Coastal Bend Bays & Estuaries Program Regional Monitoring Plan

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Dr. Carlton D. Hunt
Battelle
397 Washington St.
Duxbury, MA 02332

Submitted to:
Coastal Bend Bays & Estuaries Program
1305 N. Shoreline Blvd. Ste 205
Corpus Christi, Texas 78401

COASTAL BEND BAYS & ESTUARIES PROGRAM

Regional Monitoring Plan

Prepared for the

Coastal Bend Bays & Estuaries Program, Inc.
1305 N. Shoreline Blvd., Suite 205
Corpus Christi, TX 78401
(361) 885-6202

Prepared By:

Dr. Carlton D. Hunt
Lynn A. McLeod
Dr. Steve Mathies

of

Battelle
397 Washington St.
Duxbury, MA 02332
(781) 934-0571

and

Amanda Orrick Mintz
Shor & Orrick Planning Associates, LC
710 Buffalo Street, Suite 204
Corpus Christi, TX 78401
(361) 883-1763

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EXECUTIVE SUMMARY

Each National Estuary Program is required to develop a Comprehensive Conservation and Management Plan and Action Plans to improve the quality of the estuary. This is done under the guidance of a Management Conference. Section 320(b)(6) of the Water Quality Act of 1987 specifies that each Management Conference shall "... monitor the effectiveness of actions taken pursuant to the plan," with the following two primary goals:

- Measure the effectiveness of the management actions and programs implemented under the Comprehensive Conservation and Management Plan; and
- Provide essential information that can be used to redirect and refocus the Comprehensive Conservation and Management Plan during implementation.

This document describes the regional monitoring proposed by the Coastal Bend Bays & Estuaries Program (CBBEP) to meet these requirements and addresses the monitoring and assessment needs of specific actions in the CBBEP's Comprehensive Conservation and Management Plan, the *Coastal Bend Bays Plan* (*Bays Plan*).

This Regional Monitoring Plan (RMP) utilizes both environmental monitoring (to measure the effectiveness of actions towards improving the estuarine environment) and programmatic monitoring (to measure the progress towards implementation of specific *Bays Plan* Action Plans). The RMP directly links evaluation of the progress made on the *Bays Plan* Actions to the expected environmental responses resulting from those Actions and addresses three basic questions:

- Are the goals and objectives of the *Bays Plan* being met?
- Is the ecosystem responding to the management actions?
- Is progress being communicated in an effective and timely manner?

Environmental Monitoring

The environmental monitoring component of the RMP is designed to provide environmental data that can be compared to the objectives in each Action Plan and builds upon previous characterization studies to achieve monitoring goals. Because many of the *Bays Plan* Action Items address common issues in the CBBEP area, monitoring under one *Bays Plan* Action Item can contribute to understanding the response in the system to other *Bays Plan* Actions or to the overall response of the estuary as a result of implementing the *Bays Plan* Actions. However, the coordination and overall effectiveness of measuring the effects of individual actions in the system could be problematic and result in unnecessary expenditure of funds. Therefore, an overall health of the bays approach for measuring the effectiveness of the actions is taken in the RMP, by systematically measuring the net effectiveness of all actions implemented. However, the plan is flexible in that it provides for tailored monitoring plans at a site or project specific level for any action that requires very specific environmental evaluation to measure the success of the action.

These two complimentary approaches are presented in two separate sections of the RMP. The first section provides a monitoring program that addresses the "Health of the Bays" using a bay wide focus on status and trends. It also addresses the cumulative impacts of Action Plan implementation. The "Health of the Bays" environmental monitoring incorporates the major areas of environmental concern in the system, including habitat, sediment quality, water quality, freshwater resources, commercial and recreational fisheries, species of concern, and shoreline management. The second section addresses Action-Item specific environmental elements identified under the eleven major Action Plans of the *Bays Plan*. Monitoring or assessment or both under these Action Items will be site specific in nature and thus

subject to development of specific monitoring plans or assessments that address the environmental response to the implementation of the specific Action Item. Not all eleven areas of the *Bays Plan* require environmental monitoring or assessment, thus this section focuses on those Actions Items that have requirements for environmental evaluation and that are not addressed effectively by the "Health of the Bays" monitoring. Some of these Actions may require only short-term monitoring or a fairly simple environmental assessment rather than long-term monitoring.

Programmatic Monitoring

The proposed programmatic monitoring under each of the eleven Action Plans identified in the *Bays Plan* (Bay Tourism and Recreation; Bay Debris; Public Health; Shoreline Management; Maritime Commerce; Dredging; Habitat and Living Resources; Water and Sediment Quality; Nonpoint Source Management; Freshwater Resources; and Public Education and Outreach) will keep managers informed of the status of various actions and the degree to which programs are or are not achieving their intended outcome. Progress towards completion of the *Bays Plan* Actions will be measured through a database system designed to track completion of *Bays Plan* Action Item milestones and deliverables.

Funding and Coordination

Several ongoing environmental data collection and monitoring activities are in progress in the CBBEP area and provide the foundation for monitoring. These ongoing programs will be enhanced through recommended modifications to present monitoring activities. Implementation of the modifications is, however, contingent on the commitment of funding for these activities, as is the continuation of the present monitoring. Thus the RMP will be implemented to the level of funding available.

This monitoring plan seeks to promote cooperation among agencies and stakeholders by incorporating and coordinating efforts into an integrated monitoring plan as required to measure the response of the CBBEP system to the various *Bays Plan* Actions. Towards this end, the CBBEP will organize and facilitate an annual monitoring agencies' coordination meeting to incorporate existing and planned monitoring efforts or elements into the RMP, identify critical information gaps, and attempt to standardize and coordinate future monitoring efforts. This effort will minimize duplication of effort among agencies, reduce the cost of monitoring, and provide integrated results to the scientific, regulatory, and stakeholder communities in an efficient and timely manner.

Data Management, Synthesis and Reporting

Under the monitoring plan, standard scientifically acceptable sampling and analytical methods and quality assurance/quality control (QA/QC) protocols will be adopted to ensure that monitoring information collected by the various partners in this effort are of known, high quality and are directly comparable. Where new QA/QC plans are needed, the performing party, in coordination with the CBBEP, will act as the central organization for coordinating the development of Quality Assurance Project Plans (QAPPs). These QAPPs will clearly describe the goals, data needs, sampling locations and schedules, analytical and interpretive approach, analytical methods including data quality objectives, and how the data will be used within the monitoring program[1]. Comparability of data generated by these various programs must be demonstrated.

Data collected as part of the RMP will be stored in accordance with the CBBEP Data Management Strategy (DMS). Data from projects associated with the RMP will be available in hardcopy and electronic format from participating agencies and the CBBEP. All participating agencies will supply data

[1] Where possible, these plans should follow Texas Natural Resource Conservation Commission (TNRCC) and Environmental Protection Agency (EPA) guidelines.

from their monitoring programs in a timely and efficient manner to ensure that the CBBEP can report the data in a timely manner to the public.

Programmatic progress will be summarized at annual CBBEP meetings and in implementation reviews and annual "report cards" developed by the CBBEP. A "State of the Bays" report will be prepared every five years to convey the health of the system. With this information, managers can modify Action Plans or specific Action Items as needed to achieve the desired outcomes outlined in the *Bays Plan*. Where appropriate, resources may be redirected to ensure that desired outcomes are achieved.

The RMP will be reviewed every five years for relevancy and updated as appropriate.

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List of Acronyms and Abbreviations

Bays Plan	Coastal Bend Bays Plan
BMP	Best Management Practice
BODc	Biochemical Oxygen Demand
BRD	By-catch Reduction Design
BUG	Beneficial Use Group
CBBF	Coastal Bend Bays Land Trust
CBBEP	Coastal Bend Bays and Estuaries Program
CCBNEP	Corpus Christi Bay National Estuary Program
CCMP	Comprehensive Conservation and Management Plan
CDC	Centers for Disease Control
CPUE	Catch per unit effort
DMS	Data Management Strategy
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
FOB	Friends of the Bay
FTE	Full-time equivalents
GERG	Geochemical and Environmental Research Group
GIS	Geographic Information System
GPS	Global Positioning System
HAB	Harmful algal bloom
HAZMAT	Hazardous materials
NEP	National Estuary Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRA	Nueces River Authority
NWS	National Weather Service
O&G	Oil and grease
OSSF	On-site Sewage Facility
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyls
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RMP	Regional Monitoring Plan
RPD	Redox Potential Discontinuity
SAV	Submerged aquatic vegetation
STAC	Scientific and Technical Advisory Committee
STSSN	Sea Turtle Strandings and Salvage Network
SWQM	Surface Water Quality Management Program
TAC	Technical Advisory Committee
TAMU	Texas A&M University
TAMU-CC	Texas A&M University Corpus Christi
TCOON	Texas Coastal Ocean Observation Network
TDH	Texas Department of Health
TGLO	Texas General Land Office

List of Acronyms and Abbreviations (cont'd)

TMDL	Total maximum daily load
TMMSN	Texas Marine Mammal Strandings Network
TNC	Texas Nature Conservancy
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TPWD	Texas Parks and Wildlife Department
TSS	Total Suspended Solids
TSWQS	Texas State Water Quality Standards
TWDB	Texas Water Development Board
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTMSI	University of Texas Marine Science Institute
VTS	Vessel Traffic System

Preamble
Coastal Bend Bays & Estuaries Program
Regional Monitoring Plan

The Coastal Bend Bays & Estuaries Program (CBBEP) Regional Monitoring Plan (RMP) was developed as a comprehensive monitoring effort designed to provide environmental data of known quality and confidence. It will be responsive to the goals and objectives identified in the *Implementation Strategy* for the *Coastal Bend Bays Plan*, and will also have a larger goal of providing knowledge of bay-wide ecosystems, their variability, and social impacts both environmental and ecological. Understanding that no agency's mandate is broad enough for this entire undertaking, the RMP seeks to promote a cooperative effort by all agencies, organizations, and other stakeholders who participate in bay ecosystems monitoring activities. The RMP attempts to integrate and build upon the various monitoring efforts currently active within the CBBEP area to create a comprehensive and unified monitoring plan. It will integrate current monitoring efforts to the maximum extent possible, while working in accordance with the distinct objectives of the groups involved. The RMP will be developed with full participation of all interested stakeholders to encourage cooperation and communication and to maximize the potential for successful implementation.

Coastal Bend Bays & Estuaries Program
Regional Monitoring Plan[2]

1. INTRODUCTION

Each National Estuary Program (NEP) is required to develop a Comprehensive Conservation and Management Plan (CCMP) and Action Plans to improve the quality of the estuary. This is done under the guidance of a Management Conference. Section 320(b)(6) of the Water Quality Act of 1987 specifies that each Management Conference shall "... monitor the effectiveness of Actions taken pursuant to the plan," with the following two primary goals:

- Measure the effectiveness of the management actions and programs implemented under the Comprehensive Conservation and Management Plan; and
- Provide essential information that can be used to redirect and refocus the Comprehensive Conservation and Management Plan during implementation.

The Coastal Bend Bays & Estuaries Program (CBBEP)[3] began implementing its CCMP, titled the *Coastal Bend Bays Plan* (*Bays Plan*) in 1999. This document presents the Regional Monitoring Plan (RMP) proposed by the CBBEP to monitor and track implementation of the *Bays Plan* as required under the Water Quality Act of 1987.

In the technical sense, monitoring entails collecting a series of observations over time and involves the measurement of trends in the system or the status of an area. This repetition of measurements over time, for the purpose of detecting change, distinguishes monitoring from research and assessment. For example, a one-time measurement of contaminant levels in fish caught and used as food through recreational fishing for the purpose of health risk evaluation is an assessment. However, an annual survey to determine whether a change in contaminant levels in recreational fish occurs is monitoring.

The RMP as proposed herein is based on existing monitoring programs and modifications or additions to present monitoring activities. The RMP directly links evaluation of the progress made on the implementation of *Bays Plan* Actions to the expected environmental responses resulting from those Actions and addresses three basic questions:

- Are the goals and objectives of the *Bays Plan* being met?
- Is the ecosystem responding to the management actions?
- Is progress being communicated in an effective and timely manner?

The first question addresses the overall success of CCMP implementation, which can be based on the degree to which actions are being implemented and any measurable improvements in the ambient environment. The second question is environmental in nature, and focuses on changes in ambient water quality and sediment conditions, ecological functions, or biological populations

[2] The introduction and information on implementation and effectiveness monitoring in this RMP have been adapted in part from the Tillamook Bay National Estuary Program Monitoring Plan. The Tillamook Plan provides a succinct description and summary of the general requirements of the National Estuary Program (NEP) monitoring requirements and the purpose and need for collecting and reporting both programmatic and environmental data.

[3] Formerly the Corpus Christi Bay National Estuary Program (CCBNEP)

and communities. The third question relates to the effectiveness of communications to the public, regulators, and policy makers informing them of the progress being made on Actions and the resulting environmental response.

To effectively evaluate the success of the *Bays Plan*, it is necessary to track both the extent to which the Actions laid out in the *Bays Plan* are being implemented and the environmental response to those implemented Actions. Environmental responses and the overall health of the bays will be measured through environmental monitoring. Programmatic monitoring will be used to track the implementation of actions.

1.1 Environmental Monitoring

Environmental monitoring answers broad ecological questions: "Is the ecological integrity of the bay and watershed changing?" "Is water quality improving or getting worse, and by how much?" "Does implementation of Action Items in the *Bays Plan* have the desired effect?" Environmental monitoring lends itself more toward an assessment of success in attaining the environmental goals and objectives of the *Bays Plan* than to the implementation of specific Actions.

The environmental monitoring plan is presented in two sections. The first section provides a monitoring program that addresses the "Health of the Bays" and has a bay wide focus on status and trends. "Health of the Bays" monitoring will address the entire system and will focus on areas known to be problematic or that have a clear potential to develop problems. However, inclusion of areas that are not likely to have or develop unacceptable conditions (*e.g.*, reference or control sites) will allow a determination as to whether observed conditions are bay wide or local. This will also enable local responses to be compared to implementation of Action Items. The second section addresses environmental elements identified under the eleven major Action Plans of the *Bays Plan*. Evaluation of environmental conditions for these Action Items is site specific in nature and thus subject to development of specific monitoring plans or environmental assessments that address the environmental response to the implementation of the specific Action. This may include a simple assessment of the response of the system or short-term monitoring to ensure the action has the desired effect. The need for site-specific or project-specific assessment or monitoring will be determined by the CBBEP in coordination with the Scientific and Technical Advisory Committee (STAC) during project plan development and funding. Not all eleven areas of the *Bays Plan* require environmental monitoring or assessment or both, thus the action-specific monitoring section focuses on those Action Items that have requirements for environmental monitoring or assessment that are not addressed effectively by the "Health of the Bays" monitoring.

This type of monitoring requires a statistically sound analysis of environmental data that is of known quality and confidence. For each *Bays Plan* Action Plan goal and objective, monitoring parameters relevant to the environmental response expected from the *Bays Plan* Actions provide a measurement of success of the program.

For example, the *Bays Plan* Water and Sediment Quality Objective 1 is to "Improve the quality of ambient water and sediment in impaired or stressed segments to attain standards and criteria." The first Action Item (WSQ-1) under this objective is: *implement plans to improve water and sediment quality in identified segments*. An expected environmental response may be an increase in DO levels and reduction in bacterial levels in each identified segment. Thus the monitoring program calls for periodic measurement of DO and indicators of bacterial levels (fecal coliform and enterococci) at sites in the identified segments. Monitoring at these stations will provide

information on the DO and bacterial levels before, during, and after the Action Plans are implemented.

Together, the "Health of the Bays" and Action Item-specific sections address the environmental monitoring needs specified in the eleven Action Plans (*e.g.*, Bay Tourism and Recreation; Bay Debris; Public Health; Shoreline Management; Maritime Commerce; Dredging; Habitat and Living Resources; Water and Sediment Quality; Nonpoint Source Management; Freshwater Resources; and Public Education and Outreach) identified by the *Bays Plan*.

1.2 Programmatic Monitoring

Programmatic monitoring is designed to answer such questions as: "Are *Bays Plan* Actions being implemented?" "Is the *Bays Plan* being implemented at the level of commitment specified in the *Plan's* goals, objectives, Action Items, steps, and measures of success?"

The effectiveness of implementation will be measured by the progress in achieving the goals, objectives, or milestones for each action as defined in the *Bays Plan*. Most of the Actions in the *Bays Plan* lend themselves to this type of administrative monitoring. Programmatic monitoring establishes accountability on the part of the designated lead organizations for specific Actions. In addition, monitoring the implementation of the *Bays Plan* provides managers with information about of the status of various programs and the degree to which programs are or are not achieving their intended outcomes. For example, programmatic implementation data can be used to verify whether an educational outreach program has reached its target audience. With this type of information, managers can modify the *Bays Plan* or specific Actions as needed to implement the Action Plans and to achieve the desired outcomes outlined in the *Bays Plan*.

Under this RMP, programmatic monitoring is proposed for each of the eleven Action Plans identified in the *Bays Plan* (Bay Tourism and Recreation; Bay Debris; Public Health; Shoreline Management; Maritime Commerce; Dredging; Habitat and Living Resources; Water and Sediment Quality; Nonpoint Source Management; Freshwater Resources; and Public Education and Outreach). This information will keep managers informed of the status of various Actions and the degree to which programs are or are not achieving their intended outcome.

1.3 Monitoring Coordination

This monitoring plan seeks to promote cooperation among agencies and stakeholders by incorporating and coordinating efforts into an integrated monitoring plan as required to measure the response of the CBBEP system to the various *Bays Plan* Actions. Towards this end, the CBBEP will organize and facilitate an annual monitoring agencies' coordination meeting to incorporate existing and planned monitoring efforts or elements into the RMP, identify critical information gaps, and attempt to standardize and coordinate future monitoring efforts. This effort will minimize duplication of effort among agencies, reduce the cost of monitoring, and provide integrated results to the scientific, regulatory, and stakeholder communities in an efficient and timely manner. As presented in Section 2, Environmental Monitoring, consideration has been taken to place the monitoring stations where historic data are available or recent studies have been conducted. In addition to these, final station locations will include a stratified-random sampling design that takes into consideration known spatial and temporal trends in environmental parameters/resources and environmental risk.

Tables 1-1 and 1-2 list on-going data collection and monitoring activities funded by the CBBEP (as detailed in their Annual Work Plan), various state agencies, and other funding sources

relevant to measuring the effectiveness of the implemented Action Items. These projects, identified during RMP development and through the first annual monitoring coordination meeting, have been incorporated into the relevant environmental monitoring components of the RMP. However, existing programs will not be sufficient to meet all of the monitoring needs. Therefore, the monitoring plan identifies several additional activities that the CBBEP Management Conference proposes to incorporate into the monitoring program (Table 1-3).

The CBBEP is committed to maintaining its ongoing monitoring programs while adding other activities necessary to conduct effective monitoring of the system. These additional activities represent the recommendation of the CBBEP stakeholders for an effective monitoring program and will be implemented to the level of funding available.

With the information collected through both environmental and programmatic monitoring, the CBBEP can modify Action Plans, specific Actions, or the monitoring program as needed to achieve the desired outcomes outlined in the *Bays Plan*. Where appropriate, resources may be redirected to ensure that desired outcomes are achieved.

Table 1-1. Data Collection and Monitoring Activities Implemented by the CBBEP 1998-2000 (CBBEP, 1999 and 2000a).

Project Name and Performing Party	Program Description	Bays Plan Goal\Action Addressed
99.1.3 Atmospheric Deposition Study (TAMU – GERG) (FY 99) 0004 Atmospheric Deposition Study (TAMU – GERG) (FY 00) 0110 Atmospheric Deposition Study (TAMU – GERG) (FY 01)	This wet and dry atmospheric deposition monitoring program was amended after the first year to provide data that can be included as part of EPA's National Atmospheric Deposition Program (NADP). Samples are currently collected weekly at two sites, one on the north shore of Nueces Bay at White Point and the other at TAMU-CC on Ward Island. Each station collects wet and dry deposition as well as meteorological data. Samples are analyzed for conductivity, calcium, magnesium, potassium, sodium, ammonium, nitrate, total phosphate, chloride, sulfate, copper, zinc, lead, cadmium, titanium, vanadium, chromium, nickel, arsenic, selenium, and manganese.	WSQ-3
0002 Surface Water Quality Monitoring & Assessment Project, Phase II (TAMU-CC, Center for Coastal Studies, NRA)	30 EMAP sites from Corpus Christi Bay north (Corpus Christi, Nueces, Redfish, Aransas, Mission, and Copano Bays) and 5 fixed inner Harbor sites will be sampled quarterly for TNRCC routine field, conventional water chemistry, metals in water, and benthic macroinfauna. 6 additional fixed stations will be sampled bi-monthly for TNRCC routine field, conventional water chemistry, and metals in water (2000-2001). See also Bay Sediment Chemistry Monitoring description below.	WSQ-1, 3, & 5
0108 Surface Water Quality Monitoring Project, Upper Laguna Madre & Baffin Bay – Phase III (TAMU-CC, Center for Coastal Studies, NRA)	30 EMAP sites from upper Laguna Madre south will be sampled quarterly for TNRCC routine field, conventional water chemistry, metals in water, and benthic macroinfauna. See also Bay Sediment Chemistry Monitoring description below.	WSQ-1, 3, 4, & 5
0109 Bay Sediment Chemistry Monitoring and Assessment (TAMU-CC, Center for Coastal Studies, NRA)	30 EMAP Surface Water Quality Monitoring project sites from Nueces Bay north and 30 EMAP Surface Water Quality Monitoring project sites from Laguna Madre south will be monitored quarterly for one year for standard TNRCC sediment conventionals.	WSQ-1, 3, 4, &5

Table 1-1. Data Collection and Monitoring Activities Implemented by the CBBEP 1998-2000 (CBBEP, 1999 and 2000a) (continued).

Project Name and Performing Party	Program Description	Bays Plan Goal\Action Addressed
0003 Regional Approach to Ensure Recreational Water Quality (TNRCC)	Collection and analysis of microbial indicator organisms (fecal coliform, enterococcus, and total coliform) twice a month at four sites for twelve months (December 1998 through May 2000), including collection and analysis during and after a minimum of four significant rainfall events. Routine field parameters are collected at all stations monthly.	PH-1, WSQ-1
0012 Colonial Waterbird Rookery Island Management within the Coastal Bend Area (CBBEP) (FY 00) 0104 Colonial Waterbird Rookery Island Management within the Coastal Bend Area (CBBEP) (FY 01)	Avian monitoring, including bird counts and least tern bird surveys are conducted in coordination with multiple other agencies in support of the colonial waterbird management plan. See Table 1-2 for additional bird surveys within the Coastal Bend.	HLR-4 & 2, D-1, BTR-2, PEO-5
0105 The Effects of Redhead Ducks on Shoalgrass in the Laguna Madre (TAMU – Kingsville Caesar Kleberg Wildlife Research Institute)	This study will monitor changes in shoalgrass rhizome biomass in 12 zones throughout the southern and northeastern Laguna Madre. Monitoring will be conducted monthly from October 2000 through March 2003. Aerial flights will be conducted twice weekly to monitor redhead distribution and abundance within the Laguna Madre as well as in freshwater wetlands within approximately 5 miles of the coast. 180 Redhead specimens will be collected each year for analysis of changes in body mass, protein, and other parameters.	HLR-4, 1, & 2

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Surface Water Quality Monitoring (TNRCC)	26 sites sampled 1 – 4 times per year for depth, DO, pH, temperature, conductivity, salinity, fecal coliform, nutrients, chlorophyll a, dissolved and suspended solids, metals in water, metals in sediment, organics in water, and fish tissue.	Bays and some creeks throughout CBBEP area	Water and Sediment Quality
Coastal 2000 (EPA, TPWD)	Approximately 17 stations in the CBBEP area will be sampled as part of this Gulf-wide program. Water quality parameters that will be measured include routine field parameters, nutrients, TSS, light, DO, ph, salinity, and temperature. Sediment surveys, benthic surveys, and fish trawls will also be conducted utilizing TPWD stations. Sediments will be analyzed for metals, organics, TOC, grain size, and sediment toxicity. Fish tissue will be analyzed for contaminants. Sampling will take place annually from 2000-2005, although the design may change in years 3 through 5.	Bays throughout CBBEP area	Water and Sediment Quality, Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Clean Rivers Program (NRA)	10 sites sampled quarterly for routine benthics, conventionals, bacteria, field; 2 sites sampled quarterly for routine benthics, conventionals, bacteria, instantaneous flow, field; 8 sites sampled quarterly for conventionals, bacteria, instantaneous flow, field; 2 sites sampled quarterly for conventionals, bacteria, field.	Rivers and bays within CBBEP area	Water and Sediment Quality
TMDL/Oyster Water Use Impairment due to Zinc (TNRCC, GLO, TDH)	The TDH will be conducting a public health risk assessment project in 2001 in Nueces Bay to re-assess oyster water use impairment due to zinc contamination. TDH will collect oyster, fish, and crab tissue and analyze for metals (arsenic, cadmium, copper, lead, mercury and zinc) as well as PCBs, pesticides, and volatile and semivolatile organic compounds. This study is a follow-up to a 1994 tissue study looking at heavy metals in oyster, fish, and crab tissue in Nueces Bay.	Nueces Bay – exact locations to be determined	Water and Sediment Quality, Habitat and Living Resources, Human Uses
Mussel Watch Project (NOAA)	7 sites within the CBBEP area are monitored under this nationwide project that has monitored chemical contaminants in sediments and bivalve mollusks since 1986. Bivalves are collected every other year and sediments every fifth year. Samples are analyzed for PAHs, PCBs, DDT, DDD, DDE, 16 other chlorinated pesticides, tributyl-tins, 3 major elements, and 11 trace elements.	Mesquite, Copano, Aransas, Nueces, and Corpus Christi Bay	Water and Sediment Quality, Habitat and Living Resources
Ecological Influence of Treated Wastewater Diversions on Delta Habitats in a Semiarid Climate (TAMU-CC, Center for Coastal Studies)	14 sites sampled monthly (from 1997-2003) for TNRCC routine field parameters, benthic macroinfauna, epifaunal invertebrates and nekton macrofauna, and birds.		Water and Sediment Quality, Habitat and Living Resources, Freshwater Resources
Oso Bay and Creek DO Monitoring (TAMU-CC Conrad Blucher Institute, Center for Coastal Studies)	5 fixed Hydrolab DO platforms are sampled at 30-minute intervals for routine field parameters including DO, salinity, water temperature, and pH (1993 to present).	Oso Creek and Bay	Water and Sediment Quality, Habitat and Living Resources
Oso Creek/Oso Bay Project Surface Watershed System Study (TAMU-CC, Center for Coastal Studies)	8 sites sampled monthly (from 1999-2000) for TNRCC routine field parameters, conventional water chemistry, benthic macroinfauna, epifaunal invertebrates and nekton macrofauna, birds, and microbiological indicators; collection of baseline land use data (GIS).	Oso Creek and Bay	Water and Sediment Quality, Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Nueces Bay Salinity Monitoring Project (TAMU-CC Conrad Blucher Institute)	7 Hydrolab sites in the Nueces River, Delta, and Bay are monitored for routine field parameters, salinity, water temperature, DO, and pH at 30 minute intervals (1990 to present).	Nueces River, Delta, and Bay	Water and Sediment Quality, Habitat and Living Resources
Ambient Water Quality Monitoring/Datasonde (TWDB- TPWD)	4 sites are currently monitored on an hourly basis for water temperature, conductance, pH, dissolved oxygen, and salinity. Up to 9 years of data are available for some historic and current sites. Data are used to establish relationships between freshwater inflows and salinity.	Aransas Bay, Laguna Madre, Corpus Christi Bay, Baffin Bay	Water and Sediment Quality, Freshwater Resources
TCOON [Texas Coastal Ocean Observation Network] (TAMU-CC, Conrad Blucher Institute; TWDB; TGLO; USACE)	12 tide gauges are located in the CBBEP area collecting water level, wind speed, wind direction, and temperature data. Some gauges collect water quality data (*e.g.*, salinity, dissolved oxygen).	Laguna Madre, Corpus Christi Bay, Nueces Bay, Gulf of Mexico, Port Aransas, Aransas Bay, Copano Bay	Water and Sediment Quality, Habitat and Living Resources
Pfisteria (TPWD)	5 sites sampled approximately monthly for temperature, salinity, DO, pH, chlorophyll a, nutrients, and Pfisteria during 2000-2001.	Nueces River, Baffin Bay, Oso Bay, Port Aransas, and Mesquite Bay	Habitat and Living Resources, Water and Sediment Quality, Human Uses
Characterization of Trace Metals and Radionuclides in Lake and Coastal Sediments (TAMU-CC Conrad Blucher Institute)	Sediment samples from Nueces Bay and Lake Corpus Christi are analyzed for metals, organics, and radionuclides; fresh water samples from Lake Corpus Christi are also analyzed for metals.	Nueces Bay and Lake Corpus Christi	Water and Sediment Quality
Monitoring Constructed Wetlands for Wastewater Reuse (TAMU-Kingsville Environmental Engineering)	Water at a constructed wetland site near Sarita, Texas will be sampled weekly for DO, temperature, pH, conductivity, nutrients, total suspended solids and BOD. Monitoring will take place for four months following the construction of the wetlands (anticipated dates April – July 2001).	Constructed wetland site, Sarita	Water and Sediment Quality, Habitat and Living Resources
Port of Corpus Christi Real Time Navigation Project (TAMU-CC Conrad Blucher Institute)	3 sites measure water velocity at 12-minute intervals (1999 to present). Sites include a current meter at the UTMSI pier in Port Aransas, the Navy base at Homeport in Ingleside, and a buoy offshore of Port Aransas in the Gulf of Mexico.	UTMSI pier in Port Aransas, the Navy base at Homeport in Ingleside, and a buoy offshore of Port Aransas in the Gulf of Mexico	Water and Sediment Quality, Habitat and Living Resources
Radar Water Velocity Project (TAMU-CC Conrad Blucher Institute)	Surface current velocities are measured periodically throughout the year in Corpus Christi Bay, Matagorda Bay, Galveston Bay, and the Galveston offshore area.	Corpus Christi Bay	Water and Sediment Quality, Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Corpus Christi Ship Channel Improvement Project (USACE, PCCA)	An environmental assessment will be conducted as part of the ship channel improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel.	Corpus Christi Bay and Ship Channel – exact sites to be determined	Water and Sediment Quality, Habitat and Living Resources, Maritime Commerce and Dredging, Human Uses
Rangeland Water Quality (Welder Wildlife Foundation and Refuge, GLO)	3 sites are sampled after each rain event (runoff) for sediment, various chemicals, and fecal coliform. All three sites are located on Rob and Bessie Welder Wildlife Foundation and Refuge land.	Welder Wildlife Refuge	Water and Sediment Quality, Habitat and Living Resources
Bay Water (Corpus Christi/Nueces County Health Department)	16 sites throughout Corpus Christi Bay are sampled on a monthly basis for fecal coliform and enterococcus.	Corpus Christi Bay	Human Uses, Water and Sediment Quality
Texas – USGS Cooperative Program, Water Resources Investigations (TWDB)	9 sites are monitored daily for stream flow volume.	Copano Creek, Mission River, Aransas River, San Miguel Creek, Atascosa River, Nueces River, Oso Creek, San Fernando Creek, Los Olmos Creek	Freshwater Resources
Rincon Bayou Vegetation Monitoring/Delta Water Level (TPWD)	2 sites sampled hourly measuring the water level in Rincon Delta, April 2000 to present.	Rincon Delta	Freshwater Resources, Habitat and Living Resources
Nueces Bay Ichthyoplankton (TPWD)	4 sites sampled bi-monthly from February through May for temperature, salinity, DO, pH, fish and plankton.	Nueces Bay	Water and Sediment Quality, Habitat and Living Resources
Ichthyoplankton Collection (UTMSI)	Daily data collection from UTMSI pier in Port Aransas from September through November since 1994 (data for all sciacnid fishes and notes about other taxa).	UTMSI pier, Port Aransas	Habitat and Living Resources
Benthos Sampling (UTMSI, TWDB, Sea Grant, GLO, US Bureau of Reclamation)	15 sites sampled quarterly for benthic invertebrates, nutrients, DO, and salinity.	Site locations include Nueces Bay (2), Corpus Christi Bay (3), Rincon Bayou (6), Baffin Bay (2), and Laguna Madre (2)	Water and Sediment Quality, Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Sport-Harvest Monitoring Program (TPWD Coastal Fisheries Division)	70 sites are sampled throughout Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico. In all areas, intercept surveys are conducted for a combined total of 408 days annually at boat ramps and marinas. On 48 days/year roves are made to count the number of trailers at boat ramps. Parameters measured are: sport-boat harvest, fishing pressure, CPUE, size of fish, and other data as needed. 1974 to present.	Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico	Habitat and Living Resources
Resource Monitoring Program (TPWD Coastal Fisheries Division)	Samples are collected throughout Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico collecting relative abundance and size of marine organism data. Samples are collected using gill nets (45 overnight sets in each of spring and fall in each bay system), bag seines (20/month in each bay system), bay trawls (20/month in Aransas Bay and Corpus Christi Bay, 10/month in upper Laguna Madre), gulf trawls (16/month in the Gulf of Mexico) and oyster dredges (20/month in Aransas Bay).	Throughout Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico	Habitat and Living Resources
Shrimp Virus Sampling (TPWD Coastal Fisheries Division)	240 each of brown shrimp, white shrimp, and pink shrimp were sampled annually for 3 years (1997-2000) for virus analysis in Aransas Bay, Corpus Christi Bay, and upper Laguna Madre.	Aransas Bay, Corpus Christi Bay, and upper Laguna Madre	Habitat and Living Resources
Genetics Sampling (TPWD Coastal Fisheries Division)	Various species of fish and invertebrate are sampled each year for electrophoresis, mtDNA, and microsatellite data in Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico. 1980 to present.	Aransas Bay, Corpus Christi Bay, and upper Laguna Madre	Habitat and Living Resources
Nueces Estuary Trawl Survey (TPWD)	Fish trawls are conducted at 10 fixed stations in the Nueces Estuary monthly during the summer and every other month in the winter for a total of 9 months per year from 1996 – 2000. In addition to species counts, routine field parameters are measured for water, including temperature, pH, DO, salinity, conductivity, and percent saturation.	Nueces Estuary	Water and Sediment Quality, Habitat and Living Resources
Age/Growth Study (TPWD)	Otoliths are collected in Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico for determination of age of select finfish species. Sample number varies by species studied and year. Items subject to change each year. 1975 to present.	Aransas Bay, Corpus Christi Bay, and upper Laguna Madre	Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Commercial Harvest Program (TPWD)	Seafood dealers self-report on a monthly basis. Data include species, pounds, and price/pound for Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico.	Aransas Bay, Corpus Christi Bay, and upper Laguna Madre	Habitat and Living Resources
Sea Turtle Stranding and Salvage Network (USGS, National Park Service and others)	Systematic surveys are conducted on Gulf beaches at least once a week, year-round looking for stranded sea turtles. Data collected include location, species, condition, visible injuries, length, width, blood samples, tissue samples (from dead turtles), and tags.	Gulf Beaches	Habitat and Living Resources
Patrols to detect nesting sea turtles and sea turtles nests (USGS, National Park Service and others)	Systematic surveys are conducted daily during nesting season from March through July on the Gulf beaches of North Padre Island. Data collected include date and location of observation, number of eggs, length and width of nesting turtles, and tag numbers for nesting turtles; 3 nesting females are tracked via satellite transmitters.	Gulf Beaches of North Padre Island	Habitat and Living Resources
Texas Marine Mammal Stranding Network (TAMU-CC, Center for Coastal Studies)	This on-going study collects data on strandings; tissue archives; causes of strandings; rehabilitation of live animals; and assessment of health of cetacean populations. As needed photo IDs are performed on a quarterly basis. Most of the data and samples are housed in Galveston; students analyze data when funding is available. In the CBBEP area, coverage is from Rockport to Yarborough Pass and includes all shorelines.	All shorelines from Rockport to Yarborough Pass	Habitat and Living Resources
Sea Turtle/Marine Mammal Mortality (USFWS)	Matagorda beach is examined weekly during key periods for stranded mammals and sea turtles.	Matagorda Beach	Habitat and Living Resources
Whooping Crane Census (USFWS)	Once a week from October through April aerial flights are made over the Aransas area to monitor the whooping crane population.	Aransas Wildlife Refuge area	Habitat and Living Resources
Aplomado Falcon Reintroduction (USFWS, Welder Wildlife Foundation)	2 sites (Matagorda Island/Tatton Unit of Aransas) are monitored daily July through August for hack young.	Matagorda Island/Tatton Unit of Aransas	Habitat and Living Resources
Christmas Bird Count (National Audubon Society, Welder Wildlife Foundation, CBBEP)	One day a year a count of individual birds by species is performed by volunteers throughout the nation including the following areas in the CBBEP: Corpus Christi, Flour Bluff, Aransas National Wildlife Refuge, Port Aransas, and Kingsville.	Corpus Christi, Flour Bluff, Aransas National Wildlife Refuge, Port Aransas, and Kingsville	Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Waterbird Watch (CBBEP)	Approximately once a month a count of waterbird individuals occurs at 4 sites (Sunset Lake, Mollie Beattie Coastal Habitat Community, Indian Point, and Oso Bay).	Sunset Lake, Mollie Beattie Coastal Habitat Community, Indian Point, and Oso Bay	Habitat and Living Resources
Colonial Waterbird Count (USFWS, CBBEP)	Once a year a count of colonial waterbird nesting pairs is performed throughout the entire CBBEP region.	Entire CBBEP area	Habitat and Living Resources
Mid-Winter Waterfowl Census (USFWS/TPWD)	Once a year a count of waterfowl individuals along the entire Texas coast is performed.	Entire CBBEP area	Habitat and Living Resources
Development of Habitat-Based Population Model of Redheads in North America (TAMU-CC Center for Coastal Studies, USGS, USFWS)	Redhead flock surveys are conducted monthly by USGS and USFWS personnel from October through March (ongoing for over 10 years); this project synthesizes survey data and habitat information in GIS format to evaluate habitat availability and use for Redhead duck populations in Laguna Madre.	Laguna Madre	Habitat and Living Resources
Distribution of Seagrass Meadows and Wintering Redheads in Eastern Nueces Bay, Texas (TAMU-CC Center for Coastal Studies)	52 one-time emergent marsh surveys and 10 one-time seagrass surveys will be conducted along the western shoreline of Indian Point Peninsula in Nueces Bay to measure salinity, seagrass distribution, site elevation, and vegetation cover. Redhead abundance and behavior data will be collected every three weeks from October through March (2000-2001).	Nueces Bay	Habitat and Living Resources
Winter Burrowing Owl Ecology (USGS, CBBEP)	Approximately 20 sites are surveyed within Nueces County on a monthly basis between October and March to assess the winter survival and habitat use of the Burrowing Owl.	Nueces County	Habitat and Living Resources
Maritime Gopher Monitoring (TPWD)	Population counts conducted at 2 sites (Naval Air Station Corpus Christi and GCCA/CP&L Marine Development Center) over two days once per year.	Naval Air Station Corpus Christi and GCCA/CP&L Marine Development Center	Habitat and Living Resources
Hummingbird Roundup (TPWD)	Population count conducted statewide by volunteers based on number of birds seen in backyard over the course of a year; participation and sites vary from year to year; currently over 20 participants within the CBBEP area.	CBBEP area	Habitat and Living Resources
Texas Horned Lizard Watch (TPWD)	Volunteer watch program throughout the state; monitoring for Texas Horned Lizard, Fire Ants, and Texas Native Red Ants takes place from May through September annually; Participation and sites within the CBBEP area varies from year to year.	CBBEP area	Habitat and Living Resources
4th of July Butterfly Count (North American Butterfly Association)	Numbers of species and individuals counted on 4th of July in a 15-mile radius count circle within the Aransas National Wildlife Refuge.	Aransas National Wildlife Refuge	Habitat and Living Resources
Project Prairie Bird (Gulf Coast Bird Observatory)	A count of individuals is conducted once a month for the three winter months at 9 sites on Mustang Island.	Mustang Island	Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Breeding Bird Survey (USGS/BRD)	Count of individuals conducted in Petronilla and Kingsville one day once per year.	Petronilla and Kingsville	Habitat and Living Resources
Migration Count (USGS)	Countywide counts of individuals conducted once per year.	CBBEP area	Habitat and Living Resources
Laguna Madre Seagrass Distribution and Biomass (USGS National Wetlands Research Center, Texas Gulf Coast Field Station)	In 1988 and 1998-99 surveys of seagrass distribution and biomass were conducted for all of Laguna Madre.	Laguna Madre	Habitat and Living Resources
Upper Laguna Madre Seagrass Distribution and Biomass (USGS National Wetlands Research Center, Texas Gulf Coast Field Station)	Annual surveys of seagrass distribution and biomass have been conducted since 1991 in upper Laguna Madre between Kennedy Causeway and Point of Rocks to document effects of the Texas brown tide and subsequent recovery.	Upper Laguna Madre	Habitat and Living Resources
Seagrass Monitoring (USGS National Wetlands Research Center, Texas Gulf Coast Field Station)	The USGS Texas Gulf Coast Field Station has been monitoring underwater light since 1993 at two sites in the upper Laguna Madre that were originally located in seagrass meadows but have since gone bare. Records are hourly means. A Hydrolab Datasonde equipped with a shuttered turbidity probe was set up in September 2000 at one site. A second datasonde has been maintained at the Blucher Institute platform at Bird Island since 1992, except for the period September 1998 through September 1999. The Hydrolabs take hourly measurements of temperature, salinity, specific conductance, and dissolved oxygen. Water temperature has been monitored at two additional sites in the upper Laguna Madre since 1993. The first site is associated with *Syringodium filiforme* and the second site is associated with *Halodule wrightii*. Records are hourly.	Upper Laguna Madre, Bird Island	Habitat and Living Resources, Water and Sediment Quality
Seagrass Monitoring (UTMSI)	1 site in Upper Laguna Madre sampled monthly for density, biomass, PAR, chlorophyll, and nutrients (1989 to present).	Upper Laguna Madre	Habitat and Living Resources
Seagrass Bed Landscape Studies (TPWD)	Annually since 1997, seagrass coverage and other features (*e.g.*, propscars and bare patches) have been measured from aerial photography or imagery in Redfish Bay, east Corpus Christi Bay, and the Harbor Island area. Data is ground truthed using GPS. The program also collects information on species distribution.	Redfish Bay, east Corpus Christi Bay, and the Harbor Island area	Habitat and Living Resources

Table 1-2. Ongoing Data Collection and Monitoring Activities Funded by the State of Texas and other Agencies (continued).

Project Name and Funding Agency/Performing Party	Program Description	Sampling Location	*Bays Plan* Topic Area Addressed
Implementation of Restoration/Enhancement Projects in Nueces/Corpus Christi Bay: Hydrologic Assessments (TAMU-CC Center for Coastal Studies)	Salinity, elevation surveys, and water level measurements are being taken at multiple sites in three wetland areas from 2000 through 2001 (Indian Point Peninsula, Mustang Island State Park near Water Exchange Pass, and Nature Conservancy lands on Mustang Island near Wilson's Cut). Three-dimensional elevation models will be developed for each location to evaluate water levels within wetlands as well as movement among wetlands and adjacent bays.	Indian Point Peninsula, Mustang Island State Park near Water Exchange Pass, and Nature Conservancy lands on Mustang Island near Wilson's Cut	Habitat and Living Resources, Water and Sediment Quality
Shamrock Island *Spartina alterniflora* Wetland Creation Project: Planning, Implementation, and Evaluation (TAMU-CC Center for Coastal Studies)	Monthly surveys conducted on Shamrock Island and Sinclair Channel on Mustang Island to evaluate *Spartina alterniflora* marsh vegetation cover and growth characteristics (1999-2000).	Shamrock Island and Sinclair Channel on Mustang Island	Habitat and Living Resources
Riparian Habitat Corridor Assessment in Texas Coastal Bend (TAMU-CC Center for Coastal Studies)	A one-time characterization of each of 40 sites along riparian corridors in CBBEP includes measurements of salinity, turbidity, vegetation community composition, and invertebrate species richness.	40 sites along riparian corridors in CBBEP	Habitat and Living Resources, Water and Sediment Quality
Spatial and Temporal Dynamics of Rookery Islands in the Laguna Madre and Development of a Management Plan (TAMU-CC Center for Coastal Studies)	A one-time elevation and vegetation survey is being conducted in the Upper Laguna Madre at eight dredged material islands as well as North and South Bird Islands to identify characteristic island vegetation in relation to colonial water bird nesting potential (June 2000 through August 2001).	Upper Laguna Madre at eight dredged material islands as well as North and South Bird Islands	Habitat and Living Resources
Implementation of the ASARCO Conservation Area Management Plan: Year One (TAMU-CC Center for Coastal Studies)	Vegetation distribution and elevation surveys will be measured monthly from November 2000 through October 2001 at the ASARCO Conservation Area, Upriver Road, Corpus Christi, Texas to assess strategies to reduce exotic species and increase cover of native prairie grasses through management practices and species reintroduction.	ASARCO Conservation Area, Upriver Road, Corpus Christi	Habitat and Living Resources
Fire Effects on Live Oak Brush (USFWS)	Stems per acre are measured at two sites on the Aransas National Wildlife Refuge before and after fires.	Aransas National Wildlife Refuge	Habitat and Living Resources
Hypoxia in Corpus Christi Bay (Performed by UTMSI with Funding from TGLO)	Dissolved oxygen concentrations in water are measured biweekly or triweekly during summer (July-August) by spatial surveys or continuously with deployments. Sampling performed from 1996-2001. A GIS database of the hypoxic conditions will be created in 2001. Two experiments on hypoxic effects on benthos performed.	Surveys at 16 sites in the southeast portion of Corpus Christi Bay. Continuous measurements at one or two sites.	Habitat and Living Resources, Water and Sediment Quality
National Mussel Watch Program (NOAA)	Annual collection of oysters and *in situ* data (temperature, DO, salinity, pH). Oysters analyzed for PCBs, pesticides, and metals.	Mesquite Bay, Aransas Bay, Copano Bay, Corpus Christi Bay	Water and Sediment Quality, Habitat and Living Resources

Table 1-3. Proposed New Monitoring Activities

Program Name/ Description	Program Objective
Monitoring Coordination Meeting	To bring together all state and federal agencies conducting monitoring activities within the CBBEP area on an annual basis to coordinate activities, reduce duplication of effort, and ensure that monitoring activities are responsive to the goals of the RMP.
Extension of the Coastal 2000 Program	To expand the number of stations sampled to ensure that sampling density is sufficient to determine with statistical validity whether or not conditions throughout the bays system are improving and ensure that the water and sediment quality of the CBBEP area is suitable for fishing, swimming, and other compatible recreational and commercial activities. To expand information on concentrations of contaminants in fish tissue.
Bay Sediment Chemistry Monitoring and Assessment	To redirect present resources for quarterly or semiannual sediment quality measurements at selected benthic sampling sites to support bay wide sampling in support of "Health of the Bays" assessment or to expand the analyte list to include organic chemicals of concern in the system. To expand understanding of potential impacts from organic chemicals.
Land Use/Land Cover Assessment	To determine types and percentages of land uses within the CBBEP area via aerial photography twice per decade. To utilize ground-truthing to supplement data on habitat area and quality.

1.4 Monitoring Plan Funding

The emphasis of the CBBEP is to implement the Action Plans and specific items identified therein and to select relevant research, assessment, and monitoring projects that support implemented Action Items. Thus, the CBBEP has funded numerous projects with monitoring components (Table 1-1) that address many of the *Bays Plan* Action Items. Continued review of project proposals and funding of relevant projects is expected as part of the CBBEP Annual Work Plan.

Funding of the long-term status and trends monitoring defined in this plan comes from a diverse set of sources including federal, state, local, and corporate entities. The major funding for the long-term environmental monitoring is provided by the State of Texas through its various agencies and is supplemented where possible by other CBBEP funds. Many of these programs are mandated. The monitoring proposed in this plan will be implemented to the level of funding available based on the priorities determined by CBBEP stakeholders.

1.5 Data Management, Synthesis and Reporting

Under the monitoring plan, standard scientifically acceptable sampling and analytical methods, and quality assurance/quality control (QA/QC) protocols will be adopted to ensure that monitoring information collected by the various partners in this effort are of known, high quality and are directly comparable. Where new QA/QC plans are needed, the performing party, in coordination with the CBBEP, will act as the central organization for coordinating the development of Quality Assurance Project Plans (QAPPs)[1]. In all cases, the environmental monitoring and any research or assessment will be conducted under an approved QAPP. These plans will be prepared for the specific project before it is implemented and will clearly describe the goals, data needs, sampling locations and schedules, analytical and interpretive approach,

[1] Where possible, these plans should follow Texas Natural Resource Conservation Commission (TNRCC) and Environmental Protection Agency (EPA) guidelines.

analytical methods including data quality objectives, and how the data will be used within the monitoring program. The CBBEP will collect and house all applicable existing agency QAPPs.

All data are expected to be fully quality assured by the agency or party responsible for the monitoring and, if needed, assigned data qualifiers noting any problems. When appropriate, data will be made available through digital media to other organizations working under this RMP and to other interested parties. The data will be in a format that allows for easy visual display using various data visualization or statistical packages. The data will be compatible with standard Geographical Information Systems (GIS) formats for easy transfer of the data among organizations. All data generated under this program will be identified to the CBBEP for tracking. The CBBEP will receive all reports and publications that utilize RMP data.

Data collected as part of the RMP will be stored in accordance with the CBBEP's Data Management Strategy (DMS). Data from projects associated with the RMP will be available in hardcopy and electronic format from participating agencies and the CBBEP. As part of the DMS, the CBBEP web site will be equipped with links to the major participating agencies' data storage web sites.

Programmatic progress will be presented at annual CBBEP meetings and in annual "report cards" developed by the CBBEP. A "State of the Bays" report will be prepared every five years to convey the health of the system and report on status and trends. With this information, managers can modify Action Plans or specific Action Items as needed to achieve the desired outcomes outlined in the *Bays Plan*. Where appropriate, resources may be redirected to ensure that desired outcomes are achieved. It is anticipated that annual report cards and the State of the Bays report will be available via the CBBEP's web site.

The CBBEP's commitment to provide an annual report to the public, regulators, and scientists demands that the data from the program be made available in a timely manner. The CBBEP Management Council anticipates that data will be available within one year of sample collection. To encourage timely analysis and presentation of data and findings and to ensure that the public is informed and educated on the health of the bays system, the CBBEP will sponsor a science meeting and a state of the bays conference in alternating years.

1.6 Responding to Unacceptable Environmental Conditions

If monitoring data show that a component of the system has an unacceptable status (*i.e.*, does not meet applicable state standards) or a trend is found that suggests a potential for future problems, the CBBEP and STAC will convene to review and discuss the data. Actions to address the conditions may also be recommended to or by the state or other agencies.

1.7 Updating the Regional Monitoring Plan

The STAC will review the RMP every five years to ensure the document remains relevant towards current problems and concerns. Updates will be made to the RMP as needed.

1.8 Monitoring Plan Content

The remainder of this document presents the environmental and programmatic monitoring plans for the CBBEP. The environmental monitoring plan for the "Health of the Bays" is presented first (Section 2.1). This section is structured such that the *Bays Plan* objectives and associated Action Plans are addressed through a set of key monitoring areas of system-wide health

(e.g., habitat, water quality, sediment quality, etc.). The "Health of the Bays" monitoring will be conducted as a status and trends monitoring program and will encompass the entire CBBEP area.

Action-specific environmental monitoring is presented in Section 2.2. This section provides information on environmental monitoring for those Action Items that have an environmental monitoring component that is not addressed through the system-wide "Health of the Bays" monitoring.

Programmatic monitoring is included in Section 3. Programmatic monitoring is designed to closely track which CBBEP Action Plan milestones and goals have been accomplished each year. Both the Action Item specific monitoring and programmatic monitoring sections are grouped according to the eleven major Action Plans in the *Bays Plan*. For each area, the *Bays Plan* goals, objectives, and Action Item, as defined in the *Bays Plan*, are stated.

2. ENVIRONMENTAL MONITORING

This section of the RMP describes the ongoing and planned environmental monitoring that will be conducted as part of the *Bays Plan* Implementation. Review of the *Bays Plan* Action Plans indicates that many Action Items address common issues in the CBBEP area. Thus, monitoring for the effectiveness of one action can contribute to an understanding of the response of the system to implementation of other actions. However, the coordination and overall effectiveness of measuring the effects of individual actions in the system could be problematic and result in unnecessary expenditure of funds. Therefore, an overall health of the bays approach for measuring the effectiveness of the actions is taken in the RMP, by systematically measuring the net effectiveness of all actions implemented. However, the plan is flexible in that it provides for tailored monitoring plans (or assessments) at a site or project specific level for any action that requires very specific environmental monitoring to measure the success of the action. In these cases, site specific monitoring with defined goals and objectives and sampling plans will be developed based on guidance provided in NRC (1990) and EPA (1992). These may be developed in support of the Action Item-specific section of this plan or as independent studies. Regardless, these studies will be coordinated with the RMP through the CBBEP and use methodologies that provide comparable results to the "Health of the Bays" monitoring to ensure the resulting data can be inter-compared.

Section 2.1 describes the "Health of the Bays" monitoring at the system wide level. Section 2.2 provides information on Action specific environmental monitoring for those *Bays Plan* Action Items identified to have an environmental monitoring component.

2.1 Health Of The Bays

The overall "Health of the Bays" monitoring is designed to meet the following system goal and monitoring objective:

> **Health of the Bays Program Goal:** *Measure status and trends in the health of the Coastal Bend Bays & Estuaries Program area.*
>
> **Health of the Bays Monitoring Objective:** To provide the CBBEP, resource managers and the public with information in the areas of habitat, water quality, sediment quality, freshwater resources, commercial and recreational fisheries, species of concern, and shoreline management to allow for the effective management of Coastal Bend natural resources.

This approach to evaluating the status and health of the Coastal Bend bays and estuaries will be considered successful if the data are developed and reported under a sustained, funded, long-term, comprehensive, coordinated monitoring program, and the implementation of *Bays Plan* Actions result in measurable improvements in environmental quality as measured by the key indicators of system health. The overall monitoring will focus on the following questions: Does implementation of *Bays Plan* Actions result in improved environmental conditions within the CBBEP system? What areas show the greatest improvements?

"Health of the Bays" monitoring will be conducted as a status and trends monitoring program and will encompass the entire CBBEP area. As such, measures of *status* will be derived from spatial measurements located throughout the 12 major subregions of the CBBEP area (Mesquite Bay,

St. Charles Bay, Aransas Bay, Copano Bay, Mission Bay, Red Fish Bay, Corpus Christi Bay, Nueces Bay, Oso Bay, upper Laguna Madre, Baffin Bay, and Alazan Bay). These spatial measurements may be made on a sequential basis and based on the probabilistic approach described in Summer *et al.* (2000), where appropriate for the type of data being collected (e.g., sediment and water quality). Under this approach, not all regions are sampled each year and station locations are not necessarily repeated for each sampling. *Trends* in the system will be determined through a temporally repeated measurement program at selected locations that represent the regions of the system. These station locations will be inflexible to ensure comparability of the temporal data. In addition, comparative analysis over the period of the status sampling will provide additional information on temporal responses of the system.

The monitoring program relies heavily on on-going data collection and monitoring activities. To ensure that these widespread efforts take into consideration the goals of the RMP and best utilize existing funding, the CBBEP will facilitate an annual monitoring agencies' coordination meeting.

The CBBEP will act as a clearinghouse for data collected as part of the RMP, providing links on its website to relevant agencies' data. The CBBEP will prepare annual report cards highlighting progress and develop a State of the Bays report to summarize the status and trends measured within the bays on a five-year interval. This will include an assessment of the changes measured in the estuary and relate the changes to the Actions completed under the *Bays Plan*. The report card and State of the Bays report will be focused on the monitoring elements described for each environmental monitoring topic area (see Table 2-1) and will incorporate results of relevant research or assessments conducted during the reporting period.

The "Health of the Bays" monitoring is focused on key indicators of health under the following areas: *habitat, sediment quality, water quality, freshwater resources, commercial and recreational fisheries, species of concern, and shoreline management.* The planned monitoring under each topic area is presented in tabular format and provides the information shown in Table 2-1.

Table 2-1. General description of the topics used to present each element of the CBBEP "Health of the Bays" Environmental Monitoring Plan.

Topic Title	Description
Monitoring Objective(s)	A list of specific objectives for the monitoring program.
Measures of Success	A list of what will measure whether the goals have been met.
Monitoring Questions	A set of specific questions that the monitoring program is designed to address.
Summary of Current Monitoring and Assessment Programs	A summary of ongoing monitoring and assessment programs.
Monitoring Program Description	A brief description of the approach to the monitoring program including any research required or assessments planned.
Monitoring Parameters	A list of monitoring parameters and key indicators.
Stations	The stations and locations that will be sampled. These include (1) targeted or master stations (*i.e.*, those that are sampled for a full suite of parameters and must be sampled for trend analysis) and (2) those stations that provide supporting information on spatial or other trends but are not necessarily sampled for all variables or all times.
Sampling Frequency	The sampling frequency.
Funding Agencies	The source of the funding for the monitoring, research or assessment activities.
Additional Actions	A statement of the monitoring plan actions as appropriate to the area and its object.
Relevant Studies and Publications	A brief summary of relevant historical studies and publications.

2.1.1 Health of the Bays Environmental Monitoring: Habitat	
Monitoring Objective	*To assess changes in the area and quality of key habitats (i.e., SAV, emergent wetlands, tidal flats, riparian areas, and oyster reefs) within the CBBEP area through time.* *See the Health of the Bays Sediment Monitoring for discussion of benthic habitat monitoring. See Health of the Bays Species of Concern Monitoring for discussion of avian monitoring and related habitat. Action specific monitoring and assessment can be found in Section 2.2.*
Measures of Success	➢ The number, area and quality of key habitats remain constant or increase through time.
Monitoring Questions	*Are the number, area and quality of key habitats maintained, increasing, or decreasing?* *Are the quality and area of the SAV areas increasing or decreasing?* *Has the area of emergent wetlands increased or decreased?* *Is the quality of emergent wetlands adequate to support appropriate fish and wildlife species diversity and productivity?* *Has the tidal flat area increased or decreased and where?* *Are the tidal flat areas remaining stable, degrading, or improving?* *Are the riparian areas increasing or decreasing?* *Are the riparian areas remaining stable, degrading, or improving?* *Are oyster reef areas increasing or decreasing?* *Are the oyster reefs remaining stable, degrading, or improving?*
Summary of Current Monitoring and Assessment Programs	**Seagrass** Seagrass Bed Landscape Studies (UTMSI) – These studies have performed random sampling of seagrass since 1997. Using aerial photographs, the surveys determine seagrass coverage, propeller scarring, and bare patches. Ground truthing of the remotely collected data is via field observations and GPS positioning. Seagrass Monitoring (UTMSI) – UTMSI has been monitoring seagrasses in the Upper Laguna Madre since 1989 on a monthly basis. Some of the parameters being monitored include vegetative density, biomass, chlorophyll and nutrients. Gulf of Mexico Program (EPA) – this program is currently developing a status and trends report for seagrasses gulf-wide and is exploring ways to update and maintain gulf-wide seagrass distribution mapping. Both seagrasses and emergent wetlands are a priority for the Habitat Focus team of the Gulf of Mexico Program. Laguna Madre Seagrass Monitoring (USGS National Wetlands Research Center, Texas Gulf Coast Field Station) – In 1988 and 1998-99 surveys of

seagrass distribution and biomass were conducted for all of Laguna Madre. Annual surveys of seagrass distribution and biomass have been conducted since 1991 in upper Laguna Madre between Kennedy Causeway and Point of Rocks to document effects of the Texas brown tide and subsequent recovery. Underwater light has been monitored since 1993 at two sites in the upper Laguna Madre that were originally located in seagrass meadows but have since gone bare. Records are hourly means. A Hydrolab Datasonde equipped with a shuttered turbidity probe was set up in September 2000 at one of the sites. A second datasonde has been maintained at the Blucher Institute platform at Bird Island since 1992, except for the period September 1998 through September 1999. The Hydrolabs take hourly measurements of temperature, salinity, specific conductance, and dissolved oxygen. Water temperature has been monitored at two additional sites in upper Laguna Madre since 1993. The first site is associated with *Syringodium filiforme* and the second site is associated with *Halodule wrightii*. Records are hourly.

Distribution of Seagrass Meadows and Wintering Redheads in Eastern Nueces Bay, Texas (TAMU-CC Center for Coastal Studies) – 2 one-time emergent marsh surveys and 10 one-time seagrass surveys will be conducted along the western shoreline of Indian Point Peninsula in Nueces Bay to measure salinity, seagrass distribution, site elevation, and vegetation cover. Redhead abundance and behavior data will be collected every three weeks from October through March (2000-2001).

Coastal 2000 (EPA, TPWD) – the primary focus of this program is to assess water quality and benthic communities. However, the program will also assess acreage of SAVs.

Emergent Wetlands

Corpus Christi Ship Channel Improvement Project (USACE, PCCA) – An environmental assessment will be conducted as part of the ship channel improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel.

Implementation of Restoration/Enhancement Projects in Nueces/Corpus Christi Bay: Hydrologic Assessments (TAMU-CC Center for Coastal Studies) - Salinity, elevation surveys, and water level measurements are being taken at multiple sites in three wetland areas from 2000 through 2001 (Indian Point Peninsula, Mustang Island State Park near Water Exchange Pass, and Nature Conservancy lands on Mustang Island near Wilson's Cut). Three-dimensional elevation models will be developed for each location to evaluate water levels within wetlands as well as movement among wetlands and adjacent bays.

Shamrock Island *Spartina alterniflora* Wetland Creation Project: Planning, Implementation, and Evaluation (TAMU-CC Center for Coastal Studies) - Monthly surveys conducted on Shamrock Island and Sinclair

Channel on Mustang Island to evaluate *Spartina alterniflora* marsh vegetation cover and growth characteristics (1999-2000).

Riparian Areas

Riparian Habitat Corridor Assessment in Texas Coastal Bend (TAMU-CC Center for Coastal Studies) - A one-time characterization of each of 40 sites along riparian corridors in CBBEP includes measurements of salinity, turbidity, vegetation community composition, and invertebrate species richness.

Oyster Reefs

TMDL/Oyster Water Use Impairment due to Zinc (TNRCC, GLO, TDH) - The TDH will be conducting a public health risk assessment project in 2001 in Nueces Bay to re-assess oyster water use impairment due to zinc contamination. TDH will collect oyster, fish, and crab tissue and analyze for metals (arsenic, cadmium, copper, lead, mercury and zinc) as well as PCBs, pesticides, and volatile and semivolatile organic compounds. This study is a follow-up to a 1994 tissue study looking at heavy metals in oyster, fish, and crab tissue in Nueces Bay. Monitoring of the area covered and quality of oyster reefs is not conducted at present.

Tidal Flats

No known monitoring ongoing at this time.

Monitoring Program Description

Monitoring will focus on the key habitats of the CBBEP area, as defined in the Bays Plan (SAV, emergent wetlands, tidal flats, riparian areas, and oyster reefs) and will track the location and spatial extent of these habitats through time. The quality of the habitats will also be assessed to ensure the habitats are adequate for sustaining ecosystem health and integrity. In addition to utilizing data from ongoing monitoring and assessment programs, the CBBEP will conduct an aerial land cover/land use assessment every 5 years. Data collected during land cover/land use assessments will be important for many aspects of the RMP, especially since urban development is expected to increase dramatically over the next 20 years. During ground-truthing, habitat data will be collected to supplement data available from ongoing monitoring efforts.

While not included as a key habitat in the *Bays Plan,* soft bay bottom comprises approximately 90% of the bays system. Changes in the areal extent of this habitat will be determined based on measured changes in hard substrate areas, such as oyster reefs. Quality of bay bottom habitat will be monitored through sediment sampling and benthic studies (see Health of the Bays Environmental Monitoring: Sediment Quality).

Habitat surveys conducted at least twice per decade with comparisons of results among survey years will provide comparative data on the quality of habitat and changes in area. Current habitat maps will form the basis of these comparisons. Not all habitats will or need to be surveyed every year or simultaneously.

	However, synoptically collected data on the various habitats will provide better comparative data and will be attempted. More important is the consistency in the timing of the surveys across years to ensure comparisons are not biased by seasonal factors. An assessment of data adequacy relative to the monitoring objective and goals and a Quality Assurance Plan for the habitat monitoring will be completed by 2002. Where baseline data are inadequate to provide quantitative data for assessing change, baseline data will be acquired. Habitat surveys will use remote sensing technology and aerial imagery coupled with ground truth data collected in the field. Ground truth surveys will also collect data to assess the habitat quality. These will include such parameters as species composition and diversity, as well as condition and vigor. For terrestrial habitats like barrier beaches and marshes, above ground biomass will also be quantified on an area-normalized basis. Some habitats such as seagrasses and oyster reefs will require habitat specific mapping techniques such as underwater cameras, side scan sonar, or diver surveys. The TPWD is developing a statewide seagrass monitoring program. The CBBEP will coordinate with the TPWD in this effort. Tidal flats and riparian areas will also require habitat specific monitoring methods. No baseline data exists on the areal extent and location of oyster reefs. This baseline data will need to be acquired before monitoring of this habitat can begin.
Monitoring Parameters	**Area**: Acres of each key habitat **Quality**: Wetland Value Assessment (WVA), Habitat Evaluation Procedures (HEP), and Hydrogeomorphic Approach (HGM) for emergent wetlands. **SAV:** primary parameters include maximum depth of SAV growth, shoot density and patchiness, and vegetative species composition. Secondary parameters include above ground biomass, below ground biomass, and secondary productivity. **Emergent Wetlands:** primary parameters include vegetative species composition and percent cover; secondary parameters include above ground biomass and primary productivity. **Tidal Flats:** changes in area will be used as the primary indicator of system changes; secondary parameters include infaunal and epifaunal species composition. **Riparian Areas**: vegetative species composition, percent cover, length of vegetated stream/shoreline, width of vegetated zone around stream/shoreline, and measures of patchiness of vegetation in riparian areas. **Oyster Reef Areas**: a baseline assessment of hard substrate areas is needed before monitoring can be conducted. Once begun, monitoring could include species composition, shell volume (from quantitative dredge hauls), clump size, oyster density, oyster size distribution, oyster biomass, oyster condition index, oyster

	gonadal-somatic index, oyster sex ratio, prevalence of *Perkinsas marinus*, number of oyster drills, crab densities, mussel densities, and rate of barnacle encrustation.
Stations	The CBBEP will develop a sampling station map that identifies ongoing study sites as well as needed future sites through information gathered at the CBBEP's annual monitoring agencies coordination meeting.
Sampling Frequency	Habitat mapping a minimum of twice per decade.
Funding Agencies	TPWD, EPA, CBBEP, UTMSI, USGS, TAMU-CC, Center for Coastal Studies, FWS, NOAA
Additional Actions	Develop a comprehensive QAPP for habitat monitoring. Continue present level of monitoring and assessment. Identify funding for long-term monitoring. Implement comprehensive QAPP for habitat monitoring.
Relevant Studies and Publications	J.M. Macauley. 1993. EMAP Estuaries – Louisiana Province: 1993 Sampling Field Operations. Texas Parks & Wildlife, Austin, Texas. 1999. Seagrass Conservation Plan for Texas. 79 pp. "Indicator Development: Seagrass Monitoring and Research in the Gulf of Mexico", National Biological Survey Summers, K; G. Steyer; E, Decker; P. Crocker; F; Hill; G. McRae; S; Brown, J; Thomas, J. Simons; D. Brock, C Miska, and J. Johnston. 2000. A Framework for an Integrated and Comprehensive Monitoring Plan for the Estuaries of the Gulf of Mexico. Gulf of Mexico Program. 34 pp. Montagna, P.A., S.A. Holt, C. Ritter, S. Herzka, K.F. Binney, and K.H. Dunton. 1998. Characterization of Anthropogenic and Natural Disturbance on Vegetated and Unvegetated Bay Bottom Habitats in the Corpus Christi Bay National Estuary Program Study Area. CCBNEP-25. Pulich, W., C. Blair, and W.A. White. 1997. Current Status and Trends of Seagrasses in the CCBNEP Study Area. CCBNEP-20. 131 pp. Potential Sites for Wetland Restoration, Enhancement, and Creation: Corpus Christi/Nueces Bay Area. CCBNEP-15. Quammen, M.L., and C.P. Onuf. 1993. Laguna Madre: seagrass changes continue decades after salinity reduction. Estuaries 16: 302-310.

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Withers, K. and J.W. Tunnell Jr. 1998. Identification of Tidal Flat Alterations and Determination of Effects on Biological Productivity of these Habitats within the Coast Bend. Texas Natural Resource Conservation Commission. CCBNEP-23.

2.1.2 Health of the Bays Environmental Monitoring: Water Quality	
Monitoring Objective(s)	*To assess whether water quality standards (designated uses, numeric standards, and narrative standards) are being met.* *To document changes in water quality (i.e., eutrophication related parameters [nutrients, light penetration, dissolved oxygen, chlorophyll] and pathogen indicators) within the CBBEP area through time.* *See also the Action specific monitoring for Water and Sediment Quality, Public Health, and Nonpoint Sources in Section 2.2.*
Measures of Success	➢ Water Quality is maintained or improves over time in impaired or stressed segments.
Monitoring Questions	*Are indicators of pathogens below state standards for contact and non-contact recreational use established by the TNRCC?* *Are areas of low dissolved oxygen decreasing in extent?* *Do dissolved oxygen levels meet state standards established by the TNRCC? Where?* *Are epiphyte loads on SAVs excessive? Are they increasing or decreasing?* *Is the cumulative area and/or volume of these water bodies decreasing, due to removal of water bodies from the 303(d) lists?* *Is the frequency/duration of occurrence of low DO decreasing?* *Is the system eutrophic? Where? When?* *Is the level of eutrophication changing in time and space within the CBBEP area?* *Is light penetration adequate to support SAV growth?* *Do nutrients or light limit primary production in the CBBEP area? Where? When?* *Is phytoplankton biomass increasing or decreasing?* *Are the frequency, duration, and species composition of harmful algal blooms (HABs) changing?* *Are contaminant levels in the water column below state standards established by the TNRCC?* *Is the number of water bodies within the CBBEP area on the 303(d) impaired water body list increasing or decreasing?*
Summary of Current Monitoring and Assessment Programs	Surface Water Quality Monitoring & Assessment Project, Phase II (CBBEP, TAMU-CC Center for Coastal Studies, NRA) – this year-long water quality characterization includes quarterly sampling at 30 randomly selected stations and 5 fixed inner harbor sites and bi-monthly sampling at 6 targeted (master) stations for areas from Corpus Christi Bay north (CBBEP, 2000c). Samples are taken for selected trace metals and a full complement of nutrients plus supporting hydrographic and water quality data. Surface Water Quality Monitoring Project, Upper Laguna Madre & Baffin Bay, Phase III (CBBEP, TAMU-CC Center for Coastal Studies, NRA) - 30 EMAP sites from upper Laguna Madre south will be sampled quarterly for TNRCC routine

field, conventional water chemistry, metals in water, and benthic macroinfauna. Surface Water Quality Monitoring (TNRCC) – 26 sites sampled 1 – 4 times per year for depth, DO, pH, temperature, conductivity, salinity, fecal coliform, nutrients, chlorophyll a, dissolved and suspended solids, metals in water, metals in sediment, organics in water, and fish tissue in bays and some creeks throughout the CBBEP area.

Coastal 2000 (EPA) – this program will collect water column samples for nutrient concentrations, pH, water depth, temperature, salinity, %light transmittance, dissolved oxygen concentrations, and chlorophyll concentration. The program will also collect sediment samples for benthic community composition, benthic abundance, benthic biomass, and evaluate the acreage of SAVs.

Clean Rivers Program (NRA) – takes quarterly samples at 22 stations throughout the rivers and bays. Depending on the location, routine benthic samples, conventional parameters, bacterial indicators, and instantaneous flow samples are collected. An additional 6 stations are sampled bi-monthly for TSWQS metals in water and conventional parameters. The Authority also sampled 120 stations for routine benthic parameters, metals included on the TSWQS list, and conventional parameters during a one-time survey event. Samples are collected in Aransas, Copano, Mission, Corpus Christi, Nueces, and Redfish Bays.

TMDL/Oyster Water Use Impairment due to Zinc (TNRCC, GLO, TDH) - The TDH will be conducting a public health risk assessment project in 2001 in Nueces Bay to re-assess oyster water use impairment due to zinc contamination. TDH will collect oyster, fish, and crab tissue and analyze for metals (arsenic, cadmium, copper, lead, mercury and zinc) as well as PCBs, pesticides, and volatile and semivolatile organic compounds. Exact locations in Nueces Bay will be determined.

Ecological Influence of Treated Wastewater Diversions on Delta Habitats in a Semiarid Climate (TAMU-CC, Center for Coastal Studies) – 14 sites sampled monthly (from 1997-2003) for TNRCC routine field parameters, benthic macroinfauna, epifaunal invertebrates and nekton macrofauna, and birds.

Oso Bay and Creek DO Monitoring (TAMU-CC Conrad Blucher Institute, Center for Coastal Studies) – 5 fixed Hydrolab DO platforms are sampled at 30 minute intervals for routine field parameters including DO, salinity, water temperature, and pH (1993 to present).

Oso Creek/Oso Bay Project Surface Watershed System Study (TAMU-CC, Center for Coastal Studies) – 8 sites sampled monthly (from 1999-2000) for TNRCC routine field parameters, conventional water chemistry, benthic macroinfauna, epifaunal invertebrates and nekton macrofauna, birds, and microbiological indicators; collection of baseline land use data (GIS).

Nueces Bay Salinity Monitoring Project (TAMU-CC Conrad Blucher Institute) – 7 Hydrolab sites in the Nueces River, Delta, and Bay are monitored for routine field parameters, salinity, water temperature, DO, and pH at 30 minute intervals (1990 to present).

Ambient Water Quality Monitoring/Datasonde (TWDB- TPWD) – 4 sites are currently monitored on an hourly basis for water temperature, conductance, pH, dissolved oxygen, and salinity. Up to 9 years of data are available for some historic and current sites. Data are used to establish relationships between freshwater inflows and salinity in Aransas Bay, Laguna Madre, Corpus Christi Bay, and Baffin Bay.

Atmospheric Deposition Study (CBBEP, TAMU – GERG) – This wet and dry atmospheric deposition monitoring program was amended after the first year to provide data that can be included as part of EPA's National Atmospheric Deposition Program (NADP). Samples are currently collected weekly at two sites, one on the north shore of Nueces Bay at White Point and the other at TAMU-CC on Ward Island. Each station collects wet and dry deposition as well as meteorological data. Samples are analyzed for conductivity, calcium, magnesium, potassium, sodium, ammonium, nitrate, total phosphate, chloride, sulfate, copper, zinc, lead, cadmium, titanium, vanadium, chromium, nickel, arsenic, selenium, and manganese.

Pfisteria (TPWD) – 5 sites sampled approximately monthly for temperature, salinity, DO, pH, chlorophyll a, nutrients, and Pfisteria during 2000-2001in the Nueces River, Baffin Bay, Oso Bay, Port Aransas, and Mesquite Bay.

Characterization of Trace Metals and Radionuclides in Lake and Coastal Sediments (TAMU-CC Conrad Blucher Institute) – sediment samples from Nueces Bay and Lake Corpus Christi are analyzed for metals, organics, and radionuclides; fresh water samples from Lake Corpus Christi are also analyzed for metals.

Monitoring Constructed Wetlands for Wastewater Reuse (TAMU-Kingsville Environmental Engineering) – water at a constructed wetland site near Sarita, Texas will be sampled weekly for DO, temperature, pH, conductivity, nutrients, total suspended solids and BOD. Monitoring will take place for four months following the construction of the wetlands (anticipated dates April – July 2001).

Port of Corpus Christi Real Time Navigation Project (TAMU-CC Conrad Blucher Institute) – 3 sites measure water velocity at 12-minute intervals (1999 to present). Sites include a current meter at the UTMSI pier in Port Aransas, the Navy base at Homeport in Ingleside, and a buoy offshore of Port Aransas in the Gulf of Mexico.

Radar Water Velocity Project (TAMU-CC Conrad Blucher Institute) – Surface current velocities are measured periodically throughout the year in Corpus Christi Bay, Matagorda Bay, Galveston Bay, and the Galveston offshore area.

Corpus Christi Ship Channel Improvement Project (USACE, PCCA) – An environmental assessment will be conducted as part of the ship channel improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel.

Benthos Sampling (UTMSI, TWDB, Sea Grant, GLO, US Bureau of Reclamation) – 15 sites sampled quarterly for benthic invertebrates, nutrients, DO, and salinity. Site locations include Nueces Bay (2), Corpus Christi Bay (3), Rincon Bayou (6), Baffin Bay (2), and Laguna Madre (2).

Nueces Estuary Trawl Survey (TPWD) – Fish trawls are conducted at 10 fixed stations in the Nueces Estuary monthly during the summer and every other month in the winter for a total of 9 months per year from 1996 – 2000. In addition to species counts, routine field parameters are measured for water, including temperature, pH, DO, salinity, conductivity, and percent saturation.

Seagrass Monitoring (USGS National Wetlands Research Center, Texas Gulf Coast Field Station) – The USGS Texas Gulf Coast Field Station has been monitoring underwater light since 1993 at two sites in the upper Laguna Madre that were originally located in seagrass meadows but have since gone bare. Records are hourly means. A Hydrolab Datasonde equipped with a shuttered turbidity probe was set up in September 2000 at one site. A second datasonde has been maintained at the Blucher Institute platform at Bird Island since 1992, except for the period September 1998 through September 1999. The Hydrolabs take hourly measurements of temperature, salinity, specific conductance, and dissolved oxygen. Water temperature has been monitored at two additional sites in the upper Laguna Madre since 1993. The first site is associated with Syringodium filiforme and the second site is associated with Halodule wrightii. Records are hourly.

Seagrass Monitoring (UTMSI) – 1 site in Upper Laguna Madre sampled monthly for density, biomass, PAR, chlorophyll, and nutrients (1989 to present).

TCOON (TAMU-CC, Conrad Blucher Institute; TWDB; TGLO; USACE) – 12 tide gauges are located in the CBBEP area collecting water level, wind speed, wind direction, and temperature data. Some gauges collect water quality data (e.g., salinity, dissolved oxygen). Gauges are located in Laguna Madre, Corpus Christi Bay, Nueces Bay, Gulf of Mexico, Port Aransas, Aransas Bay, and Copano Bay.

Rangeland Water Quality (Welder Wildlife Foundation, GLO) – The foundation samples runoff at 3 sites within the Welder Refuge after every rain event. Sediments are sampled for various parameters and water is analyzed for fecal coliform.

Nueces Bay Ichthyoplankton (TPWD) – 4 sites sampled bi-monthly from February through May for the past 2 years. Samples collected include fish, plankton, and water quality parameters (temperature, salinity, DO, pH).

Bay Water (Corpus Christi/Nueces County Public Health Department) – monthly sampling at 16 sites in Corpus Christi Bay for fecal coliform and enterococci. In addition, the National Park Service samples waters at its lifeguarded beaches weekly during the summer season for enterococci. In the past, GLO has monitored pathogens at Gulf Beaches under its Beach Watch program. Although currently discontinued, this program may be reinstituted.

Regional Approach to Ensure Recreational Water Quality (TNRCC) – Collection

	and analysis of microbial indicator organisms (fecal coliform, enterococcus, and total coliform) twice a month at four sites for twelve months (December 1998 through May 2000), including collection and analysis during and after a minimum of four significant rainfall events. Routine field parameters are collected at all stations monthly. Hypoxia in Corpus Christi Bay - Dissolved oxygen concentrations in water are measured biweekly or triweekly during summer (July-August) by spatial surveys or continuously with deployments. Sampling performed from 1996-2001. A GIS database of the hypoxic conditions will be created in 2001. Two experiments on hypoxic effects on benthos performed. Surveys at 16 sites in the southeast portion of Corpus Christi Bay. Continuous measurements at one or two sites. National Mussel Watch Program - Annual collection of oysters and *in situ* data (temperature, DO, salinity, pH). Oysters analyzed for PCBs, pesticides, and metals. Sampling locations include Mesquite Bay, Aransas Bay, Copano Bay, and Corpus Christi Bay. Implementation of Restoration/Enhancement Projects in Nueces/Corpus Christi Bay: Hydrologic Assessments (TAMU-CC Center for Coastal Studies) - Salinity, elevation surveys, and water level measurements are being taken at multiple sites in three wetland areas from 2000 through 2001. Three-dimensional elevation models will be developed for each location to elevate water levels within wetlands as well as movement among wetlands and adjacent bays. Riparian Habitat Corridor Assessment in Texas Coastal Bend (TAMU-CC Center for Coastal Studies) - A one-time characterization of each of 40 sites along riparian corridors in CBBEP includes measurements of salinity, turbidity, vegetation community composition, and invertebrate species richness.
Monitoring Program Description	The CBBEP has developed an assessment framework for evaluating the water quality status in the CBBEP area (CBBEP, 2000c). This program is designed to determine the region, area, and seasons during which water quality standards (metals, dissolved oxygen, *etc.*) within the CBBEP area are exceeded. The design is based on the stratified-random statistical sample collection design of EMAP. The CBBEP Water Quality Monitoring Program will continue this approach. For long-term monitoring, the approach will be revised to include a status assessment (whereby segments of the Bays are sampled under a stratified-random design to determine area of impact) and a trends assessment (whereby selected fixed stations undergo repeated measurements through time). The status measurement program will not sample each region of the bay every year. Rather, defined areas (segments) will be sampled on a rotating basis such that in a given five-year period each area is sampled at least once. This will enable evaluation of trends in the status of the areas and bays as a whole on a five-year frequency. The fixed location (or master) stations will be selected based on the current water quality information and results from the CBBEP water quality assessment. Station locations will be chosen to be representative of the region in which they are located. These master stations will be sampled at least quarterly. More frequent sampling may be required at selected master stations if the data indicate high variability in the system. If water quality is found to be stable (unchanging) the

	sampling frequency will be reduced. Because there are several water quality studies ongoing in the CBBEP area, these programs will be integrated into the overall water quality status and trends monitoring program. Stations occupied by these ongoing studies may become master stations. Resources presently used to sample a given area extensively may be used to support sampling under the status portion of the study. Data gathered under the water quality monitoring program may point to the need for seasonal, area-specific monitoring to address issues such as pesticide loading, low DO, low light availability on some seagrass beds, occasional harmful algal blooms, exceedances of water quality criteria for metals and pathogen indicators. The monitoring program will also try to address recognized data gaps, such as the need for additional monitoring in contact recreation areas, particularly during wet weather and following storm events. For example, DO sampling should focus on the mid summer-fall period and ensure diurnal cycles or early morning conditions are measured in known/suspected problem areas. The CBBEP Quality Assurance Plan provides details for the water quality monitoring. This QAPP will form the basis for the RMP. Sample locations and frequency will be developed on the basis of the results of this study, factoring in historical results.
Monitoring Parameters	The parameters included in the water quality program are summarized below. **Station data** – location, time, date, tide stage, water depth **Routine field parameters** – *In situ* temperature, conductivity (salinity), dissolved oxygen, transparency, fluorescence (chlorophyll biomass estimate), and pH (surface and 0.5 m depth intervals where applicable) **Nutrients** – nitrogen (ammonia, nitrate, nitrate plus nitrite, total nitrogen), phosphorous (orthophosphate and total), total organic carbon (TOC) and dissolved organic carbon (DOC), sulfide if dissolved oxygen is <1 mg/L, Ammonia (under low flow) **Chlorophyll a and b** **Total suspended solids** (TSS) **Biochemical Oxygen Demand** (BODc) – In areas with identified DO problems **Sediment Oxygen Demand** (SOD) **Trace metals** **Sulfide** (if a station has low dissolved oxygen level) **Organics** (PAH, PCBs, pesticides) **Fecal Indicators** – fecal coliform, enterococci, e.coli
Stations	See Figures 2-1 through 2-5. The CBBEP will continue to revise the sampling station maps to identify ongoing study sites as well as needed future sites through information gathered at the CBBEP's annual monitoring agencies coordination meeting. The final number of stations will be determined through appropriate power analysis. These stations will be distributed through a stratified-random design to include fixed stations.
Sampling Frequency	Long-term sample collection frequency will be determined from the results of the Coastal Bend Bays Surface Water Quality Monitoring Program (CBBEP 2000c).

	Master stations will be sampled bi-monthly. Status stations will be sampled quarterly for nutrients and semiannually for metals. Bacterial indicator stations will be conducted under present city or other authority (*i.e.*, beaches) monitoring programs.
Funding Agencies	TNRCC, EPA, CBBEP, local governments, Corpus Christi/Nueces County Public Health Department, NRA, TPWD, Gulf of Mexico Program, Welder Wildlife Foundation, GLO, USGS, UTMSI, TWDB, Sea Grant, US Bureau of Reclamation, USACE, PCCA, TAMU-CC Conrad Blucher Institute, TAMU-Kingsville Environmental Engineering, TAMU – GERG
Additional Actions	Revise the CBBEP QAPP to reflect the long-term water quality monitoring. Evaluate the CBBEP Surface Water Quality Monitoring results to establish ability to statistically detect change. Maintain funding for present level of monitoring; Identify funding for long-term monitoring. Implement comprehensive Water Quality Monitoring QAPP.
Relevant Studies and Publications	Ward, GH and NE Armstrong. 1997. Current Status and Historical Trends of Ambient Water, Sediment, Fish and Shellfish Tissue Quality in the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission. CCBNEP-13 Macauley, JM; JK Summers; and VD Engle. 1999. Estimating the ecological condition of the estuaries of the Gulf of Mexico. Environmental Monitoring and Assessment. 57:59-83. Carr, RS; PA Montagna; JM Biedenback; R Kalke; MC Kennicutt; R Hooten; and G Cripe. 2000. Impact of Storm-water Outfalls on Sediment Quality in Corpus Christi Bay, Texas, USA. Environ. Toxicol. Chem. 19(3) pp.561-574. Summers, K; G. Steyer; E, Decker; P. Crocker; F; Hill; G. McRae; S; Brown, J; Thomas, J. Simons; D. Brock, C Miska, and J. Johnston. 2000. A Framework for an Integrated and Comprehensive Monitoring Plan for the Estuaries of the Gulf of Mexico. Gulf of Mexico Program. 34 pp. Ward G.H. 1997. Processes and Trends of Circulation Within the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission. CCBNEP-21. Brock, D.A. 2000. Nitrogen budget for low and high freshwater inflows, Nueces Estuary, Texas. MS. Submitted to *Estuaries*. Ritter, C. and P.A. Montagna. 1999. Seasonal Hypoxia and models of benthic response in a Texas bay. *Estuaries* 22:7-20.

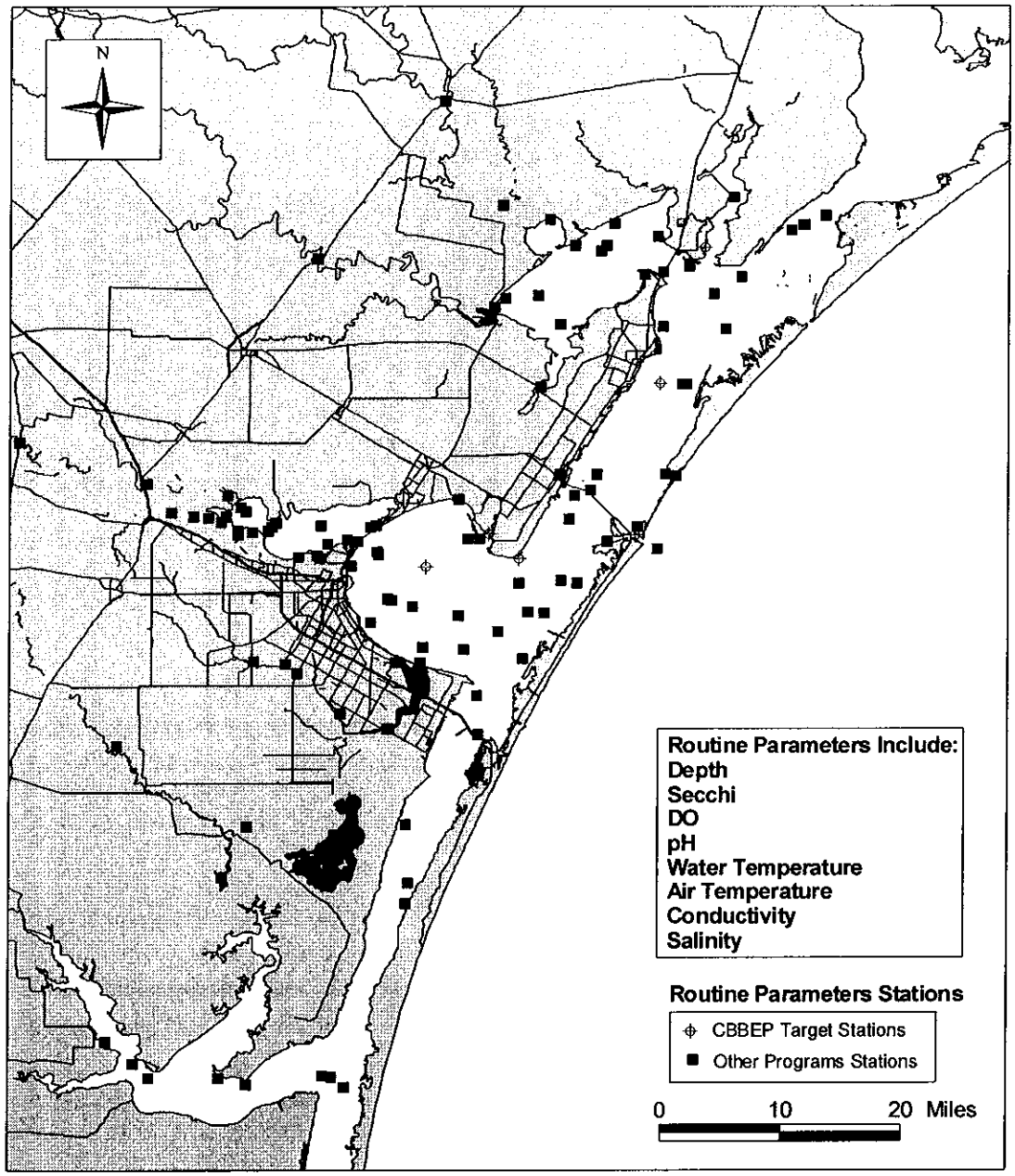

Figure 2-1. Routine Parameter Sampling Stations Throughout the CBBEP Area.

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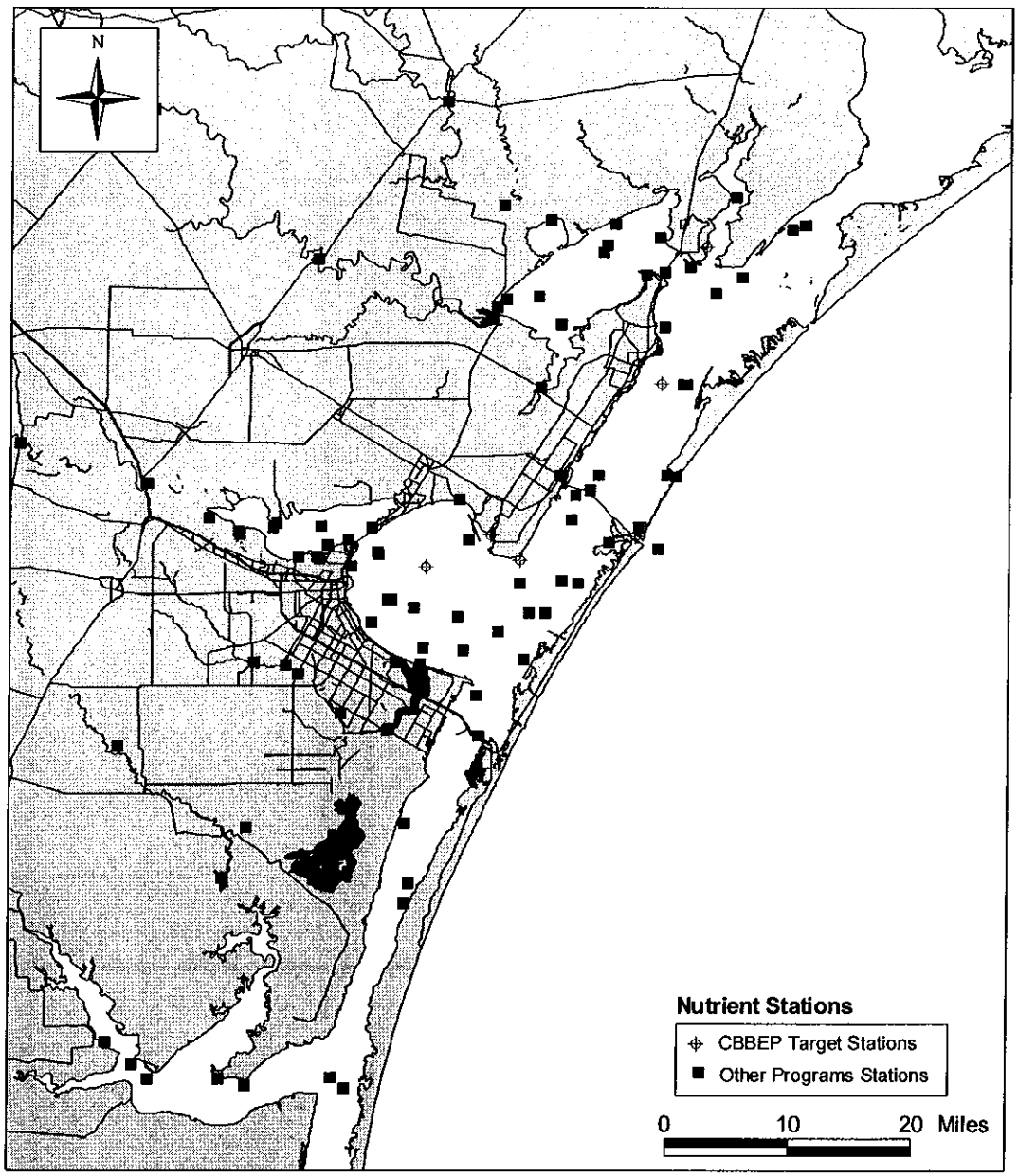

Figure 2-2. Nutrient Parameter Sampling Stations Throughout the CBBEP Area.

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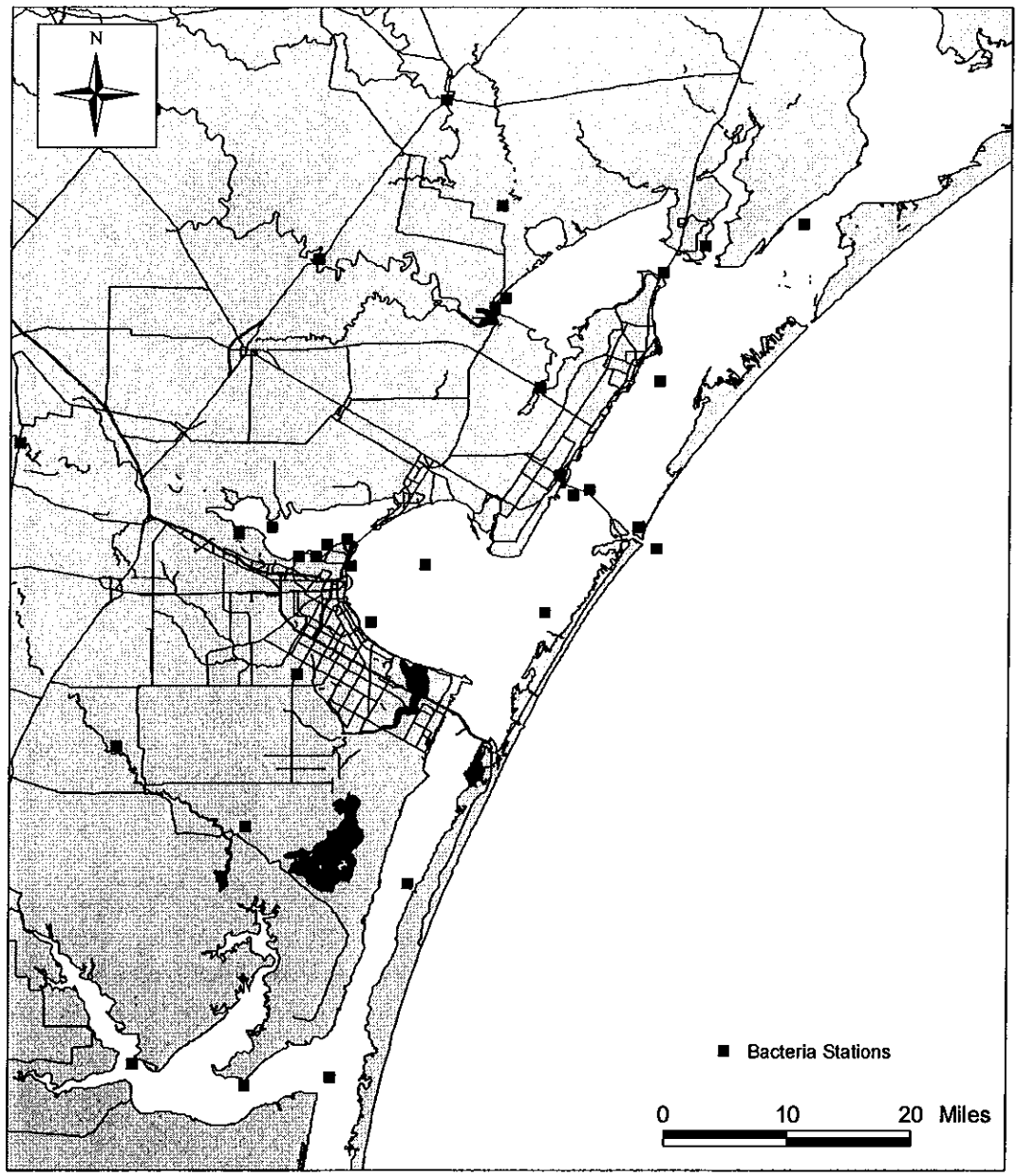

Figure 2-3. Bacteria Sampling Stations Throughout the CBBEP Area.

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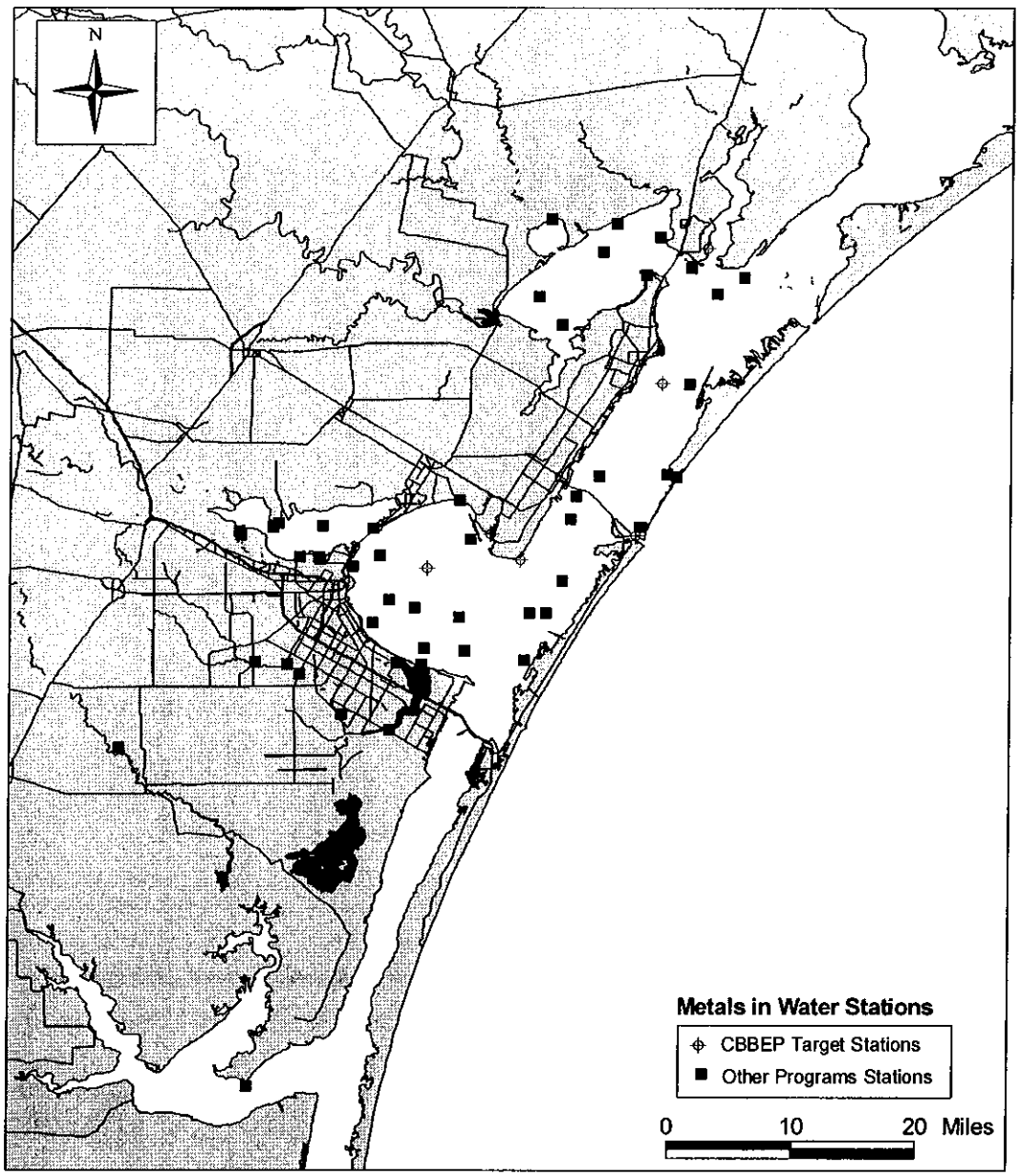

Figure 2-4. Metals in Water Sampling Throughout the CBBEP Area.

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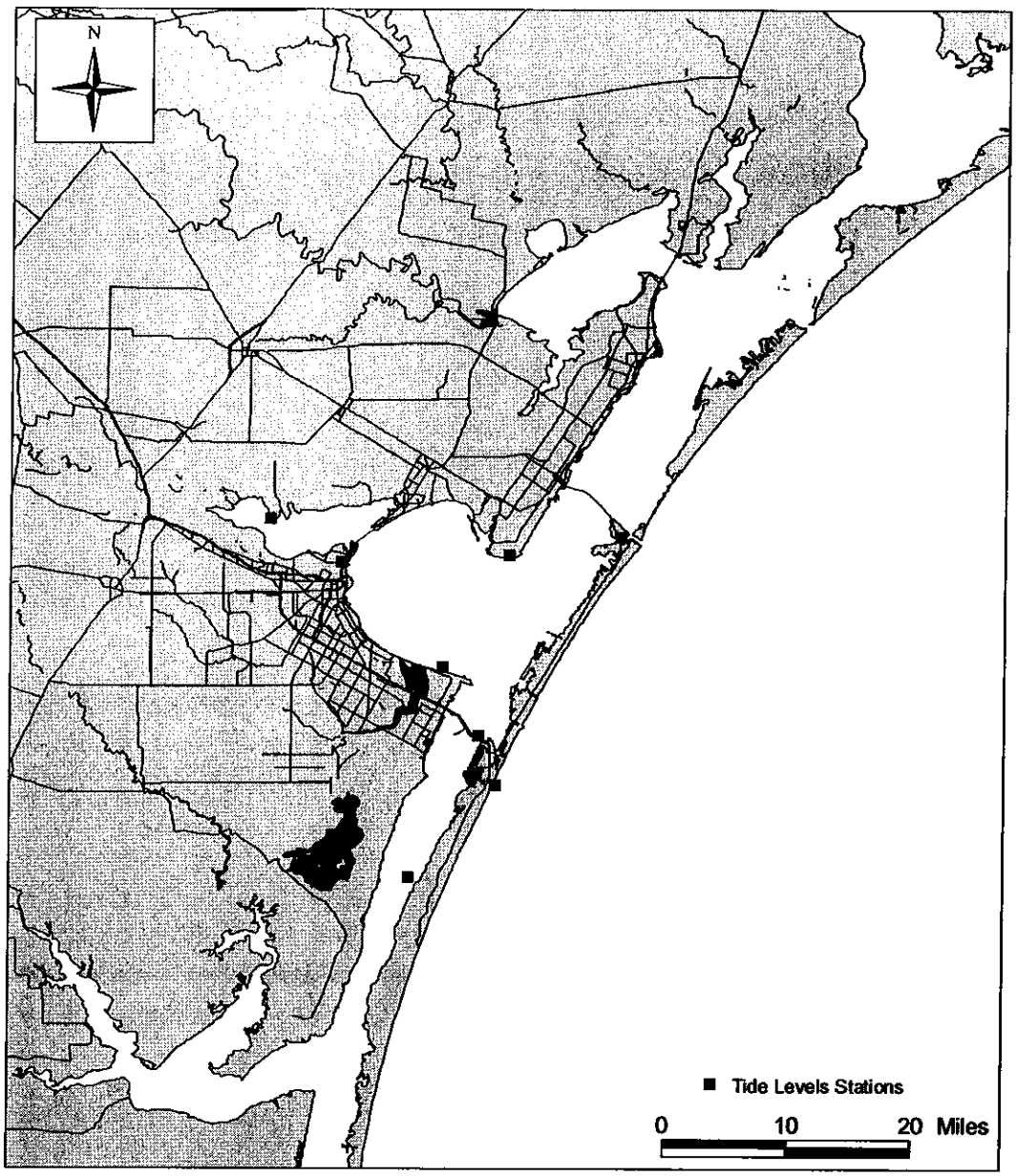

Figure 2-5. Tide Level Measurement Stations Throughout the CBBEP Area.

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2.1.3 Health of the Bays Environmental Monitoring: Sediment Quality	
Monitoring Objective(s)	*To assess changes in the quality of sediments (chemical contaminants and toxicity) within the CBBEP area through time.* *To assess changes in the benthic infaunal communities within the CBBEP area through time.* *To assess whether sediment screening levels are exceeded and where.* *See also the Action specific monitoring for sediment quality in Section 2.2.*
Measures of Success	➢ Sediment quality in uncontaminated areas is maintained and improves in contaminated areas through time.
Monitoring Questions	*Are contaminant levels in sediments decreasing or increasing?* *Do contaminant levels in the sediments exceed screening level guidelines determined by NOAA and TNRCC?* *Are sediments toxic to representative marine organisms?* *Are areas of known toxicity improving?* *Is the diversity and condition of the benthic infaunal community increasing or decreasing through time? Where?* *Are contaminants, eutrophication, or both affecting the condition of the benthic community?* *What portions of the bays and estuaries meet sediment-screening levels?* *What portions of the study area have healthy benthic communities?*
Summary of Current Monitoring and Assessment Programs	Surface Water Quality Monitoring Program (TNRCC) – the TNRCC samples 17 locations (see Table 2-2) on a semi-annual\quarterly basis for metals and bulk sediment properties. Petroleum, pesticide and chlorinated hydrocarbon measurements are infrequently made. Surface Water Quality Monitoring Program (CBBEP) – In 2000, the CBBEP initiated a year-long water quality and benthic infaunal characterization study that includes quarterly sampling at 43 stations for water quality and benthic infaunal community parameters. Several stations are located at stations sampled by other programs. Thirty stations are randomly selected based on a random stratified station location design. The program is conducted by TAMU-CC. Sampling sites are located throughout Mission Bay, Copano Bay, St. Charles Bay, Aransas Bay, Redfish Bay, Oso Creek/Oso Bay, Corpus Christi Bay, and Nueces Bay. Bay Sediment Chemistry Monitoring and Assessment (TAMU-CC, Center for Coastal Studies, NRA) - 30 EMAP Surface Water Quality Monitoring project sites from Corpus Christi Bay north and 30 EMAP Surface Water Quality Monitoring project sites from Laguna Madre south will be monitored quarterly for one year for standard TNRCC sediment conventionals (e.g., grain size, TOC, AVS, etc.).

Coastal 2000 (EPA, TPWD) –The Gulf of Mexico Program is proposing as part of EPA's Coastal 2000 program to collect sediment samples for benthic community composition, benthic abundance, benthic biomass, and acreage of SAVs. Sediments will be analyzed for metals, organics, TOC, grain size, and sediment toxicity. The program will also collect water column samples for nutrient concentrations, pH, water depth, temperature, salinity, %light transmittance, dissolved oxygen concentrations, and chlorophyll concentration.

Oso Creek/Oso Bay Project Surface Watershed System Study (TAMU-CC Center for Coastal Studies) – Eight stations in this subsystem are sampled monthly for routine TNRCC field parameters, conventional water chemistry, benthic macrofaunal, epifaunal invertebrates and nekton, plus bird observations and microbiological indicators.

Rangeland Water Quality (Welder Wildlife Foundation) – The foundation samples runoff at 3 sites within the Welder Refuge after every rain event. Sediments are sampled for various parameters and water is analyzed for fecal coliform.

Clean Rivers Program (NRA) – Quarterly samples are collected at 22 stations throughout the rivers and bays of the CBBEP area. Depending on the location, routine benthic samples, conventional parameters, bacteria, and instantaneous flow samples are collected. An additional 6 stations are sampled bi-monthly to evaluate metals and conventional parameters in the water against Texas State Water Quality Standards (TSWQS). The Authority has also sampled 120 stations for routine benthic samples, metals in water that are on the TSWQS list, and conventional parameters during a one-time survey event. Samples were collected in Aransas, Copano, Mission, Corpus Christi, Nueces, and Redfish Bays. The Nueces River Authority also performed routine benthic sampling and analysis at 12 stations on a quarterly basis during FY 2001.

Ecological Influence of Treated Wastewater Diversions on Delta Habitats in a Semiarid Climate (TAMU-CC, Center for Coastal - 14 sites sampled monthly (from 1997-2003) for TNRCC routine field parameters, benthic macroinfauna, epifaunal invertebrates and nekton macrofauna, and birds.

Benthos Sampling (UTMSI, TWDB, Sea Grant, GLO, US Bureau of Reclamation) - 15 sites sampled quarterly for benthic invertebrates, nutrients, DO, and salinity. Site locations include Nueces Bay (2), Corpus Christi Bay (3), Rincon Bayou (6), Baffin Bay (2), and Laguna Madre (2).
A total of 6 sites have been sampled since 1984. The additional 9 sites were added in 1987.

Characterization of Trace Metals and Radionuclides in Lake and Coastal Sediments (TAMU-CC Conrad Blucher Institute) - Sediment samples from Nueces Bay and Lake Corpus Christi are analyzed for metals, organics, and radionuclides; fresh water samples from Lake Corpus Christi are also analyzed for metals.

Corpus Christi Ship Channel Improvement Project (USACE, PCCA) - An environmental assessment will be conducted as part of the ship channel

	improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel. Mussel Watch Project (NOAA) – 7 sites within the CBBEP area are monitored under this nationwide project that has monitored chemical contaminants in sediments and bivalve mollusks since 1986. Bivalves are collected every other year and sediments every fifth year. Samples are analyzed for PAHs, PCBs, DDT, DDD, DDE, 16 other chlorinated pesticides, tributyl-tins, 3 major elements, and 11 trace elements.
Monitoring Program Description	Within the CBBEP area, bay segments and sample stations for assessing the status and trends of the sediments has been developed as part of Coastal 2000, an integrated and comprehensive status and trends monitoring plan for the Gulf of Mexico (Summers *et al.* 2000). The design is based on the stratified-random statistical sample collection design of EMAP. The Coastal 2000 program will sample selected stations in the bays for bulk sediment properties, selected chemical contaminants and measures of benthic community and sediment toxicity. Sediment toxicity testing will be supplemented by the CBBEP with site-specific monitoring when and if problem areas are discovered, if funding is available. For example, testing may be conducted during post-project environmental evaluations of actions that include pollution control measures. Such assessments could be repeated on a 5- or 10-year cycle. The CBBEP Bay Sediment Chemistry Monitoring and Assessment program will utilize the same approach as Coastal 2000. The approach will include a status assessment, whereby segments of the bays are sampled randomly to determine area of impact and trend assessment and selected fixed stations undergo repeated measurements through time. The status measurement program will not sample each region of the bay every year. Rather, defined areas (segments) will be sampled on a rotating basis such that in a given five-year period each area is sampled at least once and trends in the status of the areas and bay as a whole can be assessed. The targeted fixed location (or master) stations are selected based on the current sediment quality information and are chosen as stations that are representative of the region in which they are located. These master stations will be sampled annually to evaluate trends and provide information from which changes in the sediment quality and associated benthic community can be identified. If sediment quality is found to be stable (unchanging), the sampling frequency will be reduced. The period for re-sampling will be based on the variability observed in the sediments and the ability of the measurement program to detect change. The CBBEP Quality Assurance Plan (CBBEP, 2000b) provides details for the sediment quality monitoring. This QAPP will form the basis for the RMP. A comprehensive long-term sediment quality assurance project plan will be developed to guide the monitoring. This QAPP will incorporate the monitoring framework defined by Summers *et al.* (2000) and expand it to ensure appropriate coverage of the system in time and space. Over time, changes in the status of a region will be identified. Monitoring will be conducted on a schedule developed in the QAPP.

	There are several other sediment quality studies ongoing in the CBBEP area, as described above. The results of these programs will be integrated into the overall sediment quality status and trends monitoring program, and, if appropriate, stations occupied by these ongoing studies may become master stations. The annual monitoring coordination meeting will be utilized to determine if resources presently used to sample and analyze the conditions of the sediments in selected areas on a semi annual basis (*e.g.*, TNRCC Surface Water Quality Monitoring Program) could be redirected to support the sampling and analysis proposed under the status portion of the study, provided the program goals of those monitoring efforts would not be compromised. Moreover, these resources could be used to expand the analyte list to include organic chemicals of concern in the system. If the goals of these site specific or study programs can not be met under the "Health of the Bays" monitoring, site specific monitoring will continue but under separate QAPPs that may be developed in support of the Action Item-specific section of this plan or as independent studies. Regardless, these studies will be coordinated to the maximum extent with the RMP and methodologies that provide comparable results will be used to ensure the resulting data can be inter-compared.
Monitoring Parameters	**Bulk Sediment Properties:** grain size, Total Organic Carbon, Redox Potential Discontinuity (RPD) **Contaminants:** NOAA Status and Trends list of contaminants (PAHs, PCBs, pesticides, and metals), TBT, dioxin, diazinon, chlorpyrifos, acid volitile sulfide/simultaneously extracted metals (AVS/SEM) **Sediment Toxicity:** Sediment Quality Triad (sediment toxicity, sediment chemistry, and benthic macroinvertebrate community structure) **Benthic Infaunal:** species, community indicators – diversity measures (*i.e.*, log-series alpha, Pielous's eveness (J'), Sheenan diversity, (H'), and total species per grab), and proportion of opportunistic infaunal species (specific species to be determined). Indicators of benthic community health developed by the Gulf of Mexico Program EMAP data – EMAP Benthic Index (Virginia Engle EPA/620/R-99/005, Evaluation Guidelines for Ecological Indicators) may be used if appropriate and adequate reference sites in the CBBEP can be identified.
Stations	See Table 2-2 and Figures 2-6 and 2-7. The CBBEP will continue to revise the sampling station map to identify ongoing study sites as well as needed future sites through information gathered at the CBBEP's annual monitoring agencies coordination meeting.

Sampling Frequency	Sediment samples will be collected annually at the master (target stations) to evaluate trends at these representative stations. Stations used to evaluate the status of the system (stratified random stations) will be sampled on a rotating basis by subregion. Each subregion of the system area will be sampled at least once every five years.
Funding Agencies	TNRCC, CBBEP, Nueces River Authority, EPA, Rob and Bessie Welder Wildlife Foundation, the Gulf of Mexico Program, EPA, TPWD, GLO, FWS, NOAA
Additional Actions	Develop a comprehensive QAPP for sediment quality monitoring. Establish basis for statistical detection of change. Maintain funding for present level of monitoring. Evaluate redistributing selected sampling and analysis efforts and resources to ensure the RMP goals and objectives are met. Identify funding for long-term monitoring. Coordinate with Gulf of Mexico Program to increase funding to expand Coastal 2000 program to ensure an adequate statistical sampling to evaluate status and trends. Implement comprehensive QAPP for sediment quality monitoring.
Relevant Studies and Publications	Ward, GH and NE Armstrong. 1997. Current Status and Historical Trends of Ambient Water, Sediment, Fish and Shellfish Tissue Quality in the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission. CCBNEP-13. Macauley, JM; JK Summers; and VD Engle. 1999. Estimating the ecological condition of the estuaries of the Gulf of Mexico. Environmental Monitoring and Assessment. 57:59-83. Carr, RS; PA Montagna; JM Biedenback; R Kalke; MC Kennicutt; R Hooten; and G Cripe. 2000. Impact of Storm-water Outfalls on Sediment Quality in Corpus Christi Bay, Texas, USA. Environ. Toxicol. Chem. 19(3) pp.561-574. Summers, K; G. Steyer; E, Decker; P. Crocker; F; Hill; G. McRae; S; Brown, J; Thomas, J. Simons; D. Brock, C Miska, and J. Johnston. 2000. A Framework for an Integrated and Comprehensive Monitoring Plan for the Estuaries of the Gulf of Mexico. Gulf of Mexico Program. 34 pp. Ritter, M.C. and P.A. Montagna. 1999. Seasonal hypoxia and models of benthic response in a Texas bay. Estuaries 22:7-20.

Mannino, A. and P.A. Montagna. 1997. Small scale spatial variation of macrobenthic community structure. Estuaries 20:159-173.

Mannino, A. and P.A. Montagna. 1996. Fine-scale spatial variation of sediment composition and salinity in Nueces Bay of South Texas. Texas Journal of Science 48:1-14.

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Montagna, P.A. and R.D. Kalke. 1995. Ecology of infaunal Mollusca in south Texas estuaries. American Malacological Bulletin 11:163-175.

Montagna, P.A. and R.D. Kalke. 1992. The effect of freshwater inflow on meiofaunal and macrofaunal populations in the Guadalupe and Nueces Estuaries, Texas. Estuaries 15:266-285.

Table 2-2. TNRCC Water and Sediment Quality Sampling Stations within the CBBEP Area

NEP Site #	LAT	LONG	TNRCC Site #	Type and Frequency (per year) of Sampling					Location Description
				Routine	DO	Metals in Water	Metals in Sediment	Other	
	27 50 48.0	97 31 15.0	12960	4	2	2	-	-	Nueces River Tidal North of Viola turning basin
	27 29 08.0	97 32 18.0	13090	4	-	2	-	-	Petronilla Creek 1.2 km upstream of the confluence with Tunas Creek
	27 37 20.0	97 39 45.0	13094	4	-	4	2	flow/4	Petronilla Creek at FM 892 SE of Driscoll
	27 32 18.0	97 30 36.0	13033	4	-	-	-	flow/4	San Fernando Creek at US77 bypass bridge at Kingsville
	28 09 48.0	96 51 42.0	13400	4	-	-	-	-	Mesquite Bay south of ICWW Marker 13
	28 00 05.0	97 01 40.0	13402	4	-	-	2	-	Aransas Bay Intersection of Intracoastal canal and Lydia Ann Channel
	27 51 03.6	97 03 14.4	16492	4	-	2	2	Bacteria	Aransas Bay in Lydia Ann Channel west of Light House
	28 05 15.0	97 12 33.0	14783	4	-	-	1	-	Copano Bay 1 mile east of Bayside
	27 48 40.0	97 18 05.0	13407	4	-	4	2	-	Corpus Christi Bay at CM #62
	27 45 40.0	97 09 45.0	14355	4	-	4	2	-	Corpus Christi Bay near Shamrock Point
	27 48 36.0	97 23 18.0	13410	4	-	4	1	-	Corpus Christi Bay near Corpus Christi Ship CM #86
	27 45 05.0	97 21 54.0	13411	4	-	4	1	-	Corpus Christi Bay ½ mile off Doddridge Road
	27 50 15.0	97 23 36.0	13421	4	-	-	1	-	Nueces Bay at US 181 Bridge at Causeway (south side)
	27 49 58.0	97 24 57.0	13422	4	-	-	1	-	Nueces Bay ½ mile from south shore at east overhead powerline
	27 51 02.0	97 28 52.0	13425	4	-	4	2	fish tissue/1	Nueces Bay near Whites Point
	27 53 00.0	97 07 42.0	14801	4	-	2	2	-	Redfish Bay at the ICWW at Aransas Pass
	27 54 15.0	97 08 42.0	13287	4	-	-	-	-	Conn Brown Harbor
	27 49 13.0	97 25 44.0	13430	4	-	2	1	-	Corpus Christi Inner Harbor in Avery turning basin
	27 49 10.0	97 27 00.0	13432	4	-	2	2	organics in water/2	Corpus Christi Inner Harbor near Navigation Blvd. draw bridge
	27 50 36.0	97 31 12.0	13439	4	-	2	1	-	Corpus Christi Inner Harbor in Viola turning basin
	27 36 00.0	97 14 24.0	13443	4	2	-	-	-	Laguna Madre south of the intersection of ICWW and Padre Island causeway
	27 16 35.0	97 24 37.0	13444	4	-	-	-	-	Laguna Madre at intersection of ICWW at Baffin Bay marker
	27 28 45.0	97 19 15.0	13445	4	2	-	-	-	Laguna Madre at ICWW near Bird Island
	27 16 06.0	97 30 36.0	13450	4	-	4	2	-	Baffin Bay at CM 14
	27 17 24.0	97 38 36.0	13452	4	-	-	1	-	Baffin Bay at CM 36
	27 49 40.0	97 01 52.0	13468	4	-	-	-	-	Gulf of Mexico at Port Aransas near end of South Jetty near marker R-7

Routine = Depth, dissolved oxygen, pH, temp., conductivity, salinity, fecal coliform, nutrients, chlorophyll a, dissolved and suspended solids; DO = 24 hour dissolved oxygen profile
Metals in Water = Dissolved metals and Total Mercury and Selenium; Metals in Sediment = Total metals, Percent Total Solids, Total Organic Carbon, Sediment Grain Size
Organics in water = Volatile Organic Compounds
Fish Tissue = Metals, pesticides, semivolatile organics

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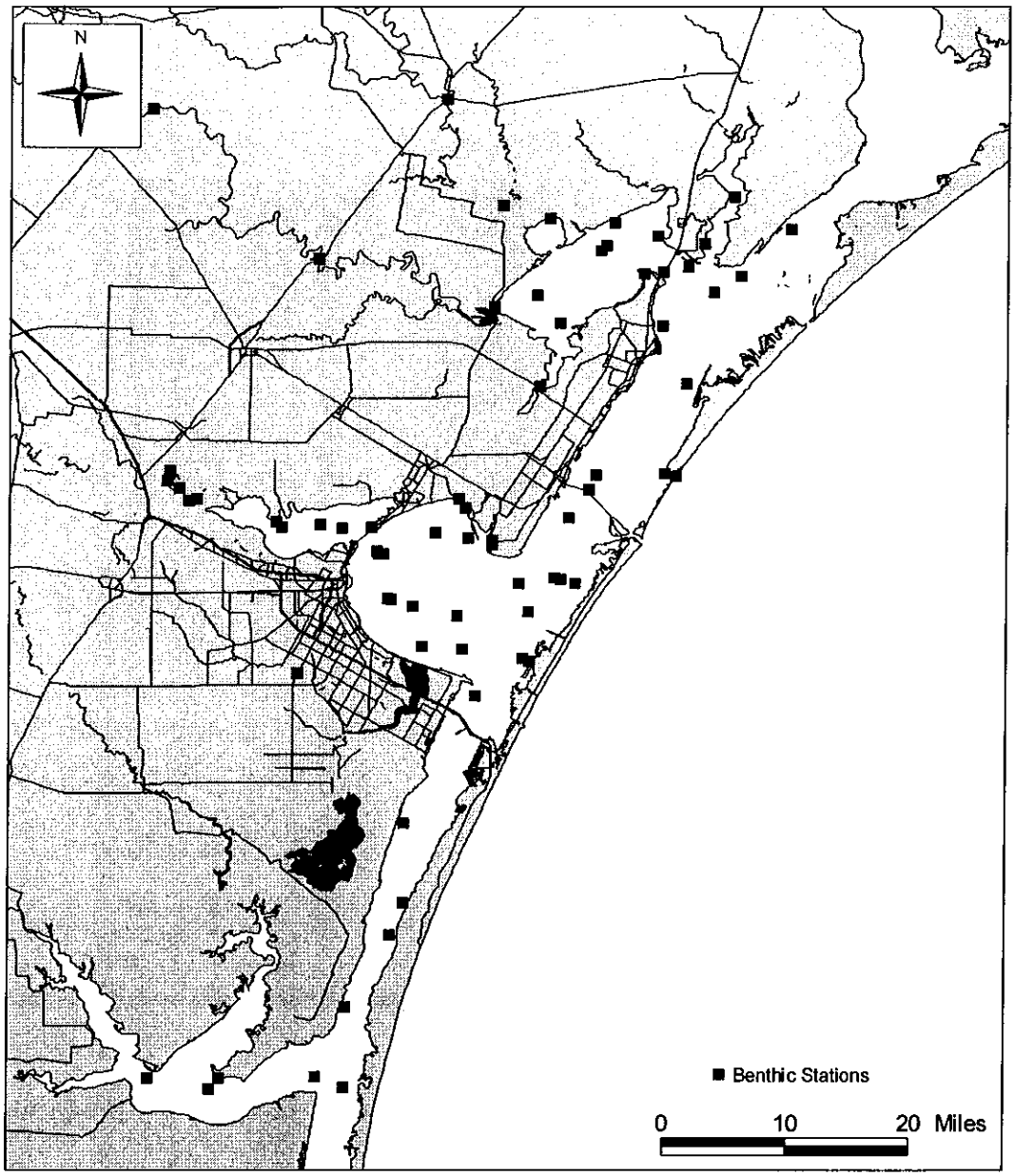

Figure 2-6. Benthic Sampling Stations Throughout the CBBEP Area.

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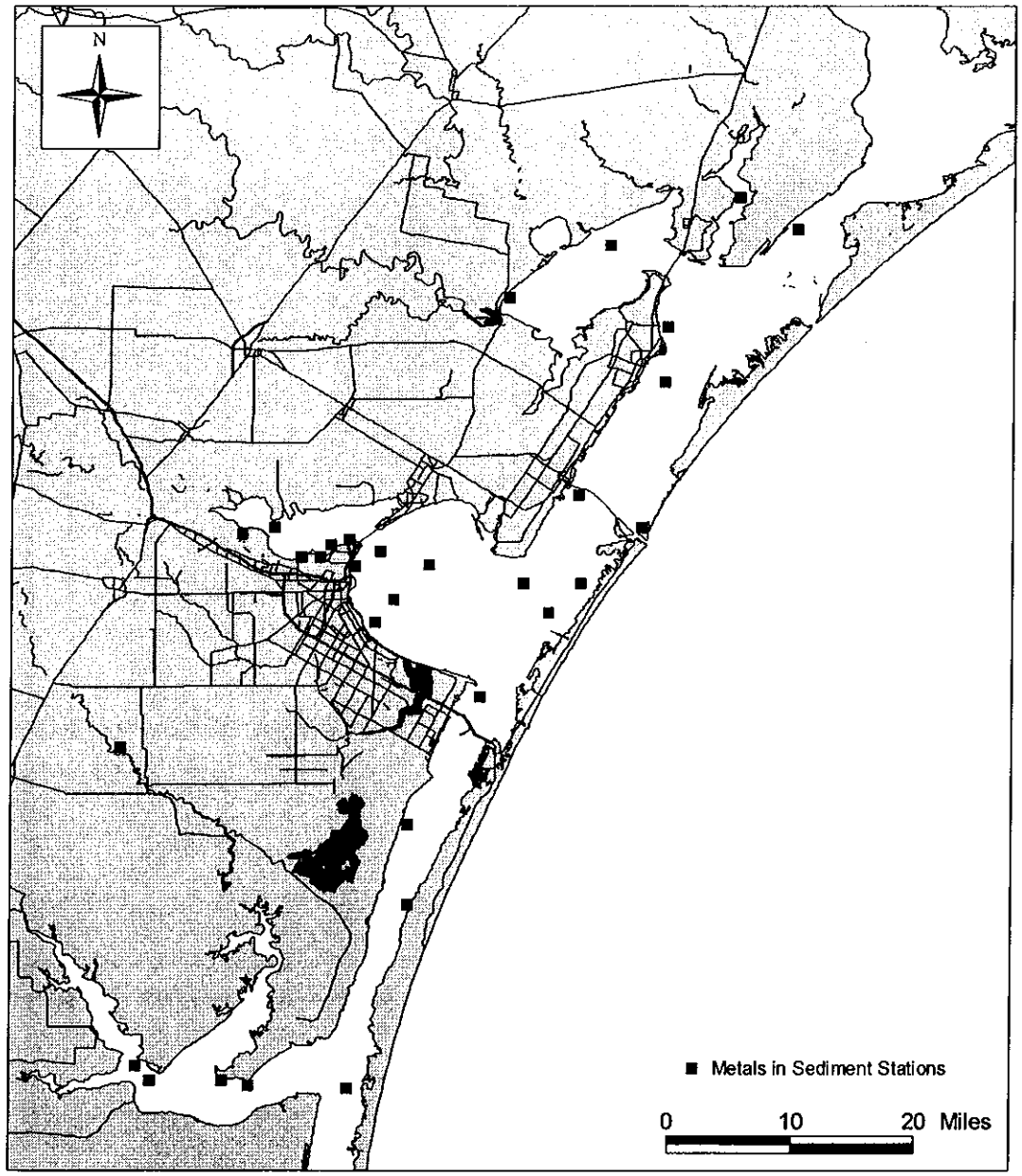

Figure 2-7. Metals in Sediment Sampling Stations Throughout the CBBEP Area.

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2.1.4 Health of the Bays Environmental Monitoring: Freshwater Resources	
Monitoring Objectives	*To assess the volume, timing, and locations of freshwater flows to the CBBEP area through time.* *To ensure flows are adequate to maintain an acceptable salinity balance and nutrient and sediment loads in the CBBEP area.* *See also the Freshwater Resources section under Section 3.2.*
Measures of Success	➢ Changes in the amount, timing, and location of freshwater inflows over time are determined. ➢ Monitoring of salinity, rainfall, sediment, and nutrient loading, and productivity of the bays is expanded. ➢ A regional water plan based on Senate Bill 1 is developed, implemented, and effective in meeting estuary needs. ➢ The number of wastewater reuse projects and volume of wastewater reuse are increased. ➢ The current reservoir freshwater pass through, including treated wastewater reuse, is effective in meeting all stakeholder needs. ➢ The potential for increasing the frequency, duration, and area of flooding the Nueces River delta over the long term is increased. ➢ Public understanding of the purpose and results of ongoing freshwater plans and programs is increased. ➢ Public support for the efficient use of water in the project area is increased.
Monitoring Questions	*Is freshwater flow adequate to maintain the historical levels and spatial/temporal distributions of salinity in the estuary?* *Is the amount of freshwater inflow to each bay/lagoon in the study area increasing, decreasing, or staying the same?* *Is the timing of freshwater inflow to each bay/lagoon in the study area changing?* *Is the location of freshwater inflow to each bay/lagoon in the study area changing?* *Are the nutrient loads associated with freshwater inflows to each bay/lagoon system in the study area increasing, decreasing, or staying the same?* *Are the sediment loads associated with freshwater inflows to each bay/lagoon system in the study area increasing, decreasing, or staying the same?*
Summary of Current Monitoring and Assessment Programs	Ambient Water Quality Monitoring/Datasonde (TWDB- TPWD) – 4 sites are currently monitored on an hourly basis for water temperature, conductance, pH, dissolved oxygen, and salinity. Up to 9 years of data are available for some historic and current sites. Data are used to establish relationships between freshwater inflows and salinity in Aransas Bay, Laguna Madre, Corpus Christi Bay, and Baffin Bay. TCOON [Texas Coastal Ocean Observation Network] (TAMU-CC, Conrad Blucher Institute; TWDB; TGLO; USACE) – 12 tide gauges are located in the CBBEP area collecting water level, wind speed, wind direction, and temperature

	data. Some gauges collect water quality data (e.g., salinity, dissolved oxygen). Gauges are located in Laguna Madre, Corpus Christi Bay, Nueces Bay, Gulf of Mexico, Port Aransas, Aransas Bay, and Copano Bay. Texas – USGS Cooperative Program, Water Resources Investigations (TWDB) – 9 sites are monitored daily for stream flow volume in Copano Creek, Mission River, Aransas River, San Miguel Creek, Atascosa River, Nueces River, Oso Creek, San Fernando Creek, and Los Olmos Creek. Rincon Bayou Vegetation Monitoring/Delta Water Level (TPWD) – 2 sites sampled hourly measuring the water level in Rincon Delta, April 2000 to present. NOAA's National Weather Service operates a network of daily precipitation stations in the program area. The City of Corpus Christi operates five urban runoff stations.
Monitoring Program Description	Monitoring for freshwater management will focus on two areas. The first is to measure the quantity (and quality) of freshwater flow entering the system. The second is measuring the response of the CBBEP area to this flow. Ongoing monitoring of stream and river flow, point source discharge records and water reuse will continue under the RMP. Agencies presently providing this monitoring will continue their activities. Continuous measurements of flow at USGS and TNRCC stations will continue. Salinity data collected under the CBBEP Water Quality Monitoring Program will be used to evaluate salinity responses in the CBBEP area. The data from these programs will be used to place the results from the Water Quality Monitoring Program into context relative to changes in freshwater discharge through time and location. Daily stream flow will be recorded at nine sites maintained by the Texas USGS Cooperative Program, Water Resources Investigations and USGS water quality stations. Stream water quality monitoring will continue as designed under this program. The Implementation Strategy for the Bays Plan recommends that seven additional gauges be added to increase the percentage of the watershed gauged under this program. The CPPEP will work with USGS to get additional gauges added to this program. Within the CBBEP area, the Water Quality Monitoring Program (Section 2.1.2) will provide information required to assess the impact of water flow changes on the salinity of the system and to assess associated changes in environmental quality. TCOON will continue to provide tide level data. This data is used in the hydrodynamic model the TWDB uses to estimate inflow needs. Meteorological data will be collected through local weather sites and meteorological data from local airports, as needed. Rainfall data will be used to estimate ungauged runoff and direct rainfall input of freshwater to the estuaries and bays.

	These data will continue to feed the ongoing evaluation of water needs/allocation. Water consumption and future anticipated use volume assessments will continue as part of managing available freshwater volumes, human and environmental needs, and determination of modifications and refinements to reservoir system operating plans.
Monitoring Parameters	The parameters included in the freshwater management monitoring are summarized below: **Freshwater flow** Flux, volume, timing and locations of fresh water flows (point and river) into the CBBEP area Rainfall trends Freshwater demand **Salinity in CBBEP area**
Stations	Routine stream flow stations (See Figure 2-8) Point source flows to the CBBEP area (*i.e.,* treatment plants and other effluents) Standard water quality monitoring stations under the "Health of the Bays" Water Quality Monitoring Program
Sampling Frequency	Freshwater flow – daily Wastewater return flow volumes – daily from treatment plants Ambient water: See the water quality program description in Section 2.1.2
Funding Agencies	USGS, TNRCC, NOAA, TWDB, TPWD, Nueces River Authority
Additional Actions	Develop a long-term Freshwater Management Monitoring QAPP (reference activities in the CBBEP Water Quality QAPP that support the response of the CBBEP area to freshwater management). Evaluate the CBBEP SWQM results to establish statistical basis for detecting change in salinity and freshwater flows. Maintain funding for present level of monitoring. Identify funding for long-term monitoring. Implement the comprehensive Freshwater Management QAPP.

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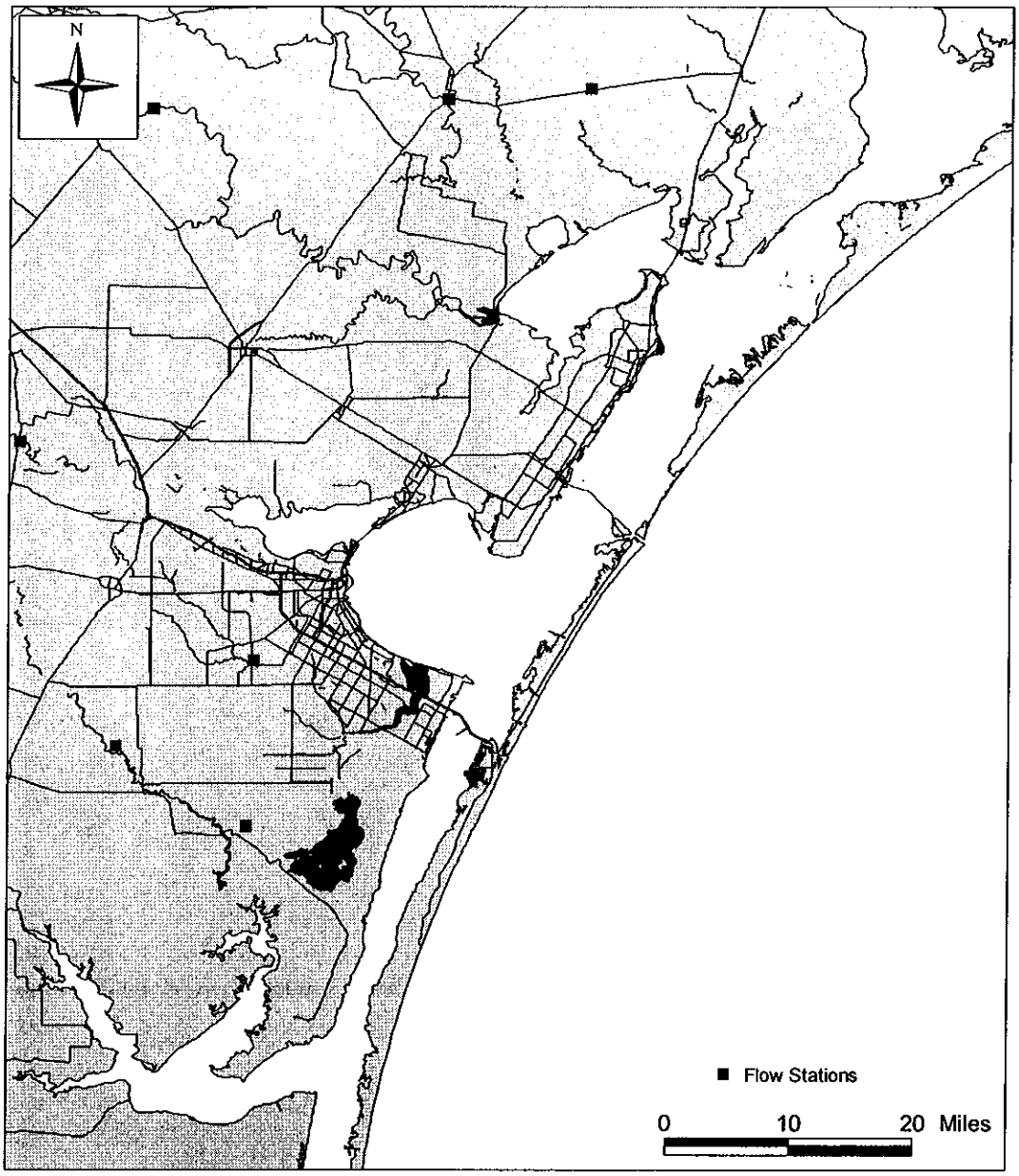

Figure 2-8. USGS\TWRCC Flow Gauge Stations Throughout the CBBEP Area.

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Relevant Studies and Publications

Asquith, W.H., J.G. Mosier, and P.W. Bush. 1997. Status, Trends and Changes in Freshwater Inflows to Bay Systems in the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-17. 47 pp.

Green, K.E. and R.M. Slade, Jr. 1995. Stream flow analysis of the Apalachicola, Pearl, Trinity, and Nueces River Basins, Southeastern United States: U.S. Geological Survey Water-Resources Investigations Report 95-4043. 64pp.

Quenzer, A.M., D.R. Maidment, F. Hellweger, N.J. Eid, G. Ward, and N.E. Armstrong. 1998. Total Loadings and Water Quality in the Corpus Christi Bay System. CCBNEP-27. 117 pp.

Ward. G.H. and N.E. Armstrong. 1997. Current Status and Historical Trends in Ambient Water, Sediment, Fish and Shellfish Tissue Quality of the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-13.

Ward G.H. 1997. Processes and Trends of Circulation Within the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission. CCBNEP-21.

Texas Department of Water Resources. 1981. Nueces and Mission Aransas Estuaries: A study of the Influence of Freshwater Inflows. TDWR LP-108.

TWDB. 2000. Values and Constraints for the TXEMP Model Used in the Freshwater Inflow Analysis of the Mission-Aransas Estuary: Technical Memorandum.

TWDB. In preparation. Values and Constraints for the TXEMP Model Used in the Freshwater Inflow Analysis of the Nueces Estuary: Technical Memorandum.

TWDB. In preparation. Values and Constraints for the TXEMP Model Used in the Freshwater Inflow Analysis of the Upper Laguna Madre Estuary: Technical Memorandum.

2.1.5 Health of the Bays Environmental Monitoring: Commercial and Recreational Fisheries	
Monitoring Objective(s)	*To assess relative abundance and changes through time of representative fish species (i.e., spotted seatrout, red drum, southern flounder, black drum, Atlantic croaker, gulf menhaden, Atlantic oyster, white shrimp, brown shrimp, pink shrimp, blue crab) in the CBBEP area.* *To determine if contaminant concentrations in key commercial and recreational fish and shellfish exceed human health risk levels determined by the Texas Department of Health and federal agencies.* *To estimate status and trends in the area of waters in the CBBEP area classified by the TDH as either "approved," "conditionally approved," or "polluted" for the purposes of shellfish harvest.* *See also the Habitat and Living Resources section under Section 3.2.*
Measures of Success	➢ Contaminant levels in commercial and recreational fish and shellfish do not exceed federal or state human health consumption or risk based consumption guidelines. ➢ TDH classification of waters in the CBBEP area as "approved" increase and areas classified as "conditionally approved" or "polluted" decrease. ➢ Relative abundance approximates historical values.
Monitoring Questions	*Are contaminant levels in fish and shellfish at safe levels for human consumption?* *Which species and portions of the bays system represent an actual or potential risk to recreational fishers?* *Are contaminant levels in fish and shellfish changing over time?* *Are the shellfish harvesting waters in the CBBEP area classified as "approved" increasing?* *Are landings of key recreational and commercial fish and shellfish species maintained?*
Summary of Current Monitoring and Assessment Programs	Resource Monitoring Program (TPWD Coastal Fisheries Division) – Since 1975, the TPWD has collected over 37,000 random samples throughout Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico. The program collects data using the following collection techniques: • Gill nets (45 overnight sets in each of spring and fall in each bay), • Bag seine (20/month in each bay system), • Bay trawls (20/month each in Aransas Bay and Corpus Christi Bay, 10/month in upper Laguna Madre • Gulf trawls (16/month in Gulf of Mexico) • Oyster dredge (20/month in Aransas Bay)

Sport-Harvest Monitoring Program (TPWD Coastal Fisheries Division) – Since 1974, the TPWD has collected data from 70 sites located throughout Aransas Bay, Corpus Christi Bay, upper Laguna Madre, and the Gulf of Mexico. Data included in this monitoring program include sport-boat harvest, fishing pressure, catch per unit effort (CPUE), size of fish, and other data as needed. In all areas, intercept surveys are conducted for a combined total of 408 days annually at boat ramps and marinas. On 48 days/year roves are made to count number of trailers at boat ramps.

Shrimp Virus Sampling (TPWD Coastal Fisheries Division) – 240 each of brown shrimp, white shrimp, and pink shrimp were sampled annually for 3 years (1997-2000) for virus analysis in Aransas Bay, Corpus Christi Bay, and upper Laguna Madre.

Genetics Sampling (TPWD Coastal Fisheries Division) – Various species of fish and invertebrate are sampled each year for electrophoresis, mtDNA, and microsatellite data in Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico. 1980 to present.

Nueces Estuary Trawl Survey (TPWD) – Fish trawls are conducted at 10 fixed stations in the Nueces Estuary monthly during the summer and every other month in the winter for a total of 9 months per year from 1996 – 2000. In addition to species counts, routine field parameters are measured for water, including temperature, pH, DO, salinity, conductivity, and percent saturation.

Age/Growth Study (TPWD) – Otoliths are collected in Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico for determination of age of select finfish species. Sample number varies by species studied and year. Items subject to change each year. 1975 to present.

Commercial Harvest Program (TPWD) – Seafood dealers self-report on a monthly basis. Data include species, pounds, and price/pound for Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Gulf of Mexico.

Nueces Bay Ichthyoplankton (TPWD) – 4 sites sampled bi-monthly from February through May for temperature, salinity, DO, pH, fish and plankton.

Ichthyoplankton Collection (UTMSI) – Daily data collection from UTMSI pier in Port Aransas from September through November since 1994 (data for all sciacnid fishes and notes about other taxa).

Epibenthic Sled Collections (UTMSI) – Weekly and twice weekly data collection at North Pass site (data on red drum with limited data on other sciacnids) from mid September through mid December since 1994.

TMDL/Oyster Water Use Impairment due to Zinc (TNRCC, GLO, TDH) – The TDH will be conducting a public health risk assessment project in 2001 in Nueces Bay to re-assess oyster water use impairment due to zinc contamination. TDH will collect oyster, fish, and crab tissue and analyze for metals (arsenic, cadmium, copper, lead, mercury and zinc) as well as PCBs, pesticides, and volatile and semivolatile organic compounds. This study is a follow-up to a 1994 tissue study looking at heavy metals in oyster, fish, and crab tissue in Nueces Bay.

	Mussel Watch Project (NOAA) – 7 sites within the CBBEP area are monitored under this nationwide project that has monitored chemical contaminants in sediments and bivalve mollusks since 1986. Bivalves are collected every other year and sediments every fifth year. Samples are analyzed for PAHs, PCBs, DDT, DDD, DDE, 16 other chlorinated pesticides, tributyl-tins, 3 major elements, and 11 trace elements. Pfisteria (TPWD) – 5 sites sampled approximately monthly for temperature, salinity, DO, pH, chlorophyll a, nutrients, and Pfisteria during 2000-2001. Coastal 2000 (EPA) – This program will examine gross external pathological disorders, overall morphology of fish for skeletal malformations, condition of the eyes, and macrophage aggregates. National Mussel Watch Program - Annual collection of oysters and *in situ* data (temperature, DO, salinity, pH). Oysters analyzed for PCBs, pesticides, and metals. Sampling locations include Mesquite Bay, Aransas Bay, Copano Bay, and Corpus Christi Bay.
Monitoring Program Description	The Texas Parks and Wildlife Department (TPWD) Coastal Fisheries Division resource monitoring programs described above will form the basis of the fish resource monitoring program. A human health risk assessment (HHRA) will be conducted to assess the potential risks associated with the consumption of fish and shellfish from within the CBBEP. The HHRA will be conducted in coordination with the Texas Department of Health (TDH) Seafood Safety Division and will focus on areas known to have elevated levels of contaminants, such as Nueces Bay and Corpus Christi Inner Harbor. Contaminants of concern will include polychlorinated biphenyls (PCBs), pesticides, polycyclic aromatic hydrocarbons (PAHs) and metals. Lipid analyses will also be included. The specific sampling scheme will be dependent on the desired statistical confidence, however, a minimum of two composite finfish samples will be collected from Nueces Bay and a minimum of three to five composite fillet samples will be collected from Corpus Christi Inner Harbor. Each composite sample will be comprised of equal portions of fillet from at least five individuals of the same species. An attempt will be made to ensure that the composites are representative of the predominant habitats located within the estuary. The evaluation will target recreationally important species such as speckled trout, red fish, flounder, and black drum. Depending on the number of fish collected, an attempt will be made to focus on only one of these species for analysis, to allow for statistical comparisons. Only fish that meet the legal size limits will be included and the length and weight of each individual fish will be recorded for each composite sample. In addition, oysters will be collected from Nueces Bay and Corpus Christi Inner Harbor for a total of eight composite samples. Each composite will be collected to represent an area known to be frequented by shellfish consumers. The data will be submitted to the Texas Department of Health for a risk assessment evaluation. Fish and shellfish data from the Coastal 2000 program and NOAA's Mussel Watch will be used to evaluate areas not sampled routinely by the Texas Department of Health. In addition, as funding allows, additional areas will be

	sampled within each estuary every five years to assess changes in tissue concentration and possible risks to human health. Bacteria in fish and shellfish waters and tissue is not routinely monitored within the CBBEP. Ongoing fish tissue assessments will continue, and data from water quality assessments (see Health of the Bays Environmental Monitoring: Water Quality) related to pathogen contamination will be utilized in assessing risk from consumption. Texas Parks and Wildlife Coastal Fisheries Division will continue to measure virus in shrimp under its Shrimp Virus Sampling program.
Monitoring Parameters	**Fish and Shellfish** Fish and shellfish relative abundance Standing crops vs. fishing pressure CPUE for spotted seatrout, red drum, southern flounder, black drum, Atlantic croaker, blue crab (TPWD Coastal Fisheries Monitoring Program) Commercial fish landings by type (gill net, otter trawl, bag seine) from within the system areas including fisheries-dependent data on commercial fish/shellfish landings based on industry self-reporting and fisheries-independent data collected by the coastal fisheries monitoring program. TPWD Creel surveys data and data on catch-and-release **Contaminants** Metals, mercury, organics, hydrophobic organics (pesticides, PCB) in edible tissue of fish and shellfish **Bacteria** Bacteria indicators in waters classified as polluted, conditionally approved, approved for harvest
Stations	Stations sampled under the Sport-Harvest Monitoring Program and the Resource Monitoring Program of the Coastal Fisheries Division of the Texas Parks and Wildlife Division form the station set for this area of monitoring (Figures 2-9, 2-10, and 2-11). Stations for the Health Risk Assessment will be developed through a risk assessment plan, data quality objectives, and a QAPP development process. A map of closed and open shellfish areas will be developed by CBBEP when data become available. Water column fecal coliform monitoring stations will be determined by TDH in response to problem areas and oyster-producing waters.
Sampling Frequency	As described above

Funding Agencies	Texas Parks and Wildlife Coastal Fisheries Division (U.S. Department of the Interior, Fish & Wildlife Service provides partial funding under DJ15.605 [Project F-34-M] for most data collection efforts), Texas Department of Health, EPA
Additional Actions	Develop a comprehensive Commercial and Recreational Fisheries QAPP (based on TPWD operational manual). Maintain funding for present level of monitoring. Identify funding for long-term monitoring.
Relevant Studies and Publications	Jensen, P. and Y.C. Su. 1996. Investigation of Selected Public Health Issues in the Corpus Christi National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-11. 170 pp. Tunnell, J.W., Q.R. Dokken, E.H. Smith, and K. Withers. 1996. Current Status and Historical Trends of the Estuarine Living Resources within the Corpus Christi Bay National Estuary Program Study Area Vol. 1 of 4. Texas Natural Resource Conservation Commission, Austin Texas. CCBNEP-06. 543 pp. Ward, G.H. and N.E. Armstrong, 1997. Current status and historical trends of ambient water, sediment, fish, and shellfish tissue Quality in Corpus Christi Bay National Estuary Program Study area (Summary report) Texas Natural Resource Conservation Commission, Austin, TX CCBNEP-13. 270pp.

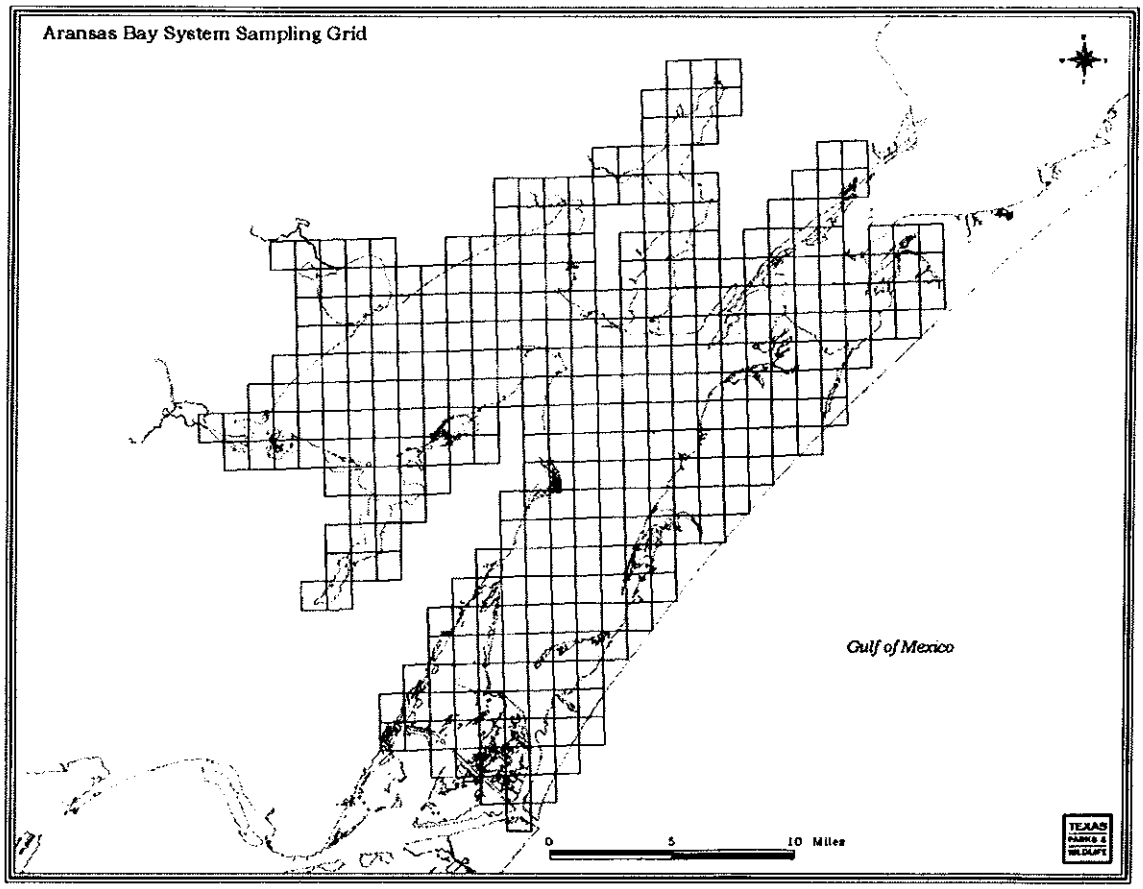

Figure 2-9. Texas Parks and Wildlife Aransas Bay System Sampling Grid

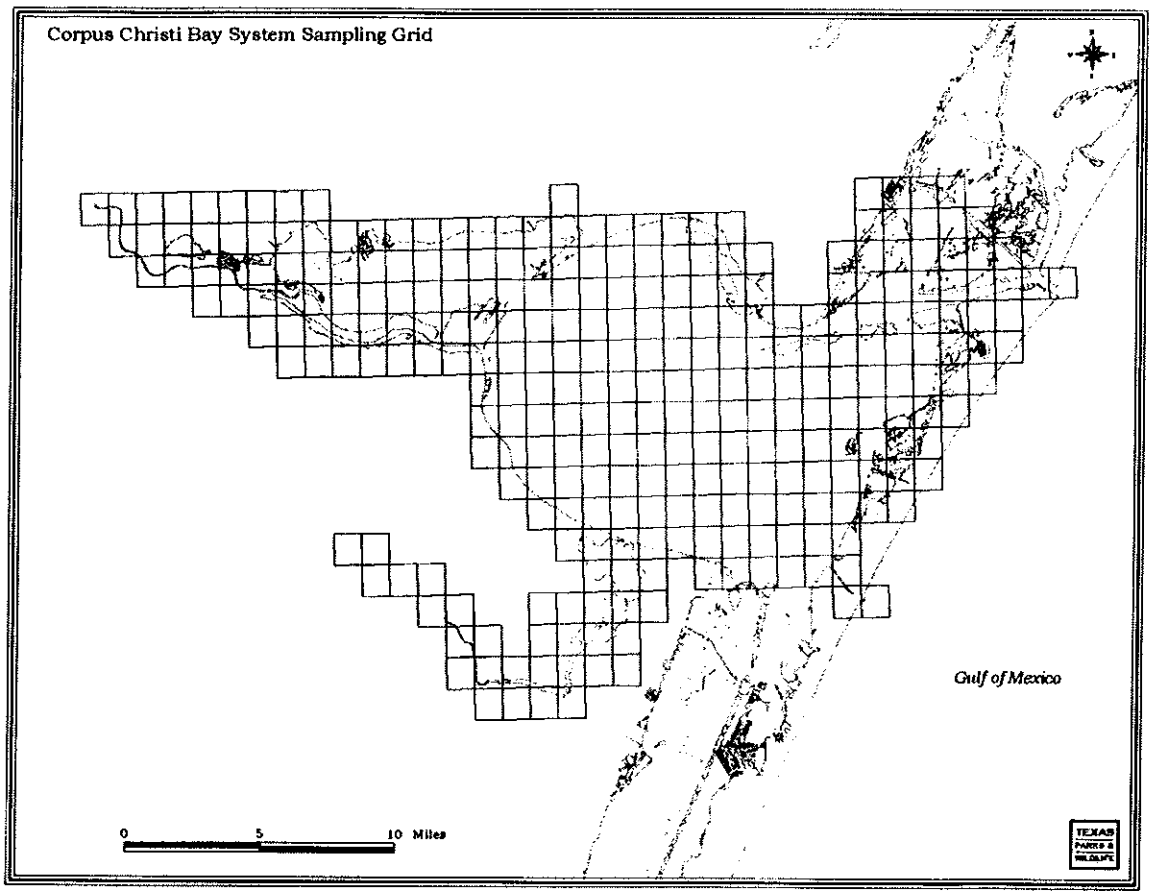

Figure 2-10. Texas Parks and Wildlife Corpus Christi Bay System Sampling Grid

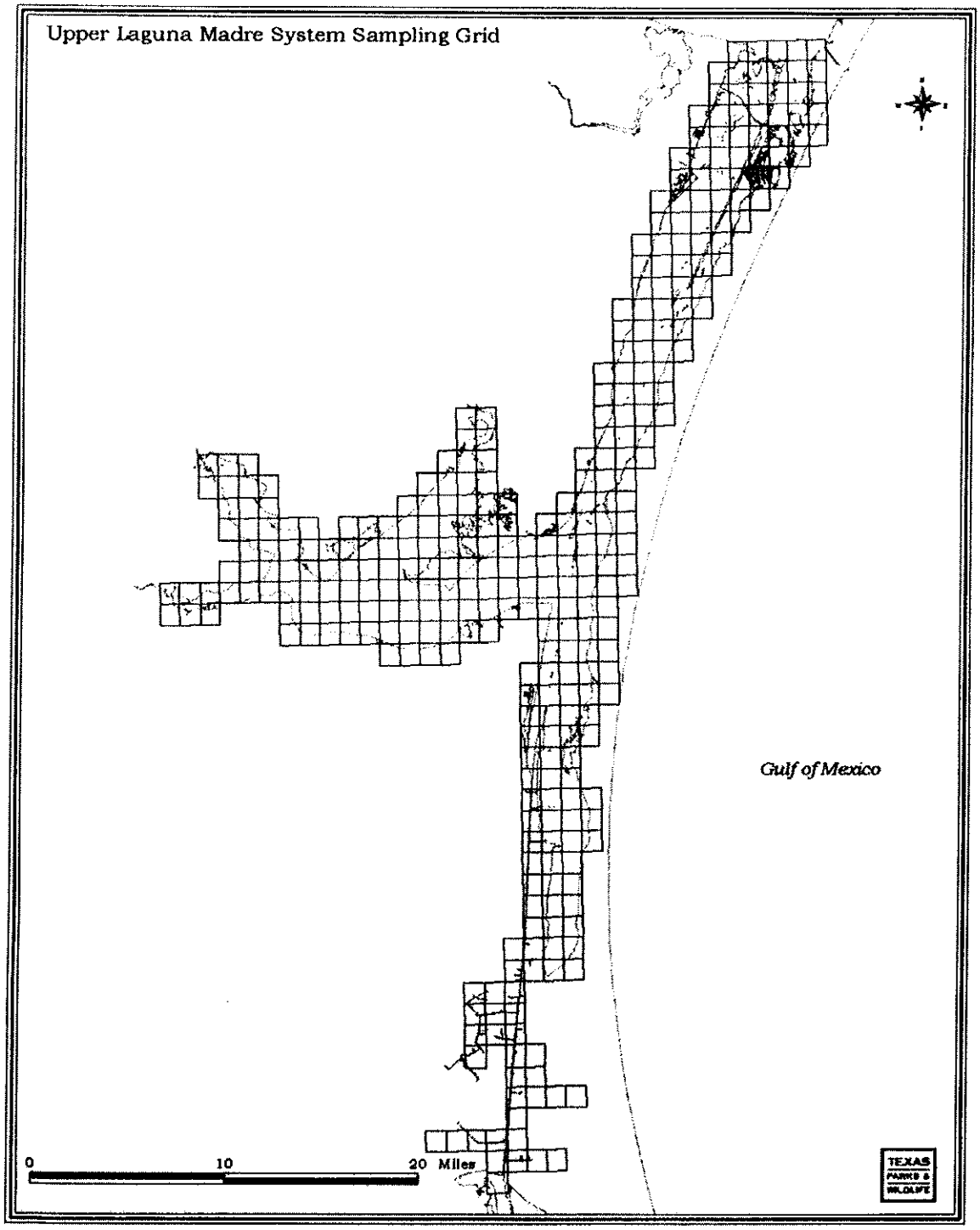

Figure 2-11. Texas Parks and Wildlife Upper Laguna Madre System Sampling Grid

2.1.6 Health of the Bays Environmental Monitoring: Species of Concern	
Monitoring Objective(s)	*To assess changes in populations of species of concern (i.e., sea turtles, marine mammals, whooping cranes, waterfowl, and colonial water birds) in the CBBEP area through time.* *To assess frequency of disturbance of critical habitats and rookeries.* *See also the Habitat and Living Resources section under Section 3.2.*
Measures of Success	➢ The impacts of human intrusion into critical habitat of whooping crane are reduced. ➢ The impacts of recreational activities on bird rookery islands are reduced. ➢ The populations of species of concern are stabilized or increased.
Monitoring Questions	*Are the populations of species of concern and colonial birds and waterfowl changing through time?*
Summary of Current Monitoring and Assessment Programs	Colonial Waterbird Rookery Island Management within the Coastal Bend Area (CBBEP) – Avian monitoring, including bird counts and least tern bird surveys are conducted in coordination with multiple other agencies in support of the colonial waterbird management plan. Christmas Bird Count (National Audubon Society, Welder Wildlife Foundation, CBBEP) – One day a year a count of individual birds by species is performed by volunteers throughout the nation including the following areas in the CBBEP: Corpus Christi, Flour Bluff, Aransas National Wildlife Refuge, Port Aransas, and Kingsville. Waterbird Watch (CBBEP) – Approximately once a month a count of waterbird individuals occurs at 4 sites (Sunset Lake, Mollie Beattie Coastal Habitat Community, Indian Point, and Oso Bay). Mid-Winter Waterfowl Census (USFWS/TPWD) – Once a year a count of waterfowl individuals along the entire Texas coast is performed. The Effects of Redhead Ducks on Shoalgrass in the Laguna Madre (TAMU – Kingsville Caesar Kleberg Wildlife Research Institute) – This study will monitor changes in shoalgrass rhizome biomass in 12 zones throughout the southern and northeastern Laguna Madre. Monitoring will be conducted monthly from October through March from 2000 through 2003. Aerial flights will be conducted twice weekly to monitor redhead distribution and abundance within the Laguna Madre as well as in freshwater wetlands within approximately 5 miles of the coast. 180 Redhead specimens will be collected each year for analysis of changes in body mass, protein, and other parameters. Development of Habitat-Based Population Model of Redheads in North America (TAMU-CC Center for Coastal Studies, USGS, USFWS) – Redhead flock surveys

are conducted monthly by USGS and USFWS personnel from October through March (ongoing for over 10 years); this project synthesizes survey data and habitat information in GIS format to evaluate habitat availability and use for Redhead duck populations in Laguna Madre.

Distribution of Seagrass Meadows and Wintering Redheads in Eastern Nueces Bay, Texas – 52 one-time emergent marsh surveys and 10 one-time seagrass surveys will be conducted along the western shoreline of Indian Point Peninsula in Nueces Bay to measure salinity, seagrass distribution, site elevation, and vegetation cover. Redhead abundance and behavior data will be collected every three weeks from October through March (2000-2001).

Whooping Crane Census (USFWS) –Aerial observations are made on a weekly basis between October and April in and around the Aransas Wildlife Refuge area.

Aplomado Falcon Reintroduction (USFWS, Welder Wildlife Foundation) - The USFWS monitors peregrine falcons on a daily basis between July and August. The monitoring is performed on Matagorda Island/Tatton Unit of Aransas as part of the Aplomado Falcon Reintroduction Project.

Colonial Waterbird Count (USFWS, CBBEP) – Once per year a count of nesting pairs of colonial waterbirds is conducted throughout the entire CBBEP area (ongoing for the last 25 years).

Winter Burrowing Owl Ecology (USGS, CBBEP) – Approximately 20 sites are surveyed within Nueces County on a monthly basis between October and March to assess the winter survival and habitat use of the Burrowing Owl.

Maritime Gopher Monitoring (TPWD) – Population counts conducted at 2 sites (Naval Air Station Corpus Christi and GCCA/CP&L Marine Development Center) over two days once per year.

Hummingbird Roundup (TPWD) – Population count conducted statewide by volunteers based on number of birds seen in backyard over the course of a year; participation and sites vary from year to year; currently over 20 participants within the CBBEP area.

Texas Horned Lizard Watch (TPWD) – Volunteer watch program throughout the state; monitoring for Texas Horned Lizard, Fire Ants, and Texas Native Red Ants takes place from May through September annually; Participation and sites within the CBBEP area varies from year to year.

4th of July Butterfly Count (North American Butterfly Association) – Numbers of species and individuals counted on 4th of July in a 15 mile radius count circle within the Aransas National Wildlife Refuge.

Project Prairie Bird (Gulf Coast Bird Observatory) – A count of individuals is conducted once a month for the three winter months at 9 sites on Mustang Island.

Breeding Bird Survey (USGS/BRD) – Count of individuals conducted in Petronilla and Kingsville one day once per year.

	Migration Count (USGS) – Countywide counts of individuals conducted once per year. Spatial and Temporal Dynamics of Rookery Islands in the Laguna Madre and Development of a Management Plan (TAMU-CC Center for Coastal Studies) – A one-time elevation and vegetation survey is being conducted in the Upper Laguna Madre at eight dredged material islands as well as North and South Bird Islands to identify characteristic island vegetation in relation to colonial water nesting potential (June 2000 through August 2001). Sea Turtle/Marine Mammal Mortality Project (USFWS) - Beaches along Matagorda Island are monitored on a weekly basis during key periods determined for each turtle/mammal. Sea Turtle Stranding and Salvage Network - (USGS and National Park Service in cooperation with several state, federal, and local agencies) – This program has existed since 1980. Since 1986, year around systematic surveys have been and continue to be conducted on Gulf beaches in the CBBEP area at least once a week. The program collects information on stranded sea turtles including the date, location, species, condition, visible injuries, length, width, and presence of tags for all sea turtles found. In addition, volunteers respond to reports of stranded sea turtles on Gulf beaches, in channels, and in bays in the CBBEP area. Texas Marine Mammal Stranding Network Program (TAMU-CC Center for Coastal Studies) – This on-going study collects data on marine mammal strandings throughout the entire Coastal Bend area. Data collected on each stranding includes a tissue archive, causes of strandings, rehabilitation of live animals, and the assessment of the health of cetacean populations. Photo identification is performed on a quarterly basis as needed. Sea Turtle Nesting - USGS and the National Park Service in partnership with other cooperating and funding entities support patrols of North Padre Island to detect nesting sea turtles and sea turtle nests. Systematic surveys are made daily from April through July on the Gulf beaches of North Padre Island. Investigations are also made in response to reports provided by the public on the Gulf beaches of North Padre Island and on other Gulf beaches in the CBBEP area. Data collected include date and location of observation, number of eggs, length and width of nesting turtles, and presence of tag numbers for nesting turtles. Corpus Christi Ship Channel Improvement Project (USACE, PCCA) - An environmental assessment will be conducted as part of the ship channel improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel.
Monitoring Program Description	The multiple monitoring programs for species of concern, colonial birds, and waterfowl currently being conducted by federal and state agencies and universities in the CBBEP area will be the initial indicator for determining the health of species of concern. A brief description of each program presently conducted in the CBBEP

	area is presented in the *Summary of Current Monitoring and Assessment Programs* above. This information will be supplemented with assessments of habitat quantity and quality conducted under the Health of the Bays Habitat Monitoring. Action Item HLR-4 calls for management plans to be developed for each species of concern. During development of each management plan, a detailed review of the present monitoring and assessment programs will be conducted to determine whether additional information needs to be collected. Based on that detailed review, specifics on additional monitoring will be developed for each species. These requirements will be incorporated into a comprehensive QAPP for monitoring the species of concern and water birds.
Monitoring Parameters	Bird species – Population size and reproduction statistics Colonial bird nesting pairs Marine mammal stranding and mortality Sea turtle stranding and turtle condition Nesting sea turtles and turtle nests Number of rookery sites visited or vandalized
Stations	See the current monitoring programs listed under *Summary of Current Monitoring and Assessment Programs*
Sampling Frequency	Seasonal and once per annual census counts as listed under *Summary of Current Monitoring and Assessment Programs*
Funding Agencies	USGS, USFWS, TPWD, National Park Service other contributing state and federal agencies, TAMU-CC, NOAA, EPA, USGS
Additional Actions	Develop a comprehensive QAPP for long-term species of concern and water bird monitoring. Maintain funding for present level of monitoring. Identify funding for long-term monitoring.
Relevant Studies and Publications	Tunnell, J.W., Q.R. Dokken, E.H. Smith, and K. Withers. 1996. Current Status and Historical Trends of the Estuarine Living Resources within the Corpus Christi Bay National Estuary Program Study Area Vol. 1 of 4. Texas Natural Resource Conservation Commission, Austin Texas. CCBNEP-06. 543 pp.

2.1.7 Health of the Bays Environmental Monitoring: Shoreline Management	
Monitoring Objectives	*To assess changes in natural and constructed shoreline within the CBBEP area through time.* *See also the Habitat and Living Resources and Shoreline Management sections under Section 3.2.*
Measures of Success	➢ Changes over time in the degree of shoreline erosion, habitat loss, vulnerability to sea level rise, storm surge, and wave energy are determined. ➢ The percentage of shoreline attributed to hardened, developed, open, natural, mitigated, and filled conditions is determined. ➢ The rate of shoreline change, including erosion/accretion at target sites, is determined.
Monitoring Questions	*Is the fraction of shoreline altered by construction or other manmade activities changing relative to the natural shoreline?* *Is the rate and degree of shoreline erosion changing over time?* *Is the amount of habitat loss changing over time?* *Are shoreline protection goals being met?*
Summary of Current Monitoring and Assessment Programs	There are no known shoreline monitoring programs that occur with regularity within the CBBEP area. Shoreline types and related habitat are observed and recorded through aerial surveys of the coast that occur under a number of different habitat-related monitoring efforts. (See Health of the Bays Environmental Monitoring: Habitat.) USACE has information on geographically specific areas related to navigation projects or coastal erosion studies. The USACE will conduct an environmental assessment as part of the ship channel improvement project which will include assessments of water and sediment quality, terrestrial and aquatic baseline surveys, recreational uses, and cumulative impacts in Corpus Christi Bay within the vicinity of the ship channel. The GLO has studied shoreline location and change over time. USGS surveys the coastal areas following tropical storms or hurricanes. The City of Corpus Christi has an active GIS system to track land use and land change patterns and conditions, as does the Geographic Information Science Program at TAMU-CC and TPWD.
Monitoring Program Description	Monitoring for the environmental aspects of shoreline management will focus on documenting landscape changes resulting from erosion, habitat alteration and coastal hazards and how those rates of change are modified with implementation of recommendations included in the to be developed "Guidelines for Shoreline Management for use by Local Governments."

	The monitoring program will incorporate relevant data from the land use/land cover and habitat surveys conducted under the Habitat section of this monitoring plan including the development of an up-to-date habitat map of the entire CBBEP area. Habitat surveys will be conducted at least twice per decade (Section 2.1.1). Remote sensing technology and aerial imagery will be used to collect habitat data as well as shoreline type and use data. This information will be placed in a GIS format that is widely available to enable cross-survey comparisons. Data (type, length, location) on the following shoreline types will be collected: hardened shoreline or protected by seawalls, solid structures (concrete, wood, metal), groins, breakwaters, bulkheads, revetments, piers and boat houses, such manmade structures as constructed wetlands, other habitat enhancements, drainage controls, slope modifications, and natural areas such as wetlands, beaches, barrier islands, *etc.*
Monitoring Parameters	**<u>Length, area, and location</u>** hardened shoreline (by type) solid structures (concrete, wood, metal) breakwaters bulkheads revetments piers and boat houses constructed wetlands drainage controls wetlands beaches barrier islands shoreline erosion/accretion statistics **<u>Shoreline linear miles for land under the administration of the Coastal Bend Land Trust</u>**
Stations	Quantitative overflights that document shorelines using high-resolution photography and other imaging techniques will be made of the entire system. Fixed stations will not be required, except under the habitat ground truthing studies.
Sampling Frequency	Overflights will be conducted at least every five years and more often if substantive erosion or accretion is detected or documented via other observations.
Funding Agencies	TGLO, USACE, USFWS, City of Corpus Christi, other local agencies
Additional Actions	Develop a comprehensive QAPP for long-term shoreline management monitoring. Develop funding for long-term monitoring.
Relevant Studies and Publications	Pulich, W. and J. Hinson. 1996. Development of Geographic Data System Data Sets on Coastal Wetlands and Land Cover. Texas Parks and Wildlife, Coastal Studies Technical Report No. 1.

Smith, E.H., T.R. Calnan, and S.A. Cox. 1997. Potential Sites for Wetland Restoration, Enhancement, and Creation: Corpus Christi/Nueces Bay Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-15. 165 pp.

White, W.A., E.G. Wermund, W. Pulich, and E.H. Smith. 1998. Current Status and Trends of Selected Estuarine and Coastal Habitats within the CCBNEP Study Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP- 29.

2.2 Implementation Project Environmental Evaluation

The main focus of the CBBEP's environmental monitoring will be to determine the overall "Health of the Bays" by monitoring the CBBEP area for overall changes in habitat, water and sediment quality, freshwater resources, commercial and recreational fisheries, species of concern, and shoreline management. The CBBEP's strategy for achieving the goals of the *Bays Plan* is through the implementation of individual projects as part of the Annual Work Plan. While it may be difficult to attribute short-term estuary-wide results from individual projects, it is important that the localized environmental improvements of each project be assessed.

As part of the process of developing the Annual Work Plan, those projects to be evaluated for localized environmental benefits will be identified. For those projects, the CBBEP will conduct an environmental evaluation as appropriate. A summary of the environmental evaluation of each project will be prepared in conjunction with the "State of the Bays" report produced every five years.

Projects implementing the following *Bays Plan* Action Items have been identified as likely to contain project elements suitable for environmental evaluation and are included in Table 2-3. Because the specifics of future implementation projects will be developed as part of the Annual Work Plan process the potential environmental evaluation parameters included in the table are meant to serve as a starting point.

Table 2-3. Project Specific Environmental Evaluation

Bays Plan Action Item	Potential Environmental Evaluation Parameters
BTR-2 – Provide for the appropriate number of improved, well-managed public access sites.	Type and acres of habitat Debris, area denuded of vegetation, tire-tracks, foot-paths, trash, and incidents of oil and gas slicks
BTR-3 – Develop and implement management strategies to reduce or avoid impacts from recreational uses.	Population size and reproduction statistics for bird species of concern related to recreational usage Number of nests abandoned due to human intrusion, whole nesting islands/colonies abandoned due to human intrusion Amount of propeller scarring in seagrass beds – e.g., area of seagrass beds scarred and/or lost, length of scars, indices of habitat fragmentation due to prop scarring Recreational boating impacts – amount of litter, parking lot runoff, incidence of oil and gas slicks (normalized for traffic) – improved vs. pre-improvement conditions, fish and benthic communities in marinas, sediment and water quality in marinas, fish/shellfish tissue analysis at marinas Standing crops vs. fishing pressure Number of pump-out stations and trash receptacles at marinas and waterside subdivisions
BTR-4 – Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	Number, length or areal extent of reefs Changes in fish populations with and without artificial reefs
BD-1 – Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	Weight and volume of debris kept out of the bay system Bay debris monitoring at key locations – e.g., vicinity of stormwater outfalls

Bays Plan Action Item	Potential Environmental Evaluation Parameters
PH-2 – Conduct health risk assessments associated with consumption of seafood in suspect areas.	Changes in the area of shellfish bed closures Monitor pathogens such as fecal coliform, E. coli, and Enteroccoccus Number of reported illnesses due to seafood consumption Area of shellfish growing waters classified as approved for harvest, conditionally approved, or polluted Area of shellfish growing waters closed due to toxic contaminants Contaminant concentration of seafood over time (NOAA Mussel Watch list parameters) PCBs, metals, pesticides Levels of toxic contaminants found in targeted local seafood
SM-1 – Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	Area or percent of shoreline that is 1) hardened, protected by seawalls, solid structures, riprap, and piers; or 2) natural Type and acres of existing habitat Shoreline erosion/accretion Vulnerability to sea level rise, wave energy, and storm surge Vegetative species composition, diversity and percent cover
SM-2 – Assist local governments with shoreline management issues.	Type and acres of habitat
SM-3 – Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	Type and acres of habitat protected or restored
D-2 – Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	Quantity and quality of dredged material Design criteria for deposition operations vs. as built conditions Vegetation type prior to and after deposition activities Aerial extent of coverage by each disposal event Acres of habitat gained/lost Acres of target habitat type created (emergent wetlands, SAVs, tidal flats, bird islands) Habitat quality indicators
D-3 – Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	See D-2 parameters
HLR-1 – Preserve functional, natural habitats of all major types.	Acres and quality of preserved habitat
HLR 2 – Create new habitats and/or restore degraded habitats where feasible.	Acres and quality of restored or created habitats Emergent Wetlands – Vegetative species composition, relative abundance, above ground biomass Seagrasses - Species composition, density and vigor via transect sampling
HLR-3 – Determine and manage the impact(s) of seismic activities and operations requiring state and/or local permits coastal habitats and associated fauna.	Number of seismic-related activities permitted in the CBBEP project area Acres and types of coastal habitat impacted by seismic activity Indicators of quality of seagrass beds, unvegetated tidal flats, oyster reefs, open bay bottoms, coastal marshes, barrier islands, and Gulf beaches
HLR-4 – Develop management plans to ensure sustainability for species of concern.	Status and trends of selected species of concern
HLR-7 – Reduce bycatch from bay shrimp trawling.	Amount of bycatch – weight by species
HLR-8 – Reduce impacts on living resources associated with industrial cooling water intake.	Number and biomass of fish and shellfish species killed on intake screens or in cooling water systems Rate of impingement and entrainment
HLR-9 – Minimize the impacts and reduce the occurrence of harmful algal blooms.	The frequency, extent, and impact of HABs Impact of HABs (decreased water clarity, loss of seagrass beds, closed shellfish beds, contact recreation advisories)

Bays Plan Action Item	Potential Environmental Evaluation Parameters
HLR-10 – Develop management plans to minimize introductions and impacts from non-native species.	Species type, distribution, and population size of non-native species
WSQ-1 – Implement plans to improve water and sediment quality in identified segments.	Water Quality Data: Station data, hydrographic parameters, nutrients, chlorophyll a and b, TSS, fecal coliform and fecal streptococci, BODc, selected trace metals, ammonia and sulfide, inorganic and suspended solids Sediment Screening: Grain size, total organic carbon, NOAA Status and Trends list of contaminants (PAHs, PCBs, pesticides, and metals), and benthic infauna (species, community indicators, and diversity)
NPS-2 – Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	Water quality improvements by constituent or number of impaired water segments Stream and Point Source Characterization (NPDES or CBBEP Monitoring): Flow (daily), nutrients, turbidity, TSS, fecal coliform and fecal streptococci, BODc, selected trace metals, PAHs, PCBs, pesticides, oil and grease Floatable and plastic debris in vicinity of major nonpoint sources
NPS-3 – Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	See NPS-2 parameters
NPS-4 – Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	See NPS-2 parameters
FW-3 – Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	Amount, timing and location of fresh water flows, rainfall trends, salinity, water quality (nutrient loading) in the system, productivity within the bay, climate trends and forecasting Benthic community species composition/biomass Fish community species composition/biomass Wetland plant species composition Wetland plant productivity/biomass Freshwater flows, duration, and extent of wetland flooding due to increased flows

3. PROGRAMMATIC MONITORING

The Coastal Bend Bays and Estuaries Program's purpose is to "help focus limited technical and financial resources in a goal-directed manner to effect resource management at the regional scale" (CBBEP, 1998). One way this can be accomplished is by closely tracking progress towards accomplishing the goals of the *Bays Plan.* The goal of the programmatic monitoring portion of the RMP focuses on measuring the progress towards accomplishing each of the *Bays Plan* goals.

Progress towards accomplishing each of the *Bays Plan* goals will be measured through progress on individual project milestones as well as progress on the overall completion of specific Actions.

There are eleven Action Plans in the *Bays Plan* (Bay Tourism and Recreation, Bay Debris, Public Health, Shoreline Management, Maritime Commerce, Dredging, Habitat and Living Resources, Water and Sediment Quality, Nonpoint Source Management, Freshwater Resources, and Public Education and Outreach). The tables that follow present each Action Plan's goal(s), objective(s), specific Action(s) to be implemented, and measure(s) of success as specified in the *Bays Plan* and the Implementation Strategy for the *Bays Plan.* The tables also include the programmatic monitoring objectives for each action as well as preliminary milestones or monitoring parameters or both. Detailed milestones will need to be developed for new projects as part of each project's work plan. These detailed milestones will be included in the CBBEP's programmatic tracking system. Project managers will report on the status of milestones (e.g., percent completed) throughout project implementation. As each project is developed, implemented, and completed, the database will be updated to show the progress to date. Overall progress in achieving the goals of each Action Plan will be summarized and presented at CBBEP annual meetings, in implementation reviews, and in "report cards" which will be prepared and provided to the public. In addition, as the CBBEP progresses towards and accomplishes the *Bays Plan* Actions and goals, changes in the Actions and milestones may be made. These changes will be updated in the database.

Table 3-1. Programmatic Monitoring: Bay Tourism and Recreation.

Bay Tourism and Recreation		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/Monitoring Parameters**
Goal: Maintain and expand tourism and recreational opportunities in a way that enhances the local economy and protects the natural resources of the bays.		
Objective 1: Enhance the reputation of the Coastal Bend as being the premier destination for people to experience Texas' coastal natural resources.		
BTR-1: Encourage and assist regional tourism organizations to adopt a "theme" of resource protection and stewardship in their promotion of tourism.	To track the progress of the Friends of the Bay (FOB) program and educational, marketing and promotional efforts.	Establishment of a Friends of the Bays program
		Number of "Friends of the Bay" logos displayed and by what type of business
	To document the number and distribution of brochures with natural resource protection or ecotourism or both themes.	Number and distribution of promotional or educational brochures with themes of natural resource protection or ecotourism or both
	To document effectiveness of ecotourism promotions.	Number of people that cite environmental resources/ ecotourism as a reason for visiting an establishment or the area
	To record trends of environmental awareness in the tourism industry and local businesses.	Number of businesses that cite environmental resources/ ecotourism as a reason for visiting their establishment or area
	To track the development, promotion, and use of the bay-wide recreational uses and events database and web-site.	Completeness, maintenance, and accessibility of bay-wide recreational uses and events database
		Number of times the bay-wide recreational uses and events database web site is accessed
	To track events that have been developed using Friends of the Bay ecotourism themes.	Number of events that have been developed using Friends of the Bay ecotourism themes
Measures of Success ➢ Natural resource protection themes are incorporated in promotional literature by the tourism industry. ➢ Community and local government stewardship of public access sites is increased (see BTR-2). ➢ An increasing number of people visit the Coastal Bend based on its 'ecotourism' reputation.		
Objective 2: Improve existing public access sites and develop additional, well-managed sites in order to protect coastal natural resources and provide the bay user with proper facilities.		
BTR-2 – Provide for the appropriate number of improved, well-managed public access sites.	To document status and increase in the number and quality of well-managed public access sites.	Number and location of public access sites
		Number of public access sites with well managed facilities and parking
		Number of people using public access sites for recreation and other usage
	To document the conversion of existing access sites to well-managed category in response to BMPs.	Number of public access sites upgraded from poorly managed to well managed
	To track the amount of funding and number of full time equivalents spent on site-specific public access improvement plans.	Amount of funds and number of full time equivalents spent by local governments on public access sites

Table 3-1. Programmatic Monitoring: Bay Tourism and Recreation (continued).

Bay Tourism and Recreation		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/Monitoring Parameters**
BTR-2 – Provide for the appropriate number of improved, well-managed public access sites (cont'd).	To track the number of site-specific public access improvement implementation strategies developed and implemented.	Number of site-specific public access improvement implementation strategies developed and implemented
	To track the number of informal alliances formed with local businesses based on stewardship of publicly-owned access sites.	Number of informal alliances formed with local businesses based on stewardship of publicly-owned access sites
Measures of Success ➢ The number and quality of public access sites are increased. ➢ An increasing percentage of existing public access sites have well-managed facilities and parking. ➢ No declines in natural resources are observed due to improvements in public access sites.		
Objective 3: Minimize adverse impacts to coastal natural resources caused by recreational uses of the bays and augment resources for recreational use where appropriate.		
BTR-3 – Develop and implement management strategies to reduce or avoid impacts from recreational uses.	To document the development and implementation of consensus-based management plans for public access to whooping crane refuge.	Number of consensus-based management plans developed and implemented for whooping crane refuge
	To track the development and implementation of the Texas Seagrass Conservation Plan.	Development and implementation of the Texas Seagrass Conservation Plan
	To track the development and implementation of management plans for public use of bird rookery islands.	Number of management plans for public use of bird rookery islands developed and implemented
	To monitor the development and implementation of a marina Best Management Practices (BMPs).	Number of site-specific marina BMPs developed and implemented
		Assessments of marine operations
	To track the installation and use of pump-out stations and trash receptacles at marinas.	The changes in volume of sewage collected at pump-out stations over time
		Number of trash receptacles and frequency of emptying at marinas
	To document the development of a public education program related to recreational boating, addressing issues such as sewage pump-out, litter, effect of propeller wash, and impact of chronic discharges.	Availability of waste handling and disposal training materials, number of training sessions completed
	To document the development and implementation of floating cabin management guidelines.	Development and implementation of Floating cabin guidelines
	To document the trends in the enforcement of existing rules regarding floating cabins on dredged material islands.	Number and type of enforcement actions
	To document the development and implementation of a catch and release promotion program.	Development and implementation of catch and release program
		Number of catch and release tournaments
BTR-4 – Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	To document the development and implementation of a bays artificial reef master plan.	Development and implementation of an artificial reef master plan

Table 3-1. Programmatic Monitoring: Bay Tourism and Recreation (continued).

Bay Tourism and Recreation		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/Monitoring Parameters**
BTR-4 – Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate (cont'd).	To document the development and implementation of a Bays artificial reef master plan (cont'd).	Development of an artificial reef monitoring plan to show positive progress and reduction of negative impacts – development and implementation
		Number of reefs (both natural and artificial)
		Development of studies related to potential for recreational fishery enhancement

Measures of Success:

- The impacts of recreational boating on seagrasses are reduced (also see HLR-1).
- The impacts of human intrusion into the critical habitat of the whooping crane are reduced.
- The impacts of recreational activities on bird rookery islands are reduced.
- The impacts of recreational fishing on recreational fishery species populations are reduced (see HLR-4).
- The Texas Seagrass Conservation Plan is implemented.
- An increasing number of pump-out stations are installed at marinas and waterside subdivisions.
- The number and quality of reefs (both natural and, if appropriate, artificial) are increased.
- Positive environmental impacts from artificial reefs are increased and negative environmental impacts are reduced.

Table 3-2. Programmatic Monitoring: Bay Debris.

Bay Debris		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Bays Plan Goal: Reduce bay debris in the Coastal Bend to ensure minimal impact to people, aquatic life, and natural resources.		
Objective 1: Reduce the amount of debris entering the bays and estuaries throughout the Coastal Bend.		
BD-1 – Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	To document progress towards improved solid waste management procedures.	Development and implementation of regional bay debris management procedures
		Development and implementation of regional bay debris monitoring program (include monitoring at stormwater outfalls)
		Implementation of improved solid waste management procedures by rural, urban, and unincorporated areas
		Establishment of partnership with National Marine Debris Monitoring Program
		Number of communities cooperating in the regional solid waste monitoring program
	To document improvements in law enforcement.	Number of education and enforcement training programs completed
		Changes over time in the number of citations written for solid waste disposal infractions
	To document improvements in public assistance.	Compilation of public assistance programs by municipality
	To document implementation of pilot and volunteer programs.	Number of voluntary bay cleanups
		Number of boat ramp owners providing solid waste\trash disposal facilities.
		Number of pilot programs deployed
		Incorporation of pilot program findings into waste management procedures
		Number of debris removal activities by municipality
Measures of Success: ➢ The overall quantity of bay debris in the project area is decreased. ➢ The amount of debris in the vicinity of stormwater outfalls is decreased. ➢ The number of illegal dumpsites in the project area is decreased. ➢ The amount of solid waste received at landfills, recycling centers, and composting facilities is increased. ➢ The number of boat ramp owners providing solid waste trash disposal facilities is increased (see BTR-3). ➢ The number of communities cooperating in a regional bay debris monitoring program is increased.		

Table 3-3. Programmatic Monitoring: Public Health.

Public Health		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Ensure public health associated with contact recreation and seafood consumption.		
Objective 1: Ensure that any threat of waterborne illness and disease in minimized.		
PH-1 – Facilitate a regional approach to recreational water quality management.	To track the establishment of a contact recreation workgroup of public health officials to address recreational water quality assessment and monitoring needs.	Establishment of the contact recreation workgroup
		Development of a contact recreation advisory plan
	To track the development and implementation of a consensus-based public health monitoring program for recreational waters.	Development and implementation of recreational waters monitoring program
		Review of existing data quality indicators
	To track the development and testing of a predictive model based on appropriate indicators and environmental conditions to assess safety of contact recreation in high use areas.	Development and testing of a predictive model
	To track development of strategies for local governments to communicate information to the public and respond to public health threats.	Development and implementation of communication strategies for public health threats
Measures of Success: ➢ A contact recreation advisory plan is implemented by Coastal Bend communities. ➢ A predictive model is developed and tested.		
Objective 2: Reduce the risk associated with consumption of fish and shellfish caught in the project area.		
PH-2 – Conduct health risk assessments associated with consumption of seafood in suspect areas.	To track the development and implementation of a (continuing) human health risk assessment study of selected contaminants in selected locally caught seafood from a minimum of Nueces Bay and Corpus Christi Inner Harbor.	Completion of risk assessment study for selected areas
		Release of results of risk assessments to the public (*e.g.*, through program website, or a link to the Texas Department of Health website)
		Implementation of source identifications and controls if unacceptable risk found
		Time from documentation of known risk to institutional control
		Number of shellfish bed closures
	To document the review of shellfish harvest area classification processes	Completion of review of shellfish harvest area classification processes
		Implementation of new shellfish harvest area classification processes
		Documentation of the reevaluation of permanently closed shellfish areas for reclassification
	To track the implementation of public health protection institutional controls.	Number of fish consumption advisories
		Number of fish advisories due to toxic contaminants
Measures of Success: ➢ The fish tissue study and risk analysis are completed for selected areas. ➢ A determination is made whether the risk to human health from consumption of fish and shellfish from known or suspected problem areas in the project area exceeds regulatory levels for consumption advisories or closures. ➢ Permanently closed shellfish areas are evaluated for reclassification.		

Table 3-3. Programmatic Monitoring: Public Health (continued).

Public Health		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Objective 3: Improve availability and data analysis of public health parameters through integration of water quality and epidemiological and injury information.		
PH-3 – Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	To track the number of regional health care providers participating in the collection of bay-related epidemiological and injury information.	Number of regional health care providers participating in the collection of bay-related epidemiological and injury information
	To track the development of an epidemiological and injury data collection and management plan.	Development and implementation of epidemiological and injury data collection and management plan
	To track the adaptation and implementation of the TDH/CDC database and reporting program for reporting of epidemiological and injury data from selected health care providers.	Implementation of public health database and reporting program
	To track the eventual use and utility of the TDH/CDC database in a regional water quality management strategy.	Inclusion of the TDH/CDC database results into the regional water quality management strategy
Measures of Success: ➢ The database from health care providers on illnesses and accidents from outdoor recreational activities is increased. ➢ A determination is made whether there are temporal or spatial trends in bay-related diseases or injuries in the project area.		

Table 3-4. Programmatic Monitoring: Shoreline Management.

Shoreline Management		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Minimize impacts to bay resources from development or activities occurring within the coastal shore area.		
Objective 1: Assist local governments to strengthen local planning and permitting operations regarding shoreline management.		
SM-1 – Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	To ensure a shoreline inventory is developed.	Development of bibliography of coastal characterization reports
		Completion of periodic shoreline inventory with ground truthing as necessary (including percent of shoreline that is hardened, developed, open, natural, mitigated, or filled)
	To track development of preliminary site improvement plans.	Development of site improvement plans
		Ranking of site improvement plans for follow-up action.
		Publication of site improvement plans
		Updating of site improvement plans every 10 years
	To track implementation of the site improvement plans.	Funding and completion of site implementation plans
SM-2 – Assist local governments with shoreline management issues.	To track types and level of assistance provided to local governments related to shoreline management.	Completion of workshop to communicate issues and guidance
	To document the creation of a Regional Shoreline Advisory Council of local governments, landowners, and resource agencies.	Completion of Shoreline Management Workshop
		Creation of Regional Shoreline Advisory Council
	To document the development and distribution of "Guidelines for Shoreline Management for Local Governments".	Creation and distribution of a user-friendly "Guidelines for Shoreline Management for Local Governments"
	To document the establishment of an ongoing technical assistance program.	Development of a clearinghouse for shoreline management and technologies and planning framework
		Completion of workshops to present guideline document and to communicate financial assistance program and other resources
		Development of an on-going technical assistance program
	To monitor the efforts of various work groups and the Regional Shoreline Advisory Council in addressing crosscutting habitat issues	Number of work groups and special meetings to discuss crosscutting habitat issues.
SM-3 – Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	To document progress towards establishment of a local Land Trust Fund.	Creation of Land Trust Fund
		Communication of operating protocols
		Development of local government structure for administration of the Land Trust Fund
		Development of a plan to solicit public donations for the Land Trust
	To document the prioritization of identified areas.	Prioritization of identified areas

Table 3-4. Programmatic Monitoring: Shoreline Management (continued).

Shoreline Management		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Measures of Success: ➢ Impacts to bay resources from development or activities within the coastal shore area over time are determined. ➢ Changes over time in the degree of shoreline erosion, habitat loss, vulnerability to sea level rise, storm surge, and wave energy are determined. ➢ The percentage of shoreline attributed to hardened, developed, open, natural, mitigated, and filled conditions is determined. ➢ The rate of shoreline change, including erosion/accretion at target sites, is determined. ➢ A Regional Shoreline Advisory Council of local governments, landowners, and resource agencies is created. ➢ A user-friendly "Guidelines for Shoreline Management for use by Local Governments" is produced and distributed to local governments. ➢ An increasing percentage of new development is consistent with the "Guidelines". ➢ A public Land Trust Fund for land acquisition is established.		

Table 3-5. Programmatic Monitoring: Maritime Commerce.

Maritime Commerce		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Enhance maritime traffic safety while reducing the rate of maritime incidents from shipping, terminal operations, and marine pipelines.		
Objective 1: Enhance commercial maritime traffic safety.		
MC-1 – Support construction of a 125-foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	To record Congressional authorization for the barge shelf.	Congressional authorization for the barge shelf
	To track funding and construction of the barge shelf.	Available funding versus costs
		Completion of permitting and authorization process
		Construction of barge shelf -- repositioning of buoys and dredging
	To evaluate if the barge shelf improves maritime safety in the channel.	Frequency of marine collisions, groundings, and spills before and after construction of the barge shelf
MC-2 – Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.	To track evaluation of existing navigation ranges and development of priority list.	Completion of evaluation of existing navigation ranges
		Development of a priority list of navigation ranges
	To track development and implementation of range improvement plans.	Development of range improvement plan
	To determine status of range improvements.	Number of range improvements completed
	To evaluate if changes in navigation ranges improve maritime safety.	Frequency of marine collisions, groundings, and spills before and after implementation of range improvements, modifications to the navigational aids system, and any changes to the vessel operator training and continuing education requirements
	To obtain funding from the USCG for modifications to existing navigation ranges.	Submission of information and plan to USGS
		Fiscal commitments to fund improvements
MC-3 – Modernize the vessel traffic system and aids to navigation.	To track development and implementation of a coordinated, real-time data aids to navigation system (wind, tide and current information).	Increase in number and modifications of electronic hydrographic monitors
		Number of calls received by aids to navigation phone
		Survey of mariners on use of aids to navigation radio link (frequency, convenience, and effectiveness)
	To monitor assessment, development and implementation of a vessel traffic system.	Assessment of available technology for a vessel traffic system
		Development and implementation of a vessel traffic system
		Federal authorization of the vessel traffic system

Table 3-5. Programmatic Monitoring: Maritime Commerce (continued).

Maritime Commerce		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
	To evaluate if modernization of aids to navigation and development of a vessel traffic system improves maritime safety.	Frequency of marine collisions, groundings, and spills before and after implementation of range improvements, modifications to the navigational aids system, and any changes to the vessel operator training and continuing education requirements
MC-4 – Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	To document establishment and self-enforcement of minimum standards for ship pilots.	Development of minimum standards for ship pilots
		Enforcement of minimum standards for ship pilots
	To document the scope of vessel operator training and continuing education.	Development of a vessel operator training program
		Funding availability for educational programs
	To track schedule of training programs, workshops and public outreach.	Number and frequency of training programs and workshops
	To document the effectiveness of certification programs.	Certification test results to quantify efficacy of training programs
	To evaluate if training initiatives improve maritime safety.	Documentation of compliance with no wake zones and other operating procedures
		Ratio of collisions and groundings to traffic volume
Measures of Success ➢ The 125-foot wide barge shelf is funded and constructed. ➢ The number and frequency of maritime collisions and groundings are reduced. ➢ The range improvement plan is implemented. ➢ The number and frequency of maritime accidents and spills are reduced. ➢ The Vessel Traffic System is implemented. ➢ The ratio of maritime collisions and groundings to traffic volumes is reduced.		
Objective 2: Reduce impacts from maritime oil and hazardous material spills.		
MC-5 – Maintain and improve regional oil spill response capability.	To track progress in the evaluation and prioritization of high-risk areas and inclusion in contingency planning documents.	Evaluation of high-risk areas completed every 5 years
		Completion of updated oil spill atlas and maps delineating high-risk areas
		Incorporation of changes in high-risk areas into contingency planning documents
	To document the development of spill response guidelines and adoption of new technologies.	Exploration and evaluation of alternative spill response equipment and technologies
		Development of guidelines and recommendations for oil spill responders
		Inclusion of updated guidelines and new technologies in contingency plans
	To assess public awareness oil spill response plans and notification network.	Number and distribution of public outreach materials

Table 3-5. Programmatic Monitoring: Maritime Commerce (continued).

Maritime Commerce		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
		Number of public employees and leaders that participate in oil spill drills
		Frequency and adequacy of spill response drills
	To monitor efforts to maintain high level of readiness.	Establishment of regional response team
MC-5 – Maintain and improve regional oil spill response capability (cont'd).	To monitor efforts to maintain high level of readiness (cont'd).	Development of an oil spill recovery database that includes cause of the accidental spill, response time of oil spill recovery teams to oil spills, response or remediation actions required, spill response and remediation time and effectiveness of containment measures, removal, and remediation
	To track development of cooperative agreements for coordination of oil spill response activities.	Number of cooperative agreements set in place for coordination of oil spill response activities
MC-6 – Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	To track development of regional HAZMAT contingency plans.	Development of HAZMAT contingency plan
		Determination of content of HAZMAT spill response records
		Collection of data for the HAZMAT spill response records
	To determine public awareness of emergency plans (evacuation routes, notification network, and emergency communications).	Number of public awareness materials published on the emergency plans
	To track development of cooperative agreements for coordination of HAZMAT response activities.	Number of cooperative agreements between agencies and private parties for HAZMAT response coordination
	To estimate the quality of spill response in environmentally sensitive areas, and changes over time.	Number and severity of oil and hazardous material spills based on the oil spill database listed under MC-5
Measures of Success ➢ Oil spill response resources are being coordinated through cooperative agreements. ➢ The response to spills is environmentally sensitive areas is improved. ➢ A HAZMAT regional plan is established in a cooperative framework. ➢ The effectiveness of hazardous material spill response is increased. ➢ Public awareness of emergency plans is increased.		
Objective 3: Reduce the occurrence and improve the response strategy to marine pipeline incidents.		
MC-7 – Establish an interagency forum to coordinate pipeline mapping and contingency planning.	To track the establishment of an interagency forum of pipeline stakeholders.	Establishment of the interagency forum
		Identification of information gaps, duplicative requirements and overlapping jurisdictions
		Development of interagency memoranda of understanding to streamline and coordinate regional pipeline oversight

Table 3-5. Programmatic Monitoring: Maritime Commerce (continued).

Maritime Commerce		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
	To document compilation of existing marine pipeline GIS databases.	Number of pipelines documented and mapped including composition, dimension, product carried, activity level, ownership, and location
	To track the development and use of pipeline database for contingency planning and dissemination.	Number of hits on the pipeline GIS database
Measures of Success: ➢ The percent of target pipelines mapped in the project area is increased.		
Objective 4: Reduce the potential for introductions of non-native species caused by maritime operations.		
MC-8 – Prevent the introduction on non-native species through improved ballast water management.	To track implementation of National Invasive Species Act locally through educational initiatives.	Frequency and efficacy of educational initiatives on ballast operations
	To identify high-risk vessels based on operational and regulatory parameters.	Listing of high-risk vessels
		Number of ship visits (focus on high-risk vessels)
	To develop a regional invasive species strategy plan for marine vessels.	Establishment of regional invasive species strategy
		Coordination of information with the USCG Marine Safety Information System database.
		Prioritization of educational efforts and compliance evaluations
Measures of Success: ➢ Introductions of non-native species from ballast water are prevented (also see HLR-10).		

Table 3-6. Programmatic Monitoring: Dredging.

Dredging		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Ensure that all dredging activities are planed and conducted in ways that consider the cost effectiveness of the operation, while minimizing ecological impacts and maximizing the beneficial uses of dredged material.		
Objective 1: Improve dredging techniques and dredged material management practices.		
D-1 – Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	To track Beneficial Use group (BUG) establishment and products.	Establishment of BUG
		Quantitative BUG milestones
	To document availability of beneficial use of dredged material research and funding sources.	Assessment of results of related research on beneficial uses of dredged material
		Number of funding sources identified for beneficial use projects and recycling incentives
	To document the design and implementation of beneficial use projects.	Number of beneficial use projects designed and implemented
	To evaluate effectiveness of beneficial use projects.	Changes in number of beneficial use projects over time
		Percentage of dredged material used beneficially
D-2 – Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	To document development of 50-year dredged material management plan.	Establishment of dredging oversight group to monitor dredging activities
		Development of a 50-year dredged material management plan
	To ensure the management plan includes implementation of BMPs and utilization of the Inland Testing Manual Guidance for addressing dredged material.	Completion of inventory of BMP dredging techniques and best management techniques
		Integration of BMPs into 50-year plan
		Increase in use of BMPs
		Reduction in need for disposal areas that are not beneficial use
	To develop a dredging bibliography/database of current and historical research and permit actions.	Completeness of database and measure of use by implementation partners
	To utilize and update database for use with predictive models to assess impacts of future dredging.	Yearly update of dredging database
		Assessment of existing models for predicting impacts and incorporation of information from the models into the dredging database
D-3 – Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	See D-2	See D-2
Measures of Success: ➢ The number of projects implementing beneficial use of dredged material is increased. ➢ The percentage of dredged material used beneficially is increased. ➢ A dredging oversight group to monitor dredging activities is established. ➢ A bibliography of current and historical research on dredging is assembled for use by implementation partners. ➢ Dredging techniques and dredged material management practices are improved. ➢ The need for and use of dredged material disposal areas that are not beneficial use sites is reduced		

Table 3-7. Programmatic Monitoring: Habitat and Living Resources.

Habitat and Living Resources		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Increase and preserve the quantity, quality, and diversity of habitats and living resources.		
Objective 1: Preserve, create, and restore coastal habitats.		
HLR-1 – Preserve functional, natural habitats of all major types.	To track the identification and prioritization of habitat types and locations for preservation efforts.	Number of habitat types and locations that have been identified and prioritized
	To track funding incentives provided to private landowners for preservation.	Number of funding incentives provided to private landowners
	To track the implementation of technical assistance provided for the development and implementation of management plans for various preservation techniques.	Number of management plans for preservation techniques
		Number of Project Wild certifications
		Number of site-specific plans developed and implemented
HLR 2 – Create new habitats or restore degraded habitats or both where feasible.	To track the identification and prioritization of habitat types and locations for creation or restoration efforts.	Development of a Regional Habitat Creation and Restoration Plan
	To track the development and implementation of site-specific plans for creation and restoration, including the appropriate follow-up monitoring and assessment.	Number of site-specific plans developed and implemented
		Monitoring and assessment following the implementation of creation and restoration efforts
HLR-3 – Determine and manage the impact(s) of seismic activities and operations requiring state or local permits or both on coastal habitats and associated fauna.	To track the development of a working group to identify and prioritize habitats and associated fauna highly susceptible to seismic activity impacts.	Establishment of a working group to identify and prioritize seismic activity impacts
	To track the development and implementation of demonstration projects to evaluate impacts to coastal habitats and living resources.	Number of demonstration projects developed and implemented
	To track the evaluation of the current seismic permitting process to ensure minimal impacts to natural resources.	Completion of evaluation of the current seismic permitting process based on demonstration project findings
Measures of Success: ➢ The area of preserved habitat is increased. ➢ The number of Project Wild certifications is increased. ➢ The area of restored or created habitat is increased. ➢ The permitting process is modified to ensure adequate measures are taken to minimize impacts to coastal habitats.		
Objective 2: Ensure long-term sustainability of native living resources.		
HLR-4 – Develop management plans to ensure sustainability for species of concern.	To track the development and implementation of management plans for species of concern (birds, fish, shellfish, marine mammals, marine reptiles and plants).	Number of species management plans developed and implemented
HLR-5 – Improve animal rescue and rehabilitation programs.	To track the completion of a workshop to establish a coordinated network of communication among professionals and volunteers involved with animal rescue and rehabilitation.	The development and completion of a workshop to establish a coordinated network of communication involved with animal rescue and rehabilitation
	To track the development and implementation of plans to stabilize funding and human resource needs (Texas Marine Mammal Stranding Network Sea Turtle Strandings Network, bird rescue and rehabilitation).	Level of funding for TMMSN, STSSN, and bird rescue and rehabilitation

Table 3-7. Programmatic Monitoring: Habitat and Living Resources (continued).

Habitat and Living Resources		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
HLR-5 – Improve animal rescue and rehabilitation programs (cont'd).	To track the improvement of animal rescue and rehabilitation programs.	Number and quality of animal rehabilitation facilities.
		Number of animals rescued or rehabilitated
		Number of volunteers at animal rehabilitation facilities
HLR-6 – Facilitate consensus on the regional approach to effective management of bay and bait shrimping.	To track the facilitation of obtaining input from stakeholders about management concerns and possible options.	Number of workshops and meetings to discuss management of bay and bait shrimping
		Number of conflicts between segments of the shrimp industry
	To track the establishment of a regional shrimping advisory board.	Formation of a Regional Shrimping Advisory Board
	To track the development and implementation of recommendations on a regional management approach.	Number of recommendations that are developed, presented, and implemented
HLR-7 – Reduce bycatch from bay shrimp trawling.	To determine the optimal Bycatch Reduction Device (BRD) design.	Completion of evaluation of bycatch Reduction Devices for optimal design
	To track funding for the purchase of BRDs and the voluntary use of the best gear choice by the bay shrimping industry.	Amount of funding for the purchase of BRDs
		Number of voluntary users of BRDs in the bay shrimping industry
HLR-8 – Reduce impacts on living resources associated with industrial cooling water intake.	To track the evaluation of impacts from impingement and entertainment of organisms at cooling water intakes.	Impacts from impingement and entrainment of organisms at cooling water intakes evaluated
	To track the determinations of potential mechanisms to reduce impingement and entrainment.	Number of potential mechanisms to reduce impingement and entrainment
	To track the evaluation of incentives to encourage voluntary use of reduction mechanisms by industry.	Number of incentives to encourage voluntary use of reduction mechanisms by industry identified
HLR-9 – Minimize the impacts and reduce the occurrence of harmful algal blooms.	To track the organization of an advisory team to identify potential factors that could reduce impacts from Harmful Algal Blooms (HABs).	Organization of advisory team to identify potential factors that could reduce impacts from HABs
	To track the process of a risk assessment of the proposed management options.	Completion of risk assessment of proposed HAB management options
		Completion of cost/benefit analysis of proposed management options
	To track the identification and implementation of potential demonstration projects evaluating inhibitory compounds, nutrient manipulations, and biological controls of HABs	Number of HAB control demonstration projects
	To track the identification of a funding mechanism to implement the HAB demonstration projects.	Number of funding sources for HAB demonstration project implementations identified
	To track the evaluation of best management practices for minimizing HAB impacts on native living resources and seagrass productivity.	Completion of evaluation of BMPs for minimizing HAB impacts
	To track the updates provided to the research consortium and the public to increase awareness of HABs.	Number of updates provided to the research consortium and the public on HABs

Table 3-7. Programmatic Monitoring: Habitat and Living Resources (continued).

Habitat and Living Resources		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
HLR-10 – Develop management plans to minimize introductions and impacts from non-native species.	To track the identification of the distribution and ecological impacts associated with existing non-native species.	Distribution and ecological impacts of existing non-native species
	To track the identification of techniques for controlling problematic non-native species.	Identification of techniques for controlling problematic non-native species
	To track the implementation of demonstration projects to determine the effectiveness of control techniques.	Number of non-native species control demonstration projects implemented
	To track the implementation of control methods through existing programs.	Number of control methods implemented through existing programs
	To track the development, completion, and implementation of management plans to minimize the introduction and impacts of non-native species	Number of non-native species management plans developed and implemented
		Changes over time in distribution an range of existing non-native species

Measures of Success:

- The number of species management plans developed and implemented for species of concern is increased.
- The population of species of special concern, (*e.g.*, shorebirds, brown pelicans, whooping cranes) in the project area is increased over time.
- The number and quality of animal rehabilitation facilities are increased.
- The number of volunteers for animal rehabilitation facilities is increased.
- The mortality rate for species of concern is decreased.
- The number of conflicts between segments of the shrimp industry is reduced.
- Profits from bay shrimping are increased.
- Sustainable levels of shrimp harvest are achieved and shrimp stocks are stabilized.
- Shrimp trawling bycatch is reduced by 50% within 10 years.
- The rate of impingement and entrainment associated with industrial cooling water intakes is reduced by 50% within 10 years.
- The number of and total funding for HAB demonstration projects are increased.
- Using a HAB monitoring program, the frequency of harmful algal blooms is decreased over time.
- The percentage of the project area affected by harmful algal blooms is decreased over time.
- The impacts of HABs are decreased over time.
- A list of non-native species which can affect the project area and effective control measures are developed.
- The distribution and range of existing non-native species are reduced over time.

Table 3-8. Programmatic Monitoring: Water and Sediment Quality.

Water and Sediment Quality		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Maintain or enhance or both water and sediment quality. Understand total loadings and the transport pathways and biological effects of loadings to the bay system.		
Objective 1: Improve the quality of ambient water and sediment in impaired or stressed segments to attain standards and criteria.		
WSQ-1 – Implement plans to improve water and sediment quality in identified segments.	To track the development and implementation of plans to improve water and sediment quality in segments that presently exceed water quality standards and sediment screening levels.	Number of segments that do not meet water quality standards and sediment screening levels
		Development and implementation of water and sediment quality improvement plans for each segment that is not in compliance
	To document the development of TMDLs for priority 303(d) listed segments and revisions of the 303(d) list.	Number of completed TMDL allocations for segments on the 303(d) list
		Number of segments on 303(d) list
	To track the development and implementation of plans to address elevated levels of metals for specific bay segments.	Development and implementation of segment specific plans to address elevated levels of metals where necessary
	To track the development and implementation of plans to address depressed DO levels and elevated fecal coliform levels in Oso Bay.	Development and implementation of DO and fecal coliform plans for Oso Bay
WSQ-2 – Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	To track applications for discharge permits by aquaculture facilities and to ensure that all CBBEP aquaculture facilities are properly applying for permits.	Percentage of aquaculture facilities that have state discharge permits
		Number of aquaculture facilities that have applied for discharge permits
	To track comparison of permit requirements for aquaculture facilities and seafood processing facilities.	Completion of comparison of requirements for aquaculture permits
	To track the implementation of interagency (TPWD/TNRCC) coordination on permitting issues, disease control and response, and aquaculture facility inspections.	Implementation of the existing interagency memorandum of understanding on permitting issues, disease control monitoring and response, and investigations of aquaculture facilities
	To track percentage of permits that utilize TPWD recommendations in setting discharge permit limits.	Percentage of permits utilizing TPWD recommended discharge permit limits
	To track implementation of public notice requirements for permitting and registration of aquaculture facilities.	Number of public notices vs. number of applications for permits for aquaculture facilities
	To track education of local governments and the public on public notice requirements and procedures.	Number of meetings/workshops open to the public for permitting and rule-making for aquaculture facilities
		Number of public comments on proposed permitting and rulemaking for aquaculture facilities received at meetings/workshops
	To document site-specific plans to minimize escape of species and diseases.	Number of site specific plans developed and implemented

Table 3-8. Programmatic Monitoring: Water and Sediment Quality (continued).

Water and Sediment Quality		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Measures of Success: ➢ Water quality in impaired or stressed segments improves over time. ➢ Sediment quality in impaired or stressed segments improves over time. ➢ The number of segments on the state 303(d) list is reduced. ➢ Opportunities for public comment on proposed permitting and rule-making for aquaculture facilities are increased. ➢ The percentage of aquaculture facilities discharging in the project area that have state wastewater discharge permits is increased. ➢ The environmental impacts associated with aquaculture facilities are reduced. ➢ The potential for escape of non-native species or diseases or both from aquaculture facilities is reduced.		
Objective 2: Assess total loadings and transport pathways of constituents.		
WSQ-3 – Quantify total constituent loadings.	To track the progress of assessing relative contributions and loadings from primary point and nonpoint sources.	Completion of assessment of data needs for point and nonpoint sources
		Completion of additional data collection if necessary
		Development and implementation of point and nonpoint source monitoring program
		Assessment of percentage of primary point and nonpoint sources
	To track the progress of a voluntary data collection program and additional self-reporting effluent data.	Development of a voluntary data collection program to collect actual data using 'clean techniques' for inclusion in the total loadings model
		Quantity and quality of voluntary data submitted
	To track the development of the 'total loadings model' and its consistency with the state's TMDL process and the usefulness of alternative models.	Development of the 'total loadings model'
		Comparison of the 'total loadings model' with the state's TMDL process
		Assessment of the usefulness of alternative models
WSQ-4 – Undertake an analysis of the biological and ecological effects of selected constituents.	To track efforts to assess the transport, fate, and biological effects of targeted loadings identified from the 'total loadings model.'	Completion of assessment of the transport, fate, and biological effects of targeted loadings
	To assess the reaction/response of marine/estuarine fauna to varying constituent concentrations.	Completion of tests run to determine the reaction/response of key life stages of marine/estuarine fauna to varying constituent concentrations
Measures of Success: ➢ Total loadings are quantified to the greatest extent possible. ➢ The number of TMDLs developed and implemented for impaired segments is increased. ➢ An understanding of the effects and pathways of harmful constituents is improved. ➢ The number of management measures initiated to minimize negative impacts is increased.		
Objective 3: Develop and implement segment-specific water and sediment quality standards.		
WSQ-5 – Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	To track efforts to review and develop recommended changes to established water quality standards, screening levels, and biological criteria.	Number of water quality standards, sediment screening levels, and biological criteria confirmed or changed as a result of monitoring data review

Table 3-8. Programmatic Monitoring: Water and Sediment Quality (continued).

Water and Sediment Quality		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
		Continued review of water quality standards, sediment screening levels, and biological criteria
Measures of Success: ➢ State water quality standards are evaluated and amended as needed. ➢ Area-specific biological standards are developed and established for specific estuarine communities.		

Table 3-9. Programmatic Monitoring: Nonpoint Source Management.

Nonpoint Source Management		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Improve management of all loadings to the bay system.		
Objective 1: Coordinate and implement a nonpoint source management plan throughout the region.		
NPS-1 – Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	To track the establishment of a regional technical advisory committee	Development of a regional technical advisory committee
	To track the progress of the urban nonpoint source BMP handbook.	Formulation of technical advisory committee, creation of nonpoint source BMP library, preparation of draft and final handbooks, promotion and distribution of the handbook
	To document the impact of the BMP handbook or other NPS reduction activities on implementation of NPS BMPs in the CBBEP area	Number of communities and business associations represented in the regional initiative
		Number of BMP startups and completions
		Number and size of grants issued, number of NPDES permits issued, number of requests for assistance
	To track efforts to provide technical assistance to coastal communities implementing nonpoint source pollution prevention strategies.	Number of technical assistance efforts implemented
	To track efforts to identify potential funding sources to assist with providing technical assistance to coastal communities implementing nonpoint source pollution prevention strategies.	Number of funding sources identified
NPS-2 – Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	To identify and track businesses subject to NPDES programs or that have nonpoint source control needs that have not implemented pollution prevention plans.	List of businesses subject to NPDES programs or that have nonpoint source control needs that have not implemented pollution prevention plans
	To document the impact of an assistance program on the NPDES permitting process.	Number of full time equivalents devoted to providing technical assistance
		Amount of funding devoted to technical assistance
		Number of workshops conducted for businesses and industries subject to NPDES programs or that have nonpoint source control needs that have not implemented pollution prevention plan
NPS-3 – Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	To document the programmatic effectiveness of the OSSF assistance program.	Number of grant applications, number of grant awards, size of grant awards, number of OSSF permits with/without assistance, % OSSF permits and completions using desired technology, reduction of number of illegal domestic discharges into waterways
		Number of local governments assisted
		Development of OSSF compliance data management system

Table 3-9. Programmatic Monitoring: Nonpoint Source Management (continued).

Nonpoint Source Management		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
NPS-3 – Assist local governments to implement On-Site Sewage Facility (OSSF) programs (cont'd).	To document the programmatic effectiveness of On-site Sewage Facility (OSSF) assistance program (cont'd).	Development and implementation of surface and ground water monitoring plan at colonias
NPS-4 – Coordinate and implement agricultural water quality management programs necessary to meet water quality standards	To document the development and implementation water quality management plans as authorized by Senate Bill 503	Formulation of technical and public participation committees, preparation and review of management plan, publication and promotion of management plan
		Level of technical assistance provided to interested landowners in support of Senate Bill 503 water quality management plans
		Identification of cost-share funding for assisting interested landowners in support of Senate Bill 503 water quality management plans
		Amount of land voluntarily placed under agricultural water quality management programs
	To track the coordination of provisions from federal legislation that address water quality.	Completion of review and coordination of provisions from federal legislation on water quality
	To assist with educational workshops on BMPs and other data pertaining to water quality management and agricultural runoff.	Number of educational workshops conducted on BMPs for water quality management and agricultural runoff
	To seek funds and implement demonstration projects on agricultural BMPs that enhance water quality.	Number and dollar value of 319 grants solicited and won, number of 319 agricultural runoff BMP demonstration projects initiated and completed
		Number of applications for 503 grants, number of grants approved and dollar value of assistance, number of grant project completed, % of participating agriculture landowners by region (number and area)

Measures of Success:

- A regional technical advisory committee is established to coordinate nonpoint source Best Management Practices.
- A handbook of urban Best Management Practices is completed and distributed to participating partners.
- Water quality improvements attributable to urban BMPs are detected.
- The number of industries/businesses that successfully come into compliance with the help of compliance assistance programs is increased.
- Nonpoint source loadings from businesses/industries using BMPs are reduced.
- The total number of grants and amount of funding received by local governments to implement effective OSSF programs are increased.
- Water quality improvements attributable to OSSF programs are detected.
- The number of agricultural producers voluntarily participating in agricultural water quality management programs is increased.
- The area of agricultural land voluntarily placed under agricultural water quality management programs is increased.
- Agricultural water management programs are effective in meeting water quality standards.

Table 3-10. Programmatic Monitoring: Freshwater Resources.

Freshwater Resources		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Develop a regional water management plan that will meet both human and environmental needs of freshwater for the long-term.		
Objective 1: Develop and implement a water management plan based on best available data.		
FW-1 – Improve scientific understanding of the freshwater needs of the estuaries.	To track the continued use of current, cost effective, and scientifically acceptable methods to monitor parameters for freshwater inflow.	Assessment of the use of current, cost effective, and scientifically acceptable methods for monitoring for freshwater inflow
		Coordination of sample analysis methods for programs monitoring freshwater inflow
	To determine the needs for freshwater inflow to maintain the ecological health and productivity of the Coastal Bend bays and estuaries.	Assessment of the needs for freshwater inflow that provide sediments, nutrients, and salinity levels necessary to maintain the health and productivity of the bays and estuaries
		Development and assessment of methods for measuring estuary and bay productivity
	To track the refinement of the reservoir operating plan.	Revision of reservoir operating plan
	To track the deployment of new stream flow and rainfall gauges throughout the project area.	Assessment and coordination of the overall data collection needs and identification of locations
		Completion of a flow and rainfall collection quality assurance plan
		Funding and deployment of the new gauges
	To track efforts to create a data information repository.	Compilation of user friendly, easy-to-access data repository
FW-2 – Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	To track the development of a regional advisory board of freshwater stakeholders.	Formation of regional advisory board developed for freshwater stakeholders
	To track the development of a regional water plan based on Senate Bill 1by the regional advisory board.	Creation of the regional water plan based on Senate Bill 1
	To document projects assessing ecology and economics of beneficial reuses of wastewater.	Inventory of projects evaluating water reuse benefits
		Compilation of alternative methods and water conservation initiatives
		Progress on diversion of treated wastewater to the Nueces delta
	To track water conservation initiatives (including water rates, building codes, incentives/disincentives) and education programs and alternative freshwater supply sources.	Number of initiatives developed and implemented
		Number of education programs conducted
		Number of alternative freshwater supply sources investigated and demonstration projects initiated
		Number of households and businesses implementing water conservation
	To track efforts to identify new innovative rates, programs, building codes, and incentives to encourage conservation.	Completion of project inventory with project feasibility assessment

Table 3-10. Programmatic Monitoring: Freshwater Resources (continued).

Freshwater Resources		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
FW-3 – Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	To track projects to increase freshwater inflows to the bays and estuaries.	Number of demonstration projects developed and implemented to increase freshwater inflows to the bays and estuaries
		Number of feasibility studies performed on implementing successful demonstration projects on a bay-wide scale
	To document support to the U.S. Bureau of Reclamation in Rincon Bayou	Development of educational materials in support of the Rincon Bayou Project and its objectives.
FW-4 – Effectively communicate the purpose and results of ongoing freshwater plans and programs.	To document development of procedures to communicate freshwater supply issues to the public.	Development and implementation of communication strategy
		Development and implementation of public opinion poll assessing public support for efficient use of water in the project area
		Number of conservation measures implemented

Measures of Success:

- Changes in the amount, timing, and location of freshwater inflows over time are determined.
- Monitoring of salinity, rainfall, sediment, and nutrient loading, and productivity of the bays is expanded.
- A regional water plan based on Senate Bill 1 is developed, implemented, and effective in meeting estuary needs
- The number of wastewater reuse projects and volume of wastewater reuse are increased.
- The current reservoir freshwater pass through, including treated wastewater reuse, is effective in meeting all stakeholder needs.
- The opportunity for flooding into the Nueces River delta over the long term is increased.
- Public understanding of the purpose and results of ongoing freshwater plans and programs is increased.
- Public support for the efficient use of water in the project area is increased.

Table 3-11 Programmatic Monitoring: Public Education and Outreach.

Public Education And Outreach		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
Goal: Implement an innovative and measurable education and outreach strategy to improve public understanding and support for effective management of bay resources.		
Objective 1: Implement a coordinated regional approach for development and distribution of information and outreach materials for identified audiences and issues.		
PEO-1 – Develop and implement a regional Public Education and Outreach Strategy.	To track the formation of a Public Outreach Advisory Committee and the establishment or enhancement of outreach efforts where gaps exist.	Formation of Public Outreach Advisory Committee
		Establishment or enhancement of public outreach efforts where the Public Outreach Advisory Committee determines there are gaps
	To track the progress of a baseline public awareness survey.	Development and implementation of public awareness surveys
	To track the utilization of mass media to distribute environmental information and cover environmental issues.	Designation of media point person
		Frequency of utilization of mass media
	To track the identification of high traffic areas where information can be distributed most effectively.	Listing of high traffic areas where information can be distributed most effectively
		Number of displays and interactive exhibits established
	To track the development and promotion of an information resource center.	Establishment of information resource center, hotline, and Internet site
		Number of people visiting the Internet site, visiting the information resource center, and calling the hotline
	To track the development and distribution of environmental education materials.	Development and distribution of "Environmental Citizen's Guide", newsletter, "State of the Bays" report, videos and public service announcements
PEO-2 – Establish a Bay Day celebration to focus attention on bay resources and uses.	To track the establishment of a Bay Day celebration, including the organization of committee, co-sponsors, participants, displays, entertainment, concessions and advertising campaign.	Formation of Bay Day Committee
		Development of list of co-sponsors and participants
		Evaluation of host sites
		Development of event work plan
		Development of advertising campaign
	To evaluate of the effectiveness of the Bay Day Celebration.	Number of people attending Bay Day
		Level of public awareness after the Bay Day has been held
Measures of Success: ➢ Public surveys are completed every 3 years to evaluate stewardship. ➢ The resource center, hotline, and Internet site are completed and operational. ➢ Public awareness of Coastal Bend bays issues is increased. ➢ The number of people exposed to educational messages is increased over time.		
Objective 2: Implement a regional approach to develop and distribute environmental education curricula for Coastal Bend school districts.		

Table 3-11 Programmatic Monitoring: Public Education and Outreach (continued).

Public Education And Outreach		
Bays Plan Goals\Objectives\Actions	**Monitoring Objectives**	**Preliminary Milestones/ Monitoring Parameters**
PEO-3 – Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	To track the coordination with school districts to determine the extent and success of currently used materials and to identify and develop new materials.	Establishment of regionally focused environmental curriculum
PEO-3 – Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults (cont'd).	To track the coordination with school districts to determine the extent and success of currently used materials and to identify and develop new materials (cont'd).	Development of K-12 state and national science standards
		Distribution of educational materials
	To track the development or enhancement or both of outdoor educational facilities for school and other user groups.	Number of existing outdoor educational facilities
		Development of improvement plan for prioritized sites
	To track the progress of workshops and teacher training.	Number of workshops and teacher training courses
	To monitor the success of curricula through the surveying of environmental education teachers.	Completion of surveys of environmental education teachers
Measures of Success: ➢ A regionally focused environmental curriculum is established in all project area school districts. ➢ The number of education sites in the project area and users of the sites are increased. ➢ Surveys of education site users reveal that they are satisfied with their experience.		
Objective 3: Promote public participation in environmental stewardship programs to increase awareness and instill individual responsibility.		
PEO-4 – Conduct public forums to increase dialogue between resource managers and users.	To track the coordination of an annual public forum (and others) on regional resource management issues.	Number of public forums held
		Number of attendees at forums
	To track the development of an Internet newsgroup focused on regional issues identified in the *Coastal Bend Bays Plan*.	Number of newsgroups developed
PEO-5 – Promote public participation and recognition programs to protect the bay system and its resources.	To track the coordination of citizens' monitoring programs.	Number and coverage of citizen monitoring programs
	To track the development and promotion of environmental volunteer award programs.	Number of bay-related environmental award programs
	To track the institutionalization of a "Clean the Bay Day".	Number of "Clean the Bay" days and the quantity of trash collected
	To track the promotion of environmental stewardship through the use of educational, industrial, local, and national grant award programs and the development of local grant proposals for education and industry.	Number of educational, industrial, local, and national grant award programs in the project area
		Number of local grant proposals developed
Measures of Success ➢ Participation in public forums on bay management is increased over time. ➢ The percentage of the project area covered by citizen monitoring programs is increased. ➢ The number of bay-related environmental volunteer award programs is increased. ➢ The number of 'Clean the Bay' days and the amount of trash collected are increased. ➢ The number of educational, industrial, and national grant award programs for environmental stewardship in the project area is increased.		

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Appendix A

Program Information Collected for Use in Figures

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
TNRCC Surface Water Quality Monitoring											
Nueces River Tidal North of Viola turning basin	12960	27° 50' 48" N	97° 31' 15" W			X	X	X	X		
Petronilla Creek 1.2 km upstream of the confluence with Tunas Creek	13090	27° 29' 08" N	97° 32' 18" W			X	X	X	X		
Petronilla Creek at FM 892 SE of Driscoll	13094	27° 37' 20" N	97° 39' 45" W		X	X	X	X	X		
San Fernando Creek at US77 bypass bridge at Kingsville	13033	27° 32' 18" N	97° 30' 36" W			X	X	X			
Mesquite Bay south of ICWW Marker 13	13400	28° 09' 48" N	96° 51' 42" W			X	X	X			
Aransas Bay Intersection of Intracoastal canal and Lydia Ann Channel	13402	28° 00' 05" N	97° 01' 40" W		X	X	X	X			
Aransas Bay in Lydia Ann Channel west of Light House	16492	27° 51' 03.60" N	97° 03' 14.40" W		X	X	X	X	X		
Copano Bay 1 mile east of Bayside	14783	28° 05' 15" N	97° 12' 33" W		X	X	X	X			
Corpus Christi Bay at CM #62	13407	27° 48' 40" N	97° 18' 05" W		X	X	X	X	X		
Corpus Christi Bay near Shamrock Point	14355	27° 45' 40" N	97° 09' 45" W		X	X	X	X	X		
Corpus Christi Bay near Corpus Christi Ship CM #86	13410	27° 48' 36" N	97° 23' 18" W		X	X	X	X	X		
Corpus Christi Bay ½ mile off Doddridge Road	13411	27° 45' 05" N	97° 21' 54" W		X	X	X	X	X		
Nueces Bay at US 181 Bridge at Causeway (south side)	13421	27° 50' 15" N	97° 23' 36" W		X	X	X	X			
Nueces Bay ½ mile from south shore at east overhead powerline	13422	27° 49' 58" N	97° 24' 57" W		X	X	X	X			
Nueces Bay near Whites Point	13425	27° 51' 02" N	97° 28' 52" W		X	X	X	X	X		
Redfish Bay at the ICWW at Aransas Pass	14801	27° 53' 00" N	97° 07' 42" W		X	X	X	X	X		
Conn Brown Harbor	13287	27° 54' 15" N	97° 08' 42" W			X	X	X			
Corpus Christi Inner Harbor in Avery turning basin	13430	27° 49' 13" N	97° 25' 44" W		X	X	X	X	X		
Corpus Christi Inner Harbor near Navigation Blvd. draw bridge	13432	27° 49' 10" N	97° 27' 00" W		X	X	X	X	X		
Corpus Christi Inner Harbor in Viola turning basin	13439	27° 50' 36" N	97° 31' 12" W		X	X	X	X	X		

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Laguna Madre south of the intersection of ICWW and Padre Island causeway	13443	27° 36' 00" N	97° 14' 24" W			X	X	X			
Laguna Madre at intesection of ICWW at Baffin Bay marker	13444	27° 16' 35" N	97° 24' 37" W			X	X	X			
Laguna Madre at ICWW near Bird Island	13445	27° 28' 45" N	97° 19' 15" W			X	X	X			
Baffin Bay at CM 14	13450	27° 16' 06" N	97° 30' 36" W		X	X	X	X	X		
Baffin Bay at CM 36	13452	27° 17' 24" N	97° 38' 36" W		X	X	X	X			
Gulf of Mexico at Port Aransas near end of South Jetty near marker R-7	13468	27° 49' 40" N	97° 01' 52" W			X	X	X			
CBBP Surface Water Quality Management Assessment											
EMAP Sampling Stations	1	28° 09' 54" N	97° 04' 56" W	X		X	X		X		
EMAP Sampling Stations	2	28° 10' 08" N	97° 09' 27" W	X		X	X		X		
EMAP Sampling Stations	3	28° 09' 04" N	97° 01' 53" W	X		X	X		X		
EMAP Sampling Stations	4	28° 08' 09" N	97° 05' 49" W	X		X	X		X		
EMAP Sampling Stations	5	28° 07' 10" N	96° 59' 40" W	X		X	X		X		
EMAP Sampling Stations	6	28° 05' 23" N	97° 10' 17" W	X		X	X		X		
EMAP Sampling Stations	7	28° 06' 43" N	97° 02' 49" W	X		X	X		X		
EMAP Sampling Stations	8	28° 06' 33" N	96° 56' 02" W	X		X	X		X		
EMAP Sampling Stations	9	28° 05' 32" N	96° 57' 56" W	X		X	X		X		
EMAP Sampling Stations	10	28° 03' 38" N	97° 08' 40" W	X		X	X		X		
EMAP Sampling Stations	11	27° 59' 55" N	96° 59' 50" W	X		X	X		X		
EMAP Sampling Stations	12	27° 54' 18" N	97° 01' 19" W	X		X	X		X		
EMAP Sampling Stations	13	27° 54' 15" N	97° 06' 05" W	X		X	X		X		
EMAP Sampling Stations	14	27° 54' 11" N	97° 00' 36" W	X		X	X		X		
EMAP Sampling Stations	15	27° 51' 18" N	97° 28' 33" W	X		X	X		X		
EMAP Sampling Stations	16	27° 51' 00" N	97° 21' 54" W	X		X	X		X		
EMAP Sampling Stations	17	27° 52' 45" N	97° 15' 47" W	X		X	X		X		
EMAP Sampling Stations	18	27° 51' 33" N	97° 08' 00" W	X		X	X		X		
EMAP Sampling Stations	19	27° 51' 08" N	97° 25' 26" W	X		X	X		X		
EMAP Sampling Stations	20	27° 50' 39" N	97° 17' 23" W	X		X	X		X		
EMAP Sampling Stations	21	27° 49' 21" N	97° 21' 24" W	X		X	X		X		
EMAP Sampling Stations	22	27° 50' 17" N	97° 15' 06" W	X		X	X		X		
EMAP Sampling Stations	23	27° 47' 43" N	97° 08' 37" W	X		X	X		X		
EMAP Sampling Stations	24	27° 46' 04" N	97° 18' 57" W	X		X	X		X		
EMAP Sampling Stations	25	27° 45' 43" N	97° 10' 53" W	X		X	X		X		

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
EMAP Sampling Stations	26	27° 46' 33" N	97° 20' 44" W	X		X	X		X		
EMAP Sampling Stations	27	27° 45' 28" N	97° 15' 49" W	X		X	X		X		
EMAP Sampling Stations	28	27° 43' 31" N	97° 18' 16" W	X		X	X		X		
EMAP Sampling Stations	29	27° 42' 47" N	97° 11' 16" W	X		X	X		X		
EMAP Sampling Stations	30	27° 43' 21" N	97° 15' 26" W	X		X	X		X		
EMAP Sampling Stations	1B	28° 09' 41" N	97° 04' 15" W								
EMAP Sampling Stations	2B	28° 08' 22" N	97° 10' 05" W								
EMAP Sampling Stations	3B	28° 09' 59" N	97° 03' 17" W								
EMAP Sampling Stations	4B	28° 06' 58" N	97° 04' 53" W								
EMAP Sampling Stations	5B	28° 08' 08" N	96° 58' 03" W								
EMAP Sampling Stations	6B	28° 05' 10" N	97° 07' 37" W								
EMAP Sampling Stations	7B	28° 06' 17" N	97° 04' 03" W								
EMAP Sampling Stations	8B	28° 04' 37" N	96° 56' 43" W								
EMAP Sampling Stations	9B	28° 05' 32" N	96° 58' 43" W								
EMAP Sampling Stations	10B	28° 03' 31" N	97° 09' 11" W								
EMAP Sampling Stations	11B	28° 02' 17" N	97° 00' 05" W								
EMAP Sampling Stations	12B	27° 55' 10" N	97° 01' 33" W								
EMAP Sampling Stations	13B	27° 53' 12" N	97° 06' 32" W								
EMAP Sampling Stations	14B	27° 54' 10" N	97° 00' 43" W								
EMAP Sampling Stations	15B	27° 52' 16" N	97° 29' 47" W								
EMAP Sampling Stations	16B	27° 52' 08" N	97° 23' 05" W								
EMAP Sampling Stations	17B	27° 52' 23" N	97° 17' 04" W								
EMAP Sampling Stations	18B	27° 52' 13" N	97° 07' 20" W								
EMAP Sampling Stations	19B	27° 50' 54" N	97° 25' 24" W								
EMAP Sampling Stations	20B	27° 50' 54" N	97° 17' 52" W								
EMAP Sampling Stations	21B	27° 49' 41" N	97° 22' 50" W								
EMAP Sampling Stations	22B	27° 49' 08" N	97° 16' 55" W								
EMAP Sampling Stations	23B	27° 47' 34" N	97° 07' 30" W								
EMAP Sampling Stations	24B	27° 45' 15" N	97° 18' 19" W								
EMAP Sampling Stations	25B	27° 47' 30" N	97° 11' 40" W								
EMAP Sampling Stations	26B	27° 46' 29" N	97° 22' 54" W								
EMAP Sampling Stations	27B	27° 44' 45" N	97° 14' 51" W								
EMAP Sampling Stations	28B	27° 42' 52" N	97° 17' 57" W								
EMAP Sampling Stations	29B	27° 45' 11" N	97° 12' 45" W								
EMAP Sampling Stations	30B	27° 42' 29" N	97° 14' 35" W								

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
EMAP Sampling Stations	1C	28° 09' 43" N	97° 05' 13" W								
EMAP Sampling Stations	2C	28° 10' 02" N	97° 09' 18" W								
EMAP Sampling Stations	3C	28° 09' 28" N	97° 01' 13" W								
EMAP Sampling Stations	4C	28° 06' 02" N	97° 05' 27" W								
EMAP Sampling Stations	5C	28° 06' 25" N	96° 59' 30" W								
EMAP Sampling Stations	6C	28° 05' 19" N	97° 09' 48" W								
EMAP Sampling Stations	7C	28° 06' 45" N	97° 03' 01" W								
EMAP Sampling Stations	8C	28° 05' 50" N	96° 55' 36" W								
EMAP Sampling Stations	9C	28° 04' 34" N	96° 57' 29" W								
EMAP Sampling Stations	10C	28° 03' 34" N	97° 08' 36" W								
EMAP Sampling Stations	11C	28° 00' 08" N	96° 58' 38" W								
EMAP Sampling Stations	12C	27° 55' 26" N	97° 03' 51" W								
EMAP Sampling Stations	13C	27° 52' 37" N	97° 06' 01" W								
EMAP Sampling Stations	14C	27° 54' 01" N	97° 00' 50" W								
EMAP Sampling Stations	15C	27° 51' 28" N	97° 28' 03" W								
EMAP Sampling Stations	16C	27° 51' 38" N	97° 23' 37" W								
EMAP Sampling Stations	17C	27° 52' 29" N	97° 16' 15" W								
EMAP Sampling Stations	18C	27° 52' 28" N	97° 06' 41" W								
EMAP Sampling Stations	19C	27° 50' 37" N	97° 26' 44" W								
EMAP Sampling Stations	20C	27° 49' 13" N	97° 19' 03" W								
EMAP Sampling Stations	21C	27° 47' 00" N	97° 22' 10" W								
EMAP Sampling Stations	22C	27° 48' 41" N	97° 17' 19" W								
EMAP Sampling Stations	23C	27° 49' 07" N	97° 07' 39" W								
EMAP Sampling Stations	24C	27° 48' 30" N	97° 18' 30" W								
EMAP Sampling Stations	25C	27° 46' 17" N	97° 12' 13" W								
EMAP Sampling Stations	26C	27° 43' 39" N	97° 20' 38" W								
EMAP Sampling Stations	27C	27° 45' 42" N	97° 15' 00" W								
EMAP Sampling Stations	28C	27° 44' 23" N	97° 17' 50" W								
EMAP Sampling Stations	29C	27° 43' 15" N	97° 12' 28" W								
EMAP Sampling Stations	30C	27° 42' 18" N	97° 14' 24" W								
EMAP Sampling Stations	1D	28° 09' 47" N	97° 04' 22" W								
EMAP Sampling Stations	2D	28° 09' 41" N	97° 10' 28" W								
EMAP Sampling Stations	3D	28° 10' 04" N	97° 02' 12" W								
EMAP Sampling Stations	4D	28° 09' 15" N	97° 06' 29" W								
EMAP Sampling Stations	5D	28° 07' 26" N	96° 57' 09" W								

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
EMAP Sampling Stations	6D	28° 05' 05" N	97° 07' 57" W								
EMAP Sampling Stations	7D	28° 06' 55" N	97° 03' 13" W								
EMAP Sampling Stations	8D	28° 05' 21" N	96° 56' 14" W								
EMAP Sampling Stations	9D	28° 03' 58" N	96° 58' 26" W								
EMAP Sampling Stations	10D	28° 02' 58" N	97° 07' 00" W								
EMAP Sampling Stations	11D	28° 00' 17" N	96° 58' 51" W								
EMAP Sampling Stations	12D	27° 54' 28" N	97° 03' 02" W								
EMAP Sampling Stations	13D	27° 53' 55" N	97° 03' 55" W								
EMAP Sampling Stations	14D	27° 54' 31" N	97° 00' 28" W								
EMAP Sampling Stations	15D	27° 50' 58" N	97° 29' 42" W								
EMAP Sampling Stations	16D	27° 51' 59" N	97° 21' 23" W								
EMAP Sampling Stations	17D	27° 51' 10" N	97° 14' 10" W								
EMAP Sampling Stations	18D	27° 51' 48" N	97° 07' 25" W								
EMAP Sampling Stations	19D	27° 51' 13" N	97° 23' 58" W								
EMAP Sampling Stations	20D	27° 50' 24" N	97° 18' 15" W								
EMAP Sampling Stations	21D	27° 47' 45" N	97° 23' 12" W								
EMAP Sampling Stations	22D	27° 47' 35" N	97° 13' 51" W								
EMAP Sampling Stations	23D	27° 47' 01" N	97° 09' 09" W								
EMAP Sampling Stations	24D	27° 45' 42" N	97° 17' 37" W								
EMAP Sampling Stations	25D	27° 47' 39" N	97° 12' 16" W								
EMAP Sampling Stations	26D	27° 44' 23" N	97° 20' 05" W								
EMAP Sampling Stations	27D	27° 45' 23" N	97° 16' 02" W								
EMAP Sampling Stations	28D	27° 43' 17" N	97° 19' 45" W								
EMAP Sampling Stations	29D	27° 44' 33" N	97° 10' 37" W								
EMAP Sampling Stations	30D	27° 42' 03" N	97° 14' 36" W								
St. Charles Bay	13406										
Aransas Bay - Intersection of ICC & Lydia Ann Channel south Rockport	13402										
Corpus Christi Bay @ mouth of Jewell Fulton Harbor	14979										
Corpus Christi Bay at Port Ingelside	14830										
Corpus Christi Bay - Intersection of CC Ship Channel with Aransas Pass & Lydia Ann Channels	13419										
Corpus Christi Channel Marker 62	13407										
Inner Harbor	13430										

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Inner Harbor	13432										
Inner Harbor	13439										
Inner Harbor	13410										
Cayo Del Oso @ Yorktown Bridge	13026										
Oso Creek at FM 2444	13027										
Oso Creek at FM 763	13029										
Oso Creek at SH 286	13028										
Oso Bay @ Padre Island Drive SH 358	13440										
Oso Bay Opposite Oso Seage Treatment Plant Discharge	13441										
Oso Bay @ Ocean Drive	13442										
Oco Creek @ Elliot Landfill	16712										
TWDB Ambient Water Quality Monitoring											
Aransas Bay east of Rockport		27° 59' 55" N	97° 00' 07" W			X					
Laguna Madre at JFK Causeway & ICWW Intersection		27° 38' 04" N	97° 14' 22" W			X					
Corpus Christi Bay near Ingleside		27° 44' 30" N	97° 13' 00" W			X					
Baffin Bay at Entrance to Cayo del Grullo		27° 16' 40" N	97° 25' 15" W			X					
NRA Clean Rivers Program											
Mission River at FM 2678	12943										
Mission River at US 77	12944										
Aransas River at FM 136	12945										
Aransas River at US 77	12948										
Aransas River near Skidmore	12952										
Nueces River at FM 666	12964										
Nueces River at SH 359	12965										
Lake Corpus at Dam	12967										
Nueces River at SH 16	12973										
Nueces River at US 59	12978										
Frio River at US 72	12977										
Atascosa River at FM 99	12980										
San Miguel Creek at SH 16	12983										
Choke Canyon Reservoir near old Hwy 99	13020										
Frio River at SH 16	13023										
St. Charles Bay	13406										
Hynes Bay at Austwell	14956										

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Port Bay at Fm 188	13405										
Copano Bay at SH 35	13404										
Redfish Bay at SH 361	13426										
Oso Bay at SH 358	13440										
Oso Creek at SH 286	13028										
NRA Coastal Bend Bays Water Quality Monitoring Project											
120 sites throughout Aransas, Copano, Mission, Corpus Christi, Nueces, Redfish Bays - 1 time only											
Aransas Bay	13402										
St. Charles Bay	13406										
Corpus Christi at Marker 62	13407										
Corpus Christi at Fulton Harbor	14979										
Corpus Christi at Port Ingleside	14830										
Corpus Christi at Channel Intersection	13419										
UTMSI											
2 sites - Nueces Bay											
3 sites - Corpus Christi											
2 sites - Baffin Bay											
2 sites - Laguna Madre											
6 sites - Rincon Bayou											
Welder Foundation											
3 sites - Rob and Bessie Wildlife Foundation											
TPW - DataSonde											
4 sites - Corpus Christi, Upper Laguna Madre, Nueces River, Baffin Bay											
TPW - Nueces Bay Ichthyoplankton											
4 sites - Nueces Bay											
TPW - Pfisteria											
2 sites - Oso Bay and Baffin Bay (map)											
TPW - Data Water Level											
2 sites - Rincon Delta											
TWDB Water Resources Investigations											
Copano Creek NR Refugio	8189200	28° 18' 12" N	97° 06' 44" W								
Mission River at Refugio	8189500	28° 17' 30" N	97° 16' 44" W								X

Table A-1. Sampling Locations Included on Each Figure (Except Fisheries Monitoring Maps Supplied by TPWD)

Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Aransas River NR Skidmore	8189700	28° 16' 56" N	97° 37' 14" W								X
San Miguel Creek NR Tilden	8206700	28° 35' 14" N	98° 32' 44" W								X
Atascosa River at Whitsett	8208000	28° 37' 19" N	98° 16' 52" W								X
Nueces River NR Mathis	8211000	28° 02' 17" N	97° 51' 36" W								X
Oso Creek at Corpus Christi	8211520.821	27° 42' 40" N	97° 30' 06" W								X
San Fernando Creek at Alice	8211900	27° 46' 20" N	98° 02' 00" W								X
Los Olmos Creek NR Falfurrias	8212400	27° 15' 51" N	98° 08' 08" W								X
TWDB TCOON											
S. Bird Island, Laguna Madre		27° 29.1'	97° 19.1							X	
Packery Channel, Corpus Christi Bay		27° 38.0'	97° 14.2							X	
Naval Air Station, Corpus Christi Bay		27° 42.3'	97° 16.8							X	
Texas State Aquarium, Corpus Christi Bay		27° 48.9'	97° 23.9							X	
White Point, Nueces Bay		27° 51.6' N	97° 29.0' W							X	
Bob Hall Pier, Gulf of Mexico		27° 34.9' N	97° 13.0' W							X	
Ingleside, Corpus Christi Bay		27° 49.3' N	97° 12.2' W							X	
Port Aransas		27° 50.4' N	97° 04.4' W							X	
Rockport, Aransas Bay		28° 01.5' N	97° 02.9' W							X	
Copano Bay		28° 06.9' N	97° 01.5' W							X	
One Year Studies											
TAMU-CC Ecological Influence of Treated Water Diversions											
14 sites around Nueces River, Nueces Delta, Nueces Bay											
TAMU-CC Oso Creek/Oso Bay Watershed System Study											
8 sites around Oso Creek/Oso Bay											
TPWD Coastal 2000 Stations											
Laguna Madre	TX00-0003	27° 15' 56.058" N	97° 23' 40.038" W	X	X	X	X				
Laguna Madre	TX00-0004	27° 06' 11.290" N	97° 23' 24.520" W	V	X	X	X				
Laguna Madre	TX00-0005	26° 57' 25.058" N	97° 30' 52.927" W	X	X	X	X				
Laguna Madre	TX00-0006	26° 56' 15.357" N	97° 24' 15.249" W	X	X	X	X				
Aransas Bay	TX00-0019	28° 03' 29.990" N	97° 01' 30.005" W	X	X	X	X				
St. Charles Bay	TX00-0020	28° 11' 30.010" N	96° 56' 30.024" W	X	X	X	X				
Copano Bay	TX00-0021	28° 08' 30.013" N	97° 05' 30.002" W	X	X	X	X				

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Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Corpus Christi Bay	TX00-0022	27° 46' 29.999" N	97° 20' 30.002" W	X	X	X	X				
Corpus Christi Bay	TX00-0023	27° 49' 30.003" N	97° 21' 29.987" W	X	X	X	X				
Mesquite Bay	TX00-0039	28° 09' 29.984" N	96° 52' 30.000" W	X	X	X	X				
Corpus Christi Bay	TX00-0040	27° 47' 30.011" N	97° 11' 30.024" W	X	X	X	X				
Corpus Christi Bay	TX00-0041	27° 47' 30.011" N	97° 07' 30.000" W	X	X	X	X				
Laguna Madre	TX00-0042	27° 27' 29.989" N	97° 19' 29.989" W	X	X	X	X				
Baffin Bay	TX00-0043	27° 16' 29.999" N	97° 32' 30.018" W	X	X	X	X				
Laguna Madre	TX00-0044	27° 40' 29.997" N	97° 14' 30.007" W	X	X	X	X				
Laguna Madre	TX00-0045	27° 32' 30.011" N	97° 19' 29.989" W	X	X	X	X				
Baffin Bay	TX00-0046	27° 16' 29.999" N	97° 37' 30.000" W	X	X	X	X				
TPWD Pfiesteria Monitoring											
Pfiesteria Monitoring	Arroyo Colorado	27° 53' 45" N	97° 37' 41" W			X	X				
Pfiesteria Monitoring	Lavaca Bay	27° 53' 45" N	97° 37' 44" W			X	X				
Pfiesteria Monitoring	Baffin Bay	27° 18' 50" N	97° 40' 30" W			X	X				
Pfiesteria Monitoring	Mesquite Bay	28° 09' 46" N	96° 51' 35" W			X	X				
Pfiesteria Monitoring	Nueces River	27° 51' 36" N	97° 33' 23" W			X	X				
Pfiesteria Monitoring	Oso Bay	27° 38' 26" N	97° 20' 37" W			X	X				
Pfiesteria Monitoring	Port Aransas	27° 49' 68" N	97° 04' 80" W			X	X				
Pfiesteria Monitoring	Caney Creek	29° 27' 26" N	97° 02' 58" W			X	X				
Pfiesteria Monitoring	Clear Creek	29° 31' 11" N	95° 06' 09" W			X	X				
Pfiesteria Monitoring	Clear Lake	29° 33' 51" N	95° 03' 52" W			X	X				
Pfiesteria Monitoring	Dickinson Bayou	29° 27' 26" N	97° 02' 57" W			X	X				
Pfiesteria Monitoring	Freeport North	29° 00' 17" N	95° 18' 47" W			X	X				
Pfiesteria Monitoring	Freeport South	28° 53' 14" N	95° 25' 26" W			X	X				
Pfiesteria Monitoring	Jamaica Beach	29° 11' 17" N	94° 58' 51" W			X	X				
Pfiesteria Monitoring	Matagorda Bay	28° 43' 20" N	95° 58' 16" W			X	X				

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Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
Pfiesteria Monitoring	Moses Bayou	29° 25' 26" N	94° 57' 70" W			X	X				
Pfiesteria Monitoring	Sabine Pass	29° 45' 50" N	93° 53' 52" W			X	X				
Pfiesteria Monitoring	Tabbs Bay	29° 42' 87" N	94° 58' 88" W			X	X				
Unknown Duration											
Corpus Christi\Nueces County Health											
Corpus Christi Beach - North Facility (Timon Street)											
Corpus Christi Beach (Gulfspray Street)											
Corpus Christi Beach - Surfside Park (Stewart Street)											
Corpus Christi Beach - South Facility (Coastal Street)											
McGee Beach (Park Street)											
McGee Beach (Furman Street)											
Cole Park Beach											
Cole Park - Windsurfing (Oleander Street)											
Cole Park - Windsurfing (Kush Street)											
Ropes Park - Windsurfing (Ropes Park)											
Texas AM University at Corpus Christi											
Kennedy Causeway - Windsurfing North											
Kennedy Causeway - Windsurfing South											
Marina Bay Water - M1 (Taylor St. Jerry)											
Marina Bay Water - M2 (T Head)											
Marina Bay Water - M3 (L Head)											
UTMSI Benthic Stations (Site locations supplied by Paul Montagna)											
UTMSI Benthic Station	NC E	27° 47.833' N	97° 09.050' W	X							
UTMSI Benthic Station	NC D	27° 42.600' N	97° 10.733' W	X							
UTMSI Benthic Station	NC C	27° 49.312' N	97° 21.077' W	X							
UTMSI Benthic Station	NC B	27° 50.855' N	97° 23.969' W	X							
UTMSI Benthic Station	NC A	27° 50.985' N	97° 28.249' W	X							
UTMSI Benthic Station	LQ A	27° 52.139' N	97° 15.327' W	X							
UTMSI Benthic Station	LQ B	27° 50.171' N	97° 13.401' W	X							

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Location Description	Agency Site Number	Latitude	Longitude	Figure 2-1 Benthic Map	Figure 2-2 Metals in Sed	Figure 2-3 Routine Parameters	Figure 2-4 Nutrients	Figure 2-5 Bacteria	Figure 2-6 Metals in Water	Figure 2-7 Tide Levels	Figure 2-8 Flow
UTMSI Benthic Station	LQ C	27° 49.894' N	97° 13.389' W	X							
UTMSI Benthic Station	LM 24	27° 15.833' N	97° 33.085' W	X							
UTMSI Benthic Station	LM 6	27° 16.618' N	97° 25.614' W	X							
UTMSI Benthic Station	LM 189	27° 20.994' N	97° 23.543' W	X							
UTMSI Benthic Station	LM 155	27° 25.448' N	97° 20.480' W	X							
UTMSI Benthic Station	RB A	27° 54.338' N	97° 36.023' W	X							
UTMSI Benthic Station	RB B	27° 54.512' N	97° 36.072' W	X							
UTMSI Benthic Station	RB C	27° 53.927' N	97° 36.250' W	X							
UTMSI Benthic Station	RB D	27° 53.423' N	97° 35.352' W	X							
UTMSI Benthic Station	RB E	27° 52.760' N	97° 34.159' W	X							
UTMSI Benthic Station	RB F	27° 52.656' N	97° 34.724' W	X							
TPWD Nueces River Estuary Trawl											
TPWD Trawl Station	1	27° 53' 44.59" N	97° 37' 43.92" W								
TPWD Trawl Station	2	27° 51' 57.62" N	97° 35' 53.34" W								
TPWD Trawl Station	3	27° 51' 38.90" N	97° 34' 23.07" W								
TPWD Trawl Station	4	27° 51' 19.39" N	97° 32' 27.06" W								
TPWD Trawl Station	5	27° 50' 41.78" N	97° 30' 13.14" W								
TPWD Trawl Station	11	27° 51' 42.25" N	97° 32' 03.39" W								
TPWD Trawl Station	7	27° 50' 46.14" N	97° 29' 04.35" W								
TPWD Trawl Station	8	27° 52' 14.11" N	97° 31' 02.39" W								
TPWD Trawl Station	9	27° 53' 00.16" N	97° 31' 58.88" W								
TPWD Trawl Station	10	27° 52' 01.07" N	97° 30' 38.36" W								
Mussel Watch Project											
Mesquite Bay - Ayres Reef		28° 10.38' N	96° 50.10' W			X					
Aransas Bay - Long Reef		28° 03.29' N	96° 57.07' W			X					
Copano Bay - Copano Reef		28° 08.52' N	97° 07.68' W			X					
Aransas Bay - Harbor Island		27° 50.33' N	97° 04.52' W			X					
Corpus Christi - Ingleside Cove		27° 50.28' N	97° 14.28' W			X					
Corpus Christi - Nueces Bay		27° 51.13' N	97° 21.59' W			X					
Corpus Christi - Boat Harbor		27° 50.17' N	97° 22.81' W			X					

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
TNRCC Surface Water Quality Monitoring																					
Nueces River Tidal North of Viola turning basin	12960	4		4	4	4		4	4	4	4	4	4	4	2	2					
Petronilla Creek 1.2 km upstream of the confluence with Tunas Creek	13090	4		4	4	4		4	4	4	4	4	4	4		2					
Petronilla Creek at FM 892 SE of Driscoll	13094	4		4	4	4		4	4	4	4	4	4	4		4	2	4			
San Fernando Creek at US77 bypass bridge at Kingsville	13033	4		4	4	4		4	4	4	4	4	4	4				4			
Mesquite Bay south of ICWW Marker 13	13400	4		4	4	4		4	4	4	4	4	4	4							
Aransas Bay Intersection of Intracoastal canal and Lydia Ann Channel	13402	4		4	4	4		4	4	4	4	4	4	4			2				
Aransas Bay in Lydia Ann Channel west of Light House	16492	4		4	4	4		4	4	4	4	4	4	4		2	2			2	
Copano Bay 1 mile east of Bayside	14783	4		4	4	4		4	4	4	4	4	4	4			1*				
Corpus Christi Bay at CM #62	13407	4		4	4	4		4	4	4	4	4	4	4		4	2				
Corpus Christi Bay near Shamrock Point	14355	4		4	4	4		4	4	4	4	4	4	4		4	2				
Corpus Christi Bay near Corpus Christi Ship CM #86	13410	4		4	4	4		4	4	4	4	4	4	4		4	1				
Corpus Christi Bay ½ mile off Doddridge Road	13411	4		4	4	4		4	4	4	4	4	4	4		4	1				
Nueces Bay at US 181 Bridge at Causeway (south side)	13421	4		4	4	4		4	4	4	4	4	4	4			1				

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Nueces Bay ½ mile from south shore at east overhead powerline	13422	4		4	4	4		4	4	4	4	4	4	4			1				
Nueces Bay near Whites Point	13425	4		4	4	4		4	4	4	4	4	4	4		4	2				fish tissue/1
Redfish Bay at the ICWW at Aransas Pass	14801	4		4	4	4		4	4	4	4	4	4	4		2	2				
Conn Brown Harbor	13287	4		4	4	4		4	4	4	4	4	4	4							
Corpus Christi Inner Harbor in Avery turning basin	13430	4		4	4	4		4	4	4	4	4	4	4		2	1				
Corpus Christi Inner Harbor near Navigation Blvd. draw bridge	13432	4		4	4	4		4	4	4	4	4	4	4		2	2				organics in water/2
Corpus Christi Inner Harbor in Viola turning basin	13439	4		4	4	4		4	4	4	4	4	4	4		2	1				
Laguna Madre south of the intersection of ICWW and Padre Island causeway	13443	4		4	4	4		4	4	4	4	4	4	4	2						
Laguna Madre at intesection of ICWW at Baffin Bay marker	13444	4		4	4	4		4	4	4	4	4	4	4							
Laguna Madre at ICWW near Bird Island	13445	4		4	4	4		4	4	4	4	4	4	4	2						
Baffin Bay at CM 14	13450	4		4	4	4		4	4	4	4	4	4	4		4	2				
Baffin Bay at CM 36	13452	4		4	4	4		4	4	4	4	4	4	4			1				
Gulf of Mexico at Port Aransas near end of South Jetty near marker R-7	13468	4		4	4	4		4	4	4	4	4	4	4							
CBBP Surface Water Quality Management Assessment																					
EMAP Sampling Stations	1		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	2		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	3		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	4		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	5		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	6		1	1	1	1	1	1	1		1	1	1	1		1			1		

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
EMAP Sampling Stations	7		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	8		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	9		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	10		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	11		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	12		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	13		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	14		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	15		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	16		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	17		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	18		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	19		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	20		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	21		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	22		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	23		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	24		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	25		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	26		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	27		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	28		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	29		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	30		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	1B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	2B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	3B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	4B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	5B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	6B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	7B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	8B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	9B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	10B		1	1	1	1	1	1	1		1	1	1	1		1			1		

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
EMAP Sampling Stations	11B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	12B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	13B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	14B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	15B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	16B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	17B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	18B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	19B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	20B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	21B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	22B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	23B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	24B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	25B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	26B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	27B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	28B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	29B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	30B		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	1C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	2C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	3C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	4C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	5C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	6C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	7C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	8C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	9C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	10C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	11C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	12C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	13C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	14C		1	1	1	1	1	1	1		1	1	1	1		1			1		

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Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
EMAP Sampling Stations	15C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	16C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	17C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	18C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	19C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	20C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	21C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	22C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	23C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	24C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	25C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	26C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	27C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	28C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	29C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	30C		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	1D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	2D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	3D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	4D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	5D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	6D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	7D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	8D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	9D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	10D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	11D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	12D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	13D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	14D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	15D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	16D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	17D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	18D		1	1	1	1	1	1	1		1	1	1	1		1			1		

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Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
EMAP Sampling Stations	19D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	20D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	21D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	22D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	23D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	24D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	25D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	26D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	27D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	28D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	29D		1	1	1	1	1	1	1		1	1	1	1		1			1		
EMAP Sampling Stations	30D		1	1	1	1	1	1	1		1	1	1	1		1			1		
St. Charles Bay	13406		6	6	6	6	6	6	6		6	6	6	6		6					
Aransas Bay - Intersection of ICC & Lydia Ann Channel south Rockport	13402		6	6	6	6	6	6	6		6	6	6	6		6					
Corpus Christi Bay @ mouth of Jewell Fulton Harbor	14979		6	6	6	6	6	6	6		6	6	6	6		6					
Corpus Christi Bay at Port Ingelside	14830		6	6	6	6	6	6	6		6	6	6	6		6					
Corpus Christi Bay - Intersection of CC Ship Channel with Aransas Pass & Lydia Ann Channels	13419		6	6	6	6	6	6	6		6	6	6	6		6					
Corpus Christi Channel Marker 62	13407		6	6	6	6	6	6	6		6	6	6	6		6					
Inner Harbor	13430		4	4	4	4	4	4	4		4	4	4	4		4					
Inner Harbor	13432		4	4	4	4	4	4	4		4	4	4	4		4					
Inner Harbor	13439		4	4	4	4	4	4	4		4	4	4	4		4					
Inner Harbor	13410		4	4	4	4	4	4	4		4	4	4	4		4					
Cayo Del Oso @ Yorktown Bridge	13026		4	4	4	4	4	4	4		4	4	4	4		4					
Oso Creek at FM 2444	13027		4	4	4	4	4	4	4		4	4	4	4		4					
Oso Creek at FM 763	13029		4	4	4	4	4	4	4		4	4	4	4		4					
Oso Creek at SH 286	13028		4	4	4	4	4	4	4		4	4	4	4		4					
Oso Bay @ Padre Island Drive SH 358	13440		4	4	4	4	4	4	4		4	4	4	4		4					

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Oso Bay Opposite Oso Seage Treatment Plant Discharge	13441		4	4	4	4	4	4	4		4	4	4	4		4					
Oso Bay @ Ocean Drive	13442		4	4	4	4	4	4	4		4	4	4	4		4					
Oco Creek @ Elliot Landfill	16712		4	4	4	4	4	4	4		4	4	4	4		4					
TWDB Ambient Water Quality Monitoring																					
Aransas Bay east of Rockport				HR	HR	HR		HR	HR												
Laguna Madre at JFK Causeway & ICWW Intersection				HR	HR	HR		HR	HR												
Corpus Christi Bay near Ingleside				HR	HR	HR		HR	HR												
Baffin Bay at Entrance to Cayo del Grullo				HR	HR	HR		HR	HR												
NRA Clean Rivers Program																					
Mission River at FM 2678	12943		4	4	4	4	4	4	4		4	4	4	4					4	4	
Mission River at US 77	12944		4	4	4	4	4	4	4		4	4	4	4				4	4	4	
Aransas River at FM 136	12945		4	4	4	4	4	4	4		4	4	4	4					4	4	
Aransas River at US 77	12948		4	4	4	4	4	4	4		4	4	4	4					4	4	
Aransas River near Skidmore	12952		4	4	4	4	4	4	4		4	4	4	4				4	4	4	
Nueces River at FM 666	12964		4	4	4	4	4	4	4		4	4	4	4				4		4	
Nueces River at SH 359	12965		4	4	4	4	4	4	4		4	4	4	4				4		4	
Lake Corpus at Dam	12967		4	4	4	4	4	4	4		4	4	4	4						4	
Nueces River at SH 16	12973		4	4	4	4	4	4	4		4	4	4	4				4		4	
Nueces River at US 59	12978		4	4	4	4	4	4	4		4	4	4	4				4		4	
Frio River at US 72	12977		4	4	4	4	4	4	4		4	4	4	4				4		4	
Atascosa River at FM 99	12980		4	4	4	4	4	4	4		4	4	4	4				4		4	
San Miguel Creek at SH 16	12983		4	4	4	4	4	4	4		4	4	4	4				4		4	
Choke Canyon Reservoir near old Hwy 99	13020		4	4	4	4	4	4	4		4	4	4	4						4	
Frio River at SH 16	13023		4	4	4	4	4	4	4		4	4	4	4				4		4	
St. Charles Bay	13406		4	4	4	4	4	4	4		4	4	4	4					4	4	
Hynes Bay at Austwell	14956		4	4	4	4	4	4	4		4	4	4	4					4	4	

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Port Bay at Fm 188	13405		4	4	4	4	4	4	4		4	4	4	4					4	4	
Copano Bay at SH 35	13404		4	4	4	4	4	4	4		4	4	4	4					4	4	
Redfish Bay at SH 361	13426		4	4	4	4	4	4	4		4	4	4	4					4	4	
Oso Bay at SH 358	13440		4	4	4	4	4	4	4		4	4	4	4					4	4	
Oso Creek at SH 286	13028		4	4	4	4	4	4	4		4	4	4	4					4	4	
NRA Coastal Bend Bays Water Quality Monitoring Project																					
120 sites throughout Aransas, Copano, Mission, Corpus Christi, Nueces, Redfish Bays - 1 time only			1	1	1	1	1	1	1		1	1	1	1		1			1		
Aransas Bay	13402		24	24	24	24	24	24	24		24	24	24	24		24					
St. Charles Bay	13406		24	24	24	24	24	24	24		24	24	24	24		24					
Corpus Christi at Marker 62	13407		24	24	24	24	24	24	24		24	24	24	24		24					
Corpus Christi at Fulton Harbor	14979		24	24	24	24	24	24	24		24	24	24	24		24					
Corpus Christi at Port Ingleside	14830		24	24	24	24	24	24	24		24	24	24	24		24					
Corpus Christi at Channel Intersection	13419		24	24	24	24	24	24	24		24	24	24	24		24					
UTMSI																					
2 sites - Nueces Bay				4					4		4								4/Benthic Invertebrates		
3 sites - Corpus Christi				4					4		4								4/Benthic Invertebrates		
2 sites - Baffin Bay				4					4		4								4/Benthic Invertebrates		
2 sites - Laguna Madre				4					4		4								4/Benthic Invertebrates		
6 sites - Rincon Bayou				4					4		4								4/Benthic Invertebrates		

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Welder Foundation																					
3 sites - Rob and Bessie Wildlife Foundation										each rain event											Various Chemicals
TPW - DataSonde																					
4 sites - Corpus Christi, Upper Laguna Madre, Nueces River, Baffin Bay				HR	HR	HR			HR			HR									
TPW - Nueces Bay Ichthyoplankton																					
4 sites - Nueces Bay				2	2	2			2												plankton, fish
TPW - Pfisteria																					
2 sites - Oso Bay and Baffin Bay (map)				12	12	12			12			12									
TPW - Data Water Level																					
2 sites - Rincon Delta																					water level
TWDB Water Resources Investigations																					
Copano Creek NR Refugio	8189200																	D			
Mission River at Refugio	8189500																	D			
Aransas River NR Skidmore	8189700																	D			
San Miguel Creek NR Tilden	8206700																	D			
Atascosa River at Whitsett	8208000																	D			
Nueces River NR Mathis	8211000																	D			
Oso Creek at Corpus Christi	8211520.821																	D			
San Fernando Creek at Alice	8211900																	D			
Los Olmos Creek NR Falfurrias	8212400																	D			
TWDB TCOON																					
S. Bird Island, Laguna Madre																					Tide levels\Met Data - every 6 minutes
Packery Channel, Corpus Christi Bay																					Tide levels\Met Data - every 6 minutes

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Naval Air Station, Corpus Christi Bay																					Tide levels\Met Data - every 6 minutes
Texas State Aquarium, Corpus Christi Bay																					Tide levels\Met Data - every 6 minutes
White Point, Nueces Bay																					Tide levels\Met Data - every 6 minutes
Bob Hall Pier, Gulf of Mexico																					Tide levels\Met Data - every 6 minutes
Ingleside, Corpus Christi Bay																					Tide levels\Met Data - every 6 minutes
Port Aransas																					Tide levels\Met Data - every 6 minutes
Rockport, Aransas Bay																					Tide levels\Met Data - every 6 minutes
Copano Bay																					Tide levels\Met Data - every 6 minutes
One Year Studies																					
TAMU-CC Ecological Influence of Treated Water Diversions																					
14 sites around Nueces River, Nueces Delta, Nueces Bay			12	12	12	12	12	12	12										12/Benthic Macroinfauna		12/Epifaunal Invertebrates and Nekton Macrofauna\ Birds

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
TAMU-CC Oso Creek/Oso Bay Watershed System Study																					
8 sites around Oso Creek/Oso Bay			12	12	12	12	12	12	12		12	12	12	12					12/Benthic Macroinfauna		12/Epifaunal Invertebrates and Nekton Macrofauna\ Birds\ Microbiological Indicators
TPWD Coastal 2000 Stations																					
Laguna Madre	TX00-0003	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Laguna Madre	TX00-0004	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Laguna Madre	TX00-0005	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Laguna Madre	TX00-0006	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Aransas Bay	TX00-0019	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
St. Charles Bay	TX00-0020	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Copano Bay	TX00-0021	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Corpus Christi Bay	TX00-0022	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Corpus Christi Bay	TX00-0023	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Mesquite Bay	TX00-0039	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Corpus Christi Bay	TX00-0040	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Corpus Christi Bay	TX00-0041	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Laguna Madre	TX00-0042	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Baffin Bay	TX00-0043	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Laguna Madre	TX00-0044	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Laguna Madre	TX00-0045	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
Baffin Bay	TX00-0046	1	1	1	1	1		1	1		1			1			1				Coastal 2000 Stations
TPWD Pfiesteria Monitoring																					
Pfiesteria Monitoring	Arroyo Colorado			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Lavaca Bay			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Baffin Bay			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Mesquite Bay			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Nueces River			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Oso Bay			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Port Aransas			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Caney Creek			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Clear Creek			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Clear Lake			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Dickinson Bayou			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Freeport North			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Freeport South			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Jamaica Beach			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Matagorda Bay			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Moses Bayou			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Sabine Pass			12	12	12			12		12	12									Pfisteria
Pfiesteria Monitoring	Tabbs Bay			12	12	12			12		12	12									Pfisteria
Unknown Duration																					
Corpus Christi\Nueces County Health																					

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
Corpus Christi Beach - North Facility (Timon Street)										12											Enterococcus
Corpus Christi Beach (Gulfspray Street)										12											Enterococcus
Corpus Christi Beach - Surfside Park (Stewart Street)										12											Enterococcus
Corpus Christi Beach - South Facility (Coastal Street)										12											Enterococcus
McGee Beach (Park Street)										12											Enterococcus
McGee Beach (Furman Street)										12											Enterococcus
Cole Park Beach										12											Enterococcus
Cole Park - Windsurfing (Oleander Street)										12											Enterococcus
Cole Park - Windsurfing (Kush Street)										12											Enterococcus
Ropes Park - Windsurfing (Ropes Park)										12											Enterococcus
Texas AM University at Corpus Christi										12											Enterococcus
Kennedy Causeway - Windsurfing North										12											Enterococcus
Kennedy Causeway - Windsurfing South										12											Enterococcus
Marina Bay Water - M1 (Taylor St. Jerry)										12											Enterococcus
Marina Bay Water - M2 (T Head)										12											Enterococcus
Marina Bay Water - M3 (L Head)										12											Enterococcus
UTMSI Benthic Stations (Site locations supplied by Paul Montagna)																					
UTMSI Benthic Station	NC E																		1		
UTMSI Benthic Station	NC D																		1		
UTMSI Benthic Station	NC C																		1		
UTMSI Benthic Station	NC B																		1		
UTMSI Benthic Station	NC A																		1		
UTMSI Benthic Station	LQ A																		1		

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
UTMSI Benthic Station	LQ B																		1		
UTMSI Benthic Station	LQ C																		1		
UTMSI Benthic Station	LM 24																		1		
UTMSI Benthic Station	LM 6																		1		
UTMSI Benthic Station	LM 189																		1		
UTMSI Benthic Station	LM 155																		1		
UTMSI Benthic Station	RB A																		1		
UTMSI Benthic Station	RB B																		1		
UTMSI Benthic Station	RB C																		1		
UTMSI Benthic Station	RB D																		1		
UTMSI Benthic Station	RB E																		1		
UTMSI Benthic Station	RB F																		1		
TPWD Nueces River Estuary Trawl																					
TPWD Trawl Station	1			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	2			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	3			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	4			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	5			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	11			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	7			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	8			9	9	9		9	9												Species Counts; % Saturation

Table A-2. Parameters and Frequency of Sampling (per year) at Each Sampling Location

Location Description	Agency Site Number	Depth	Secchi	DO	pH	Water Temp	Air Temp	Conductivity	Salinity	Fecal coliform	Nutrients	Chlorophyll a	Dissolved solids	Suspended solids	DO (24 hr)	Metals in Water	Metals in Sediment	Flow	Routine Benthic	Bacteria	Other
TPWD Trawl Station	9			9	9	9		9	9												Species Counts; % Saturation
TPWD Trawl Station	10			9	9	9		9	9												Species Counts; % Saturation
Mussel Watch Project																					
Mesquite Bay - Ayres Reef				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Aransas Bay - Long Reef				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Copano Bay - Copano Reef				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Aransas Bay - Harbor Island				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Corpus Christi - Ingleside Cove				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Corpus Christi - Nueces Bay				1	1	1			1												PCBs, Pesticides, and Metals in Oysters
Corpus Christi - Boat Harbor				1	1	1			1												PCBs, Pesticides, and Metals in Oysters