration studies;
11. Stream monitoring;
12. Use attainability analysis.

As can be seen from this list, our past efforts have focused on collecting much needed water quality data and on regulatory and permitting activities. Much of the pollution entering the Houston Ship Channel is thought to come from industrial businesses near the channel; therefore, the effort proposed in this plan focuses on decreasing the amount of pollution entering the Houston Ship Channel by educating, and working closely with the industrial dischargers in the use of industrial waste audits, waste recovery methodologies, and waste exchange programs.

2. STATEMENT OF SPECIFIC OBJECTIVES RELATED TO THE PROBLEM, SOURCE, OR CAUSE.

The Texas Water Commission's approach to the problem will be based on accomplishing five objectives. These specific objectives are:

1. Define pollutants: - Based on analyses of risks, define the pollutants of concern in the Houston Ship Channel.
2. Define Businesses: - Based on a review of Texas Water Commission Hazardous Waste Generation data, define the businesses located near the channel most likely generating the pollutants found in the channel.
3. Select businesses: - Select and contact 5 to 10 businesses and make arrangements for them to voluntarily participate in a program focusing on the use of waste audits, waste recovery methodologies, and waste exchange programs.
4. Conduct training: - Conduct waste minimization training for the selected businesses, either as a group or at individual sites.
5. Follow-up: - Follow-up with businesses in order to evaluate the success of the program and to provide technical assistance.

3. DISCUSSION OF THE VARIOUS MANAGEMENT OPTIONS CONSIDERED.

As discussed in "1. DISCUSSION OF THE PROBLEM, IDENTIFYING THE PROBLEM CAUSES AND SOURCES", the Texas Water Commission has employed various management options to the problem of pollution in the Houston Ship Channel. TWC has worked with Federal and local agencies in addressing this problem in both enforcement and remedial contexts. The current proposal focuses on a capability that did not exist within the Texas Water Commission until last year. That capability is Hazardous Waste Minimization training. Waste minimization makes sense and its use in pollution prevention can be significant; therefore, TWC would like the opportunity to employ its use to the problems facing the Houston Ship Channel.

An outline of a one day hazardous waste minimization course is included in Appendix A.

4. DISCUSSION OF THE CHOSEN OPTION WITH REFERENCE TO THE LIKELIHOOD OF SUCCESS, PUBLIC SUPPORT, AND TIME AND RESOURCES.

Industrial waste audits, waste recovery programs and exchanges and waste minimization programs have proven to be effective options in decreasing the amounts of pollutants entering the environment. In light of this fact both the Federal government and the State of Texas have made waste minimization their number one waste management methodology for dealing with pollutants.

In the State of Texas, two bills are currently in front of the state legislature that deal with pollution prevention. Both bills require businesses located within the state to develop waste minimization plans and annual waste minimization reports. In light of these bills, it is apparent that the proposed project is timely, and that the likelihood of public (and industry) support would be high. This factor when coupled with the Texas Water Commission's past involvement with the Houston Ship Channel and TWC's past Waste Minimization efforts in the State of Texas makes the probability of the proposed project's success high.

Examples of TWC's past Waste Minimization efforts include:

- 1) Development of the Resource Exchange Network for Eliminating Waste (RENEW). RENEW is an information clearinghouse established, at the direction of the 70th Texas Legislature, to promote the reuse and reclamation of waste materials. The exchange provides an opportunity to sell surplus materials, by-products and waste. During Fiscal Year 1990 RENEW received 78 new listings. Of these, 60 were for materials available while 10 were for materials wanted. During the same period, RENEW received 901 inquiries for the materials listed, up 100% from 1989, RENEW confirmed 14 successful exchanges in FY 1990, with many inquiries still under negotiation.
- 2) Publication of the "State of Texas Industrial Materials Recycling Directory", which lists companies who recycle industrial solid waste, including hazardous and non-hazardous waste in Texas. An updated version is due out in 1991.
- 3) Development of waste minimization training. Presentations have been made at various events throughout the state including the "Wastewater Pretreatment Seminar" (San Antonio, November 14, 1990); the Texas Chemical Council's "Hazardous Waste Workshop" (Austin, December 1990); and the Texas Water Commission's "Hazardous Waste Trade Fair and Conference" (Dallas, March 1991).
- 4) A "Waste Minimization Self-Assessment Manual" which is scheduled to be published in 1991.

5. A COMPLETE OUTLINE OF THE SPECIFIC PLAN NEEDED TO ABATE AND CONTROL THE PROBLEM OR PROTECT THE RESOURCE. EACH OUTLINE SHOULD ADDRESS: WHO, WHAT, WHERE, WHEN, HOW.

WHO:

Texas Water Commission
Water Quality Division
Hazardous and Solid Waste Division
Waste Minimization Unit
Contact: Dr. Priscilla Seymour
(512) 463-7761

The Texas Water Commission will be in charge of the entire project and conduct the work with in-house staff. The Project leader will be Dr. Priscilla Seymour, Unit Head off the Waste Minimization Unit. She will be supported in her efforts by her staff and by personnel of the Water Quality Division.

WHAT:

Section 2 "Statement of Specific Objectives Related to the Problem, Source, or Cause", the objectives of this proposed program. By attaining these objectives we will also attain the environmental objective of reducing the pollution loading in the Galveston Bay and Houston Ship Channel. Our primary method for reducing the loadings will be education---hazardous waste minimization training, coupled with follow-up technical assistance. Results of these efforts will be monitored with ongoing TWC systems as described in section "Description and Schedule of Activities to Monitor Success of the Implementation".

WHERE:

This project will affect the Houston Ship Channel system which is part of the San Jacinto River Basin and is located in Southeast Texas adjacent to the City of Houston and Galveston Bay.

WHEN:

September 1991 - Begin Study

December 1991 - Complete risk study delineating pollutants of concern in the Houston Ship Channel.

January 1992 - Complete delineation of businesses causing high risk pollutants in the Houston Ship Channel.

February 1992 - Begin contact businesses for program of industrial waste audits; waste recovery and exchange programs; and waste minimization training.

May 1992 - Begin training programs.

June 1993 - Begin follow-up and technical assistance as well as evaluation of program's success

January 1993 - Complete training programs.

HOW:

Delineation of Pollutants and risk analysis will be based on in house reports on the Galveston Bay and Houston Ship Channel, as well as any outside input that might be made available by Federal or local agencies.

Delineation of Businesses possibly causing the pollution will be based on matching the high risk pollutants to the Texas Water Commissions data on industrial businesses near the Houston Ship Channel. This includes the information on RCRA hazardous waste generators and SARA toxic materials emitters.

Contacts with the Businesses including training in industrial waste audits will be handled by the TWC's Waste Minimization Unit. These contacts will focus on incentives for businesses participating in the program. By having a waste minimization program a generator can:

- * Save money by reducing waste treatment and disposal costs, raw material purchases, and other operating costs.
- * Meet state and national waste minimization policy goals.
- * Reduce potential environmental liabilities.
- * Protect public health and worker health and safety.
- * Protect the environment.

Methods for obtaining these benefits will be presented during the waste minimization training. Appendix A contains an outline of the proposed course.

Six months after the training course, a follow-up meeting will take place with each business participating in the program. The purpose of this meeting will be to offer further on-site technical assistance and to ascertain the business views on the success of the project. Quantitative measures of the success of the project will be measured employing the methods described in section 6 "Description and Schedule of Activities to Monitor Success of the Implementation".

6. DESCRIPTION AND SCHEDULE OF ACTIVITIES TO MONITOR SUCCESS OF THE IMPLEMENTATION.

Success will be measured with three existing systems:

- a) In the State of Texas large quantity generators are required to file, annually, Hazardous Waste Minimization Reports. Historical reports filed by the businesses selected will be

reviewed and compared to reports filed by the companies after their training in waste minimization techniques.

b) Similar data on toxic materials is collected under SARA Section 313. This data will also be compared on a before and after basis.

c) Water quality discharge monitoring reports which include the quality and quantity of effluent discharged under the state NPDES system.

7. TIMETABLE AND DESCRIPTION OF REPORTS CONCERNING PROGRESS, COSTS, AND RESULTS.

Semi-annual reports will be prepared by the Texas Water Commission and submitted to the Technical Project Officer designated by the U.S. EPA.

8. DISCUSSION OF METHODS AND SCHEDULES FOR REVIEW, REEVALUATION, AND REDIRECTION OF THE PROJECT.

A workplan will be drafted based on this proposal which will be reviewed and approved by the Management Conference, EPA Region 6 and the GBNEP staff. Quarterly reports will provide opportunities for redirection. Any problems or changes in the scope of work will require discussion and resolution with GBNEP staff and EPA Region 6 staff at a minimum; and with appropriate GBNEP committees.

9. DISCUSSION OF POSSIBLE BASINWIDE AND/OR NATIONAL APPLICATION OF THE ACTION PLAN.

If successful, the techniques of delineating high risk pollutants, matching the pollutants to possible generators and working with the generators to conduct industrial waste audits and waste minimization training should be applicable throughout the basin and/or nationally.

Because the Texas Water Commission has district offices throughout the State it would be possible to work with each office and to apply the program's techniques to basins and businesses in their areas of the State. The data needed to develop the lists of high rise pollutants and businesses reside with the TWC in its Austin headquarters. In working with the local district staff, the waste minimization staff could develop the lists, contact the businesses and conduct waste minimization training on a basin-wide or statewide bases. The only constraints would be time and funding.

It is believed that similar data exists on a national basis; therefore, the techniques could be employed by other states.

10. COMMITMENT TO DEVELOP COST ESTIMATES FOR BASINWIDE APPLICATION OF THE ACTION PLAN; THIS INFORMATION IS NECESSARY TO DEVISE FINANCIAL STRATEGIES FOR IMPLEMENTATION OF CCMP ACTION PLANS.

If awarded the contract, the Texas Water Commission would commit to developing cost estimates for basinwide application of the action plan. These estimates can be used by GBNEP in development of a CCMP action plan.

11. COST ESTIMATE

A.) MANPOWER

<u>CATEGORY</u>	<u>ANNUAL SALARY</u> <u>(INC. RELEASE)</u>	<u>UNIT</u>	<u>TOTAL</u> <u>COST</u>
Program Admin.II	@ \$37,950/year x	0.75 Year	\$ 28,463
Biologist	@ \$37,950/year x	0.50 Year	\$ 18,975
Supervisor	@ \$42,500/year x	0.10 Year	\$ 4,250
Secretary	@ \$17,250/year x	0.10 Year	\$ 1,725

Subtotal Salaries			\$ 53,413

B. BUDGET

BUDGET CATEGORY	STATE SOURCE	FEDERAL SOURCE	TOTAL COST
I. Personnel			
A. Salaries	\$13,354	\$40,059	\$ 53,413
B. Fringe Bene. (@ 23.56%)	3,146	9,438	12,584
Subtotal	16,500	49,497	65,997
II. Nonpersonnel			
A. Travel	1,395	4,187	5,582
B. Equipment	750	2,250	3,000
C. Supplies	750	2,250	3,000
D. Contractual	0	0	0
E. Other	0	0	0
Total Direct Charges	19,395	58,184	77,579
III. Indirect Cost (@ 84.48%)	13,938	41,816	55,754
TOTAL	33,333	100,000	133,333

C. WORKLOAD SCHEDULE

Work Objectives: (See "2. Statement of Specific Objectives Related to the Problem, Source, or Cause).

1. Define Pollutants - Based on analyses of risks, define the pollutants in the Houston Ship Channel.

2. Define Businesses - Based on a review of Texas Water Commission Hazardous Waste Generation data, define the businesses located near the channel most likely generating the pollutants found in the channel.

3. Select businesses - Select and contact 5 to 10 businesses and make arrangements for them to voluntarily participate in a program focusing on the use of waste audits, waste recovery methodologies, and waste exchange programs.

4. Conduct Training - Conduct waste minimization training for the selected businesses, either as a group or at individual sites. This objective will include preparation of teaching materials (handouts, overheads, etc) on which most of the supply and equipment budget will be spent. Also travel costs will be spent under this objective (ie. training trips to Houston).

WORK OBJECTIVE	POSITION	TIME CHARGED (YEAR)	ANNUAL SALARY	TOTAL COST
DEFINE POLLUTANTS	BIOLOGIST	0.20	\$37,950	\$ 7,590
	PROGRAM ADMIN	0.10	\$37,950	\$ 3,795
DEFINE BUSINESSES	BIOLOGIST	0.05	\$37,950	\$ 1,898
	PROGRAM ADMIN	0.05	\$37,950	\$ 1,898
SELECT BUSINESSES	BIOLOGIST	0.05	\$37,950	\$ 1,898
	PROGRAM ADMIN	0.05	\$37,950	\$ 1,898
CONDUCT TRAINING	BIOLOGIST	0.10	\$37,950	\$ 3,795
	PROGRAM ADMIN	0.45	\$37,950	\$17,076
FOLLOW-UP	BIOLOGIST	0.10	\$37,950	\$ 3,795
	PROGRAM ADMIN	0.10	\$37,950	\$ 3,795
ADMIN.	PROJECT SUPER.	0.10	\$42,500	\$ 4,250
ADMIN.	PROJECT SECTY.	0.10	\$17,250	\$ 1,725
TOTAL SALARIES		1.25		\$53,413

HAZARDOUS WASTE MINIMIZATION ONE DAY COURSE OUTLINE

1.0. Introduction	<u>TIME</u>
1.0. General - Greetings/Register/Materials/ Pass-outs and Class Outline (10 Minutes)	8:30-8:40
1.1. Example of Hazardous Waste Minimization Project (10 minutes)	8:40-8:50
1.2. Definitions (10 minutes)	8:50-9:00
1.2.1. Waste Minimization	
1.2.1.1. Source Reduction	
1.2.1.2. Reuse/Recycling	
1.2.2. Treatment	
1.2.3. Examples of Waste Minimization Saving Money	
1.2.4. Role of Waste Minimization In a Waste Management Program	
1.3. Texas Hazardous Waste Management Hierarchy as It Relates to Waste Minimization (10 minutes)	9:00-9:10
1.3.1. Minimization of Waste Production	
1.3.2. Reuse and/or Recycling of Waste	
1.3.3. Treatment to Destroy Hazardous Characteristics	
1.3.4. Treatment to Reduce Hazardous Characteristics	
1.3.4. Underground Injection	
1.3.6. Land Disposal	
1.4. Why Hazardous Waste Minimization? (20 Minutes)	
1.4.1. Review Federal Law	
1.4.1.1. Where We're At	
1.4.1.2. Where We're Going	
1.4.2. Review State Law	
1.4.2.1. Where We're At	
1.4.2.2. Where We're Going	
1.4.3. Review Texas Hazardous Waste Statistics	
1.4.3.1. Amounts Generated by Industry	
1.4.3.2. Amount for Top 25; Top 200; LQG; SQG	
1.4.3.3. Top 21 Texas Generators Names/Locations/Percent of Total	
1.5. Video - Chevron - Smart Moves (30 Minutes)	9:30-10:00

	<u>TIME</u>
2.0. Introduction to Minimization Phases (10 Minutes)	10:00-10:10
2.1. General Course Outline	
2.2. Modular Approach	
2.2.1. Planning and Organization	
2.2.1.1. Management Commitment	
2.2.1.2. Goals	
2.2.1.3. Program Organization	
2.2.1.4. Project Team Make-Up	
2.2.2. Assessment	
2.2.2.1. Site Description	
2.2.2.2. Personnel	
2.2.2.3. Process Information	
2.2.2.4. Input Materials Summary	
2.2.2.5. Products Summary	
2.2.2.6. Individual Waste Stream Characteristics	
2.2.2.7. Waste Stream Summary	
2.2.2.8. Option Generation	
2.2.2.9. Option Description	
2.2.2.10. Option Evaluation by Weighted Sum Method	
2.2.3. Feasibility Analysis	
2.2.3.1. Technical Feasibility	
2.2.3.2. Cost Information	
2.2.3.3. Profitability - Payback Period	
2.2.3.4. Profitability - NPV or IRR	
2.2.4. Implementation	
2.2.4.1. Project Summary	
2.2.4.2. Option Performance	
2.2.4.3. Presentation	
2.2.5. References	
2.2.6. Examples	
2.2.7. Case Studies	
3.0. Break (15 minutes)	10:10-10:25
4.0. Planning and Organization (30 Minutes)	10:25-10:55
4.0.1. Where and How to Begin	
4.1. Examples of Companies:	
4.1.1. Management Commitments	
4.1.2. Goals	
4.1.2.1. How to Build Goals	
4.1.2.2. Content/Key Elements and Objectives of a Waste Minimization Strategy	
4.1.2.3. Public or Private	

4.2.	Who <u>Could</u> be on a Project Team	<u>TIME</u>
4.2.1.	LQG	
4.2.2.	SQG	
4.2.3.	Technical Leader <u>and</u> Corporate Leader	
4.2.4.	Enlist 3rd party experts	
4.2.5.	Involve R&D	
4.2.6.	Involve Engineering	
4.2.7.	Involve Manufacturing	
4.3.	How to Build Management Information Systems as a report card on progress towards goals	
4.4.	Train Employees	
5.0.	Goal Setting/Team Exercise	10:55-11:30
6.0.	LUNCH (60 minutes)	11:30-12:30
7.0.	Assessment I (70 minutes)	12:30-1:40
7.1.	Site Description	
7.2.	Personnel	
7.3.	Process Information	
7.4.	Input Materials Summary	
7.5.	Products Summary	
7.6.	Individual Waste Stream Characterization	
7.7.	Waste Stream Summary	
7.8.	Option Generation	
7.8.1.	References	
7.8.2.	TWC Tech. Library	
7.8.3.	PPIC Tech. Database	
7.8.4.	Lamar University	
7.8.5.	Univ. Texas - Environmental Solutions Program	
7.8.6.	List of Contractors	
7.8.7.	TWC Handbooks	
7.9.	Option Evaluation By Weighted Sum Method	
8.0.	Assessment II (60 Minutes)	1:40-2:40
8.1.	Technical Feasibility	
8.2.	Cost Information	
8.2.1.	Vendors	
8.2.2.	Manuals	
8.2.3.	Contractors	
8.2.4.	Costing Textbooks	

8.3. Profitability	<u>TIME</u>
8.3.1. Payback Period	
8.3.1.1. Introduce Concept and Formula	
8.3.1.2. Work Example	
8.3.1.3. References	
8.3.2. NPV or IRR	
8.3.2.1. Introduce concept and procedures	
8.3.2.2. Work Example	
8.3.2.3. References	
8.4. Implementation	
8.4.1. Project Summary	
8.4.2. Option Performance	
8.4.3. Presentation	
8.4.4. Not Too Long	
8.4.5. Repeat Introductory Case Study	
9.0. VIDEO - 3M's Pollution Prevention Pays (9 minutes) - Challenge to Innovation (3M Corp.) (8.5 minutes)	2:40-3:00
10.0. Recycling (30 minutes) 10.1. Same procedures as those used for source reduction 10.2. RENEW Directory 10.3. Recyclers Directory	3:00-3:30
11.0. Treatment (10 minutes)	3:30-3:40
12.0. Wrap-up (10 minutes)	3:40-3:50