

Coastal Bend Bays Plan

Protecting the Coastal Bend bays and estuaries



2nd
EDITION

FINAL
December 2020



Implementation Strategy for the Coastal Bend Bays Plan

2nd Edition



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The Comprehensive Conservation and Management Plan (CCMP) was first adopted by the State of Texas in 1999. This revised version was adopted December 2020. The CCMP, 2nd Edition was developed in part with funds provided by the U.S. Environmental Protection Agency, Region 6 and the Texas Commission on Environmental Quality through a cooperative agreement with the Coastal Bend Bays & Estuaries Program.

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Cover Photo

Snowy Egret grabs a fish at the Nueces Delta Preserve. (Photo by Charlie Spiekerman)

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All commitments made in the CCMP, 2nd Edition are subject to the availability of appropriated funds and the budget priorities of the EPA, the State of Texas, and the organizations that participate in the Coastal Bend Bays & Estuaries Program. Nothing in this plan, in and of itself, obligates the CBBEP, EPA, or the State of Texas to expend appropriations or to enter into any contract, assistance agreement, interagency agreement, or other financial obligation.

CONTENTS

CONTENTS	iii	Land Conservation and Stewardship	111
ACRONYMS	v	Introduction.....	112
Background	1	Land Conservation and Stewardship Action Plan.....	115
What is the Coastal Bend Bays & Estuaries Program?.....	2	Water and Sediment Quality	119
Why is the Bays Plan being revised?.....	3	Introduction.....	120
What has changed in the Bays Plan?.....	4	Water and Sediment Quality Action Plan.....	125
The Landscape	6	Nonpoint Source Management Action Plan.....	131
The Estuary.....	7	Freshwater Resources	138
The Watershed.....	12	Introduction.....	139
Human Role.....	15	Freshwater Resources Action Plan.....	141
Population.....	17	Public Education and Outreach	149
Economy.....	18	Introduction.....	150
Ecosystem Services.....	20	Public Education and Outreach Action Plan.....	152
Status and Trends	23	Delta Discovery	159
Environmental Indicators.....	24	Introduction.....	160
Climate Change Vulnerability Assessment.....	28	Delta Discovery Action Plan.....	162
Coastal Bend Bays & Estuaries Program	34	Coastal Resilience	168
National Estuary Program.....	35	Introduction.....	169
Administrative Framework.....	35	Coastal Resilience Action Plan.....	171
Public and Partner Involvement.....	36	Monitoring Strategy	176
Facilities.....	37	Environmental Monitoring.....	177
The Bays Plan	38	Programmatic Monitoring.....	181
Guiding Principles.....	39	Informational Products.....	181
History of The Bays Plan.....	39	Finance Strategy	184
The Bays Plan, 2nd edition.....	40	Ongoing Support.....	185
Human Uses	43	Enhanced Funding Strategy.....	186
Introduction.....	44	Literature Cited	188
Tourism and Recreation Action Plan.....	49	Appendix A	191
Shoreline Management Action Plan.....	54	Appendix B	209
Bay Debris Action Plan.....	57	Appendix C	212
Public Health Action Plan.....	60	Appendix D	214
Maritime Commerce and Dredging	63	Appendix E	216
Introduction.....	64	Appendix F	220
Maritime Commerce Action Plan.....	69	Appendix G	224
Dredging Action Plan.....	80		
Habitat and Living Resources	85		
Introduction.....	86		
Habitat and Living Resources Action Plan.....	90		
Coastal Birds	103		
Introduction.....	104		
Coastal Birds Action Plan.....	106		

CONTENTS

LIST OF FIGURES

Figure 1. Detailed map of the CBBEP program area.....	7
Figure 2. Land use/land cover in the 11 sub-basins draining into the Coastal Bend bays and estuaries.	12
Figure 3. Major aquifers of Texas and reservoirs that supply water to the twelve-county CBBEP program area.	14
Figure 4. Water usage in 2010 and projected water use through 2060 for the Texas Coastal Bend Region.....	15
Figure 5. Recorded population of the Coastal Bend in 2000 and 2010 and the projected population through 2070.....	18
Figure 6. Heat map showing average number of ecosystem services provided by habitats in EBMP study area.....	22
Figure 7. Mean sea level trend from 1937 to 2016 at NOAA Station 8774770 in Rockport, Texas.	31
Figure 8. SLAMM results show the impact of local sea level rise on coastal habitats.	31
Figure 9. Administrative structure of the CBBEP.....	36
Figure 10. Map of boat ramps, marinas, fishing piers, and Gulf beach access points in the Coastal Bend.....	45
Figure 11. Map of local parks, state parks, wildlife refuges, and right of way access points in the Coastal Bend.....	46
Figure 12. Map showing major dredged navigable waterways in the Coastal Bend.....	65
Figure 13. Map of hazardous material pipelines within the bays of the Coastal Bend.....	66
Figure 14. Map of estuarine habitats and bird rookeries in the Coastal Bend.	87
Figure 15. Map of properties owned by the CBBEP.....	111
Figure 16. Map showing the location of the CBBEP’s Nueces Delta Preserve.....	112
Figure 17. Map of TCEQ-permitted wastewater outfalls.....	119

LIST OF TABLES

Table 1. Population and population density in 2000 and 2010 for the 12-county program area.	17
Table 2. Ecosystem service values associated with key estuarine habitats.	21
Table 3. Comparison of action plans in "The Bays Plan" and "The Bays Plan, 2nd Edition."	41
Table 4. Descriptions of the major environmental monitoring programs and activities within the CBBEP program area.....	178
Table 5. Summary table of all actions and steps related to monitoring in The Bays Plan, 2nd Ed.....	182
Table 6. List of the CBBEP’s major funding sources.....	185
Table 7. List of potential funding opportunities CBBEP and its partners could pursue to implement Bays Plan actions.....	187
Table 8. List of endangered and threatened species found within the CBBEP 12-county program area.....	210
Table 9. List of Species of Greatest Conservation Need (SGCN) within the CBBEP 12-county program area.	213

ACRONYMS

ANWR

Aransas National Wildlife Refuge

ARK

Animal Rehabilitation Keep

BBASC

Bay and Basin Area Stakeholder Committee

BMP

Best Management Practice

CBBEP

Coastal Bend Bays & Estuaries Program

CBBF

Coastal Bend Bays Foundation

CBCiN

Coastal Bend Children in Nature

CBLT

Coastal Bend Land Trust

CCA

Coastal Conservation Association

CCAP

Coastal Change Analysis Program

CCMSH

Corpus Christi Museum of Science and History

CCS

Center for Coastal Studies

CMP

Coastal Management Program

CCVA

Climate Change Vulnerability Assessment

COG

Council of Governments

DDT

Dichlorodiphenyltrichlorethane

DU

Ducks Unlimited

EPA

Environmental Protection Agency

ESC

Education Service Center

GBRT

Guadalupe Blanco River Trust

GICA

Gulf Intracoastal Canal Association

GIWW

Gulf Intracoastal Waterway

GBRA

Guadalupe Blanco River Authority

HAB

Harmful Algal Bloom

HRI

Harte Research Institute

HSST

Home Schools of South Texas

HUT

Homeschoolers Unlimited Texas

ICF

International Crane Foundation

ICT

Interagency Coordination Team

IPCC

Intergovernmental Panel on Climate Change

LEPC

Local Emergency Planning Committee

MANERR

Mission-Aransas National Estuarine Research Reserve

NAI

National Association for Interpretation

NCCOS

National Centers for Coastal Ocean Science

NEP

National Estuary Program

NMFS

National Marine Fisheries Service

NFWF

National Fish and Wildlife Foundation

NOAA

National Oceanic and Atmospheric Administration

NPS

National Park Service

NRA

Nueces River Authority

NRCS

Natural Resource Conservation Service

NSF

National Science Foundation

NWF

National Wildlife Federation

OSSF

On-site Sewage Facility

PAH

Polycyclic Aromatic Hydrocarbon

PCB

Polychlorinated Biphenyl

PCCA

Port of Corpus Christi Authority

PICC

Port Industries of Corpus Christi

PINS

Padre Island National Seashore

RESTORE

Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies

SABF

San Antonio Bay Foundation

SABP

San Antonio Bay Partnership

SARA

San Antonio River Authority

SEA

Saltwater Fisheries Enhancement Association

SGCN

Species of Greatest Conservation Need

SLAMM

Sea Level Affecting Marshes Model

SLR

Sea Level Rise

SoIVES

Social Values of Ecosystem Services

ACRONYMS

STCZAC

South Texas Coastal Zone Area Advisory Committee

STSSN

Sea Turtle Stranding and Salvage Network

STWAC

South Texas Waterways Advisory Committee

SWCD

Soil and Water Conservation District

SWQM

Surface Water Quality Monitoring Program

TAES

Texas A&M AgriLife Extension Services

TAMU

Texas A&M University

TAMUCC

Texas A&M University – Corpus Christi

TCEQ

Texas Commission on Environmental Quality

TCiN

Texas Children in Nature

TDSHS

Texas Department of State Health Services

TEA

Texas Education Agency

TEEAC

Texas Environmental Education Advisory Committee

TFS

Texas Forest Service

TGLO

Texas General Land Office

TMDL

Total Maximum Daily Load

TMMSN

Texas Marine Mammal Stranding Network

TMN

Texas Master Naturalists

TNC

The Nature Conservancy

TPDES

Texas Pollutant Discharge Elimination System

TPWD

Texas Parks and Wildlife Department

TRC

Texas Railroad Commission

TSA

Texas State Aquarium

TSSWCB

Texas State Soil and Water Conservation Board

TWDB

Texas Water Development Board

TXDOT

Texas Department of Transportation

USACE

United State Army Corps of Engineers

USCG

United States Coast Guard

USFWS

United States Fish and Wildlife Service

USGS

United States Geological Survey

UTMSI

University of Texas Marine Science Institute

WIF

Wildlife in Focus

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CBBEP

Background



CONTENTS

What is the Coastal Bend Bays & Estuaries Program?

Why is the Bays Plan being revised?

What has changed in the Bays Plan?

What is the Coastal Bend Bays & Estuaries Program?

The Coastal Bend Bays & Estuaries Program (CBBEP) is a local non-profit 501(c)(3) organization dedicated to researching, protecting, and restoring the bays and estuaries in the Texas Coastal Bend. The CBBEP program area encompasses the 12 counties extending from an area locally referred to as the “landcut” in the Laguna Madre, through the Corpus Christi Bay system, and north to the Aransas National Wildlife Refuge. The CBBEP was founded following the designation of Corpus Christi Bay and the surrounding area as a National Estuary Program.

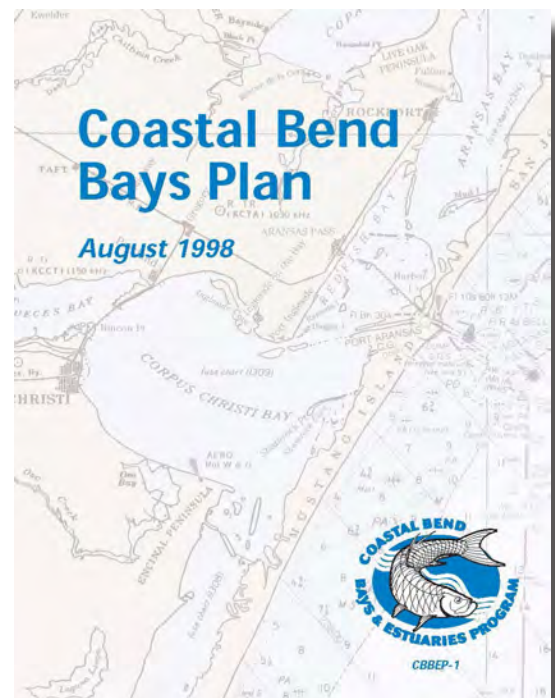
Efforts to improve the health and productivity of the Coastal Bend bays and estuaries began in the 1990's and resulted in the region being designated as an “estuary of national significance.” This eventually led to the establishment of the Corpus Christi Bay National Estuary Program, which in turn initiated a multi-year, community-based planning effort to identify the problems facing the bay system and to develop a long-term “Comprehensive Conservation and Management Plan” (CCMP) that outlined how to address the major priorities and issues. The CCMP, often referred to as *The Coastal Bend Bays Plan*, identified specific actions that would benefit the bay system and the users of the bays. It was designed to complement and coordinate existing resource management programs and plans, and it received approval in 1998.

Federal and state agencies played an important role in the development of *The Coastal Bend Bays Plan*. However, stakeholders wanted to localize and take ownership of The Bays Plan as it moved forward into the implementation phase. Therefore, the CBBEP was created in 1999 as a non-profit organization with the specific role of implementing *The Bays Plan*, which calls for the protection and restoration of the health and productivity of the bays and estuaries, while still supporting continued economic growth and public use of the bays.

As part of the National Estuary Program, the CBBEP is a non-regulatory, voluntary partnership effort working with industry, environmental groups, bay users, governments, and resource managers to improve the health of the bay system. Public participation by individuals and organizations is encouraged. A mix of local governments, private industry, and state (Texas Commission on Environmental Quality) and federal (United States Environmental Protection Agency) agencies provide program funding. The CBBEP also seeks private grants and additional governmental funding.



THE COASTAL BEND BAYS & ESTUARIES PROGRAM area includes 12 counties in an area of Texas known as the Coastal Bend.



THE COASTAL BEND BAYS PLAN was originally published in 1998, and the CBBEP was established to oversee its implementation.

◀ **SUNSET** at the Nueces Delta Preserve.
(Photo by David Satterwhite)

ACCOMPLISHMENTS

Since the 1998 Bays Plan was published, the CBBEP and its partners have completed numerous projects with the goal of improving the health of our bays and estuaries. Several of these accomplishments are highlighted in Chapters 5-14.

Page 44	Packery Flats Improvements
Page 47	Shoreline Protection at Indian Point Park
Page 48	Rookery Island Cleanups
Page 67	Beneficial Use of Dredge Material at Causeway Island
Page 68	La Quinta Channel Extension
Page 88	Nueces Bay Marsh Restoration
Page 89	Matagorda Island Restoration
Page 102	Migratory Connectivity Project
Page 103	Expanding the Motus Network
Page 110	Conservation of the Nueces River Delta
Page 120	Baffin Bay Study Group
Page 121	Cole and Ropes Park Coordination Committee
Page 137	Nueces Delta Salinity Monitoring
Page 148	Coastal Issues Forums
Page 149	Earth Day - Bay Day
Page 158	Record Year for Delta Discovery
Page 159	Youth Odyssey Visits Nueces Delta

Why is the Bays Plan being revised?

The Coastal Bend Bays Plan has served as a regional framework for the management, protection, and conservation of Coastal Bend bays and estuaries for over 20 years. A consensus-building process was used by local stakeholders to collectively design and create a plan that represented their diverse perspectives and interests. The Plan included a detailed, yet flexible, regional framework for action that could be used by partners in industry, local government, academia, and resource management to align their resources and programs to voluntarily participate in Bays Plan implementation.

The Coastal Bend Bays Plan was focused on seven priority issues: (1) alteration of freshwater inflow into bays and estuaries, (2) condition of living resources, (3) loss of wetlands and estuarine habitats, (4) degradation of water quality, (5) altered estuarine circulation, (6) bay debris, and (7) selected public health issues. Each of these priority issues was addressed in the Plan under the following categories of action plans: Human Uses; Maritime Commerce and Dredging; Habitat and Living Resources; Water and Sediment Quality; Freshwater Resources; and Environmental Education and Outreach. The action plans were developed and refined through a series of workshops and committees that involved more than 325 individuals representing over 100 organizations.

Year after year, the CBBEP and its partners have been translating *The Bays Plan* into actions and projects that have resulted in a Texas Coastal Bend with cleaner water and sediment, healthier habitats, greater public access, and a more aware and engaged public. Despite this progress, many of the same issues still remain and several new challenges have emerged, such as the impacts of climate change. The CBBEP recognizes that its action plans cannot remain static and must be modified to respond to the changing needs of communities, incorporate new programmatic, scientific, and technological advances, and address new environmental challenges. In 2016, the CBBEP initiated a new collaborative effort to revise *The Bays Plan* in order to incorporate developments that have occurred since the previous plan was drafted and to ensure that new priorities are being addressed. The goal of the revision process was to produce *The Coastal Bend Bays Plan, 2nd ed.*, which meets the current and future needs of stakeholders in industry, local government, academia, and resource management and can be used for years to come.



What has changed in the Bays Plan?

The Coastal Bend Bays Plan, 2nd ed. sets a course for the next 20 years for the CBBEP and its implementation partners. While much of *The Coastal Bend Bays Plan* was found to still be relevant, there have been a number of changes and developments since the publication of the previous *Plan* that have prompted revisions, including:

- Establishment of the Coastal Bend Bays & Estuaries Program, a non-profit organization, that is responsible for the implementation of the Coastal Bend Bays Plan;
- Development of “Implementation Teams” and “Advisory Committees” to allow for the continued guidance and involvement of stakeholders in Bays Plan implementation;
- Collaboration with local partners on implementation of numerous projects, including protection and restoration of thousands of acres of coastal wetlands;
- New data and better knowledge of the natural and anthropogenic changes within the CBBEP program area;
- Acquisition of close to 13,000 acres of coastal habitat at the Nueces Delta, Mustang Island, Lamar Peninsula, Aransas River Delta, and Mission River Delta;
- Development of an environmental education program, known as Delta Discovery, that operates primarily at the Nueces Delta Preserve;
- Observations of declining coastal bird populations and development of a regional program to combat these declines;
- Observations of climate change impacts and an increased need to address vulnerability and resiliency;
- Increased need to incorporate sound science, ecosystem services, and environmental indicators into resource management decision-making; and
- Increased need to incorporate measurable ecosystem targets and management outcomes into action plans.

The goal of *The Coastal Bend Bays Plan, 2nd ed.* is to create a Coastal Bend which supports a high quality of life for its inhabitants and a thriving bay system which is sustained throughout all generations. *The Coastal Bend Bays Plan, 2nd ed.* takes into account the changes and developments listed above, and it seeks to achieve its goal through the implementation of the following expanded action plan categories: Human Uses; Maritime Commerce and Dredging; Habitat and Living Resources; Coastal Birds; Land Conservation and Stewardship; Water and Sediment Quality; Freshwater Resources; Public Education and Outreach; Delta Discovery; and Coastal Resilience. A full accounting of how the action plans have been modified from *The Coastal Bend Bays Plan* is provided in Appendix A.

◀ **A HIGH SCHOOL VOLUNTEER** plants marsh grass as part of the Nueces Bay Marsh Restoration Project. (Photo by CBBEP)

LESSONS LEARNED

Stakeholder involvement helps achieve results

Informing and involving stakeholders in the implementation of *The Bays Plan* has allowed CBBEP to promote greater consistency and continuity in regional and local decision-making, address cross-boundary issues and develop effective solutions, and increase public understanding of the critical linkages between the economy and environment.

Leveraging resources is key to reaching goals

Collaborations with governments, private business, foundations, and local communities have allowed CBBEP to leverage its federal investment in clean water, healthy ecosystems, and thriving waterfront communities. This leveraging of resources is key to achieving the goals outlined in *The Bays Plan*, and has allowed the CBBEP to implement numerous projects that would not have otherwise been possible.

Good science can help develop and implement good management

CBBEP recognizes the benefits of working with partners to collect and analyze reliable and objective data that can be used to assess estuary conditions, develop solutions to estuary problems, and adapt management efforts. A related outcome is raising awareness about the need for ongoing monitoring and ecological assessments as part of comprehensive resource management planning.

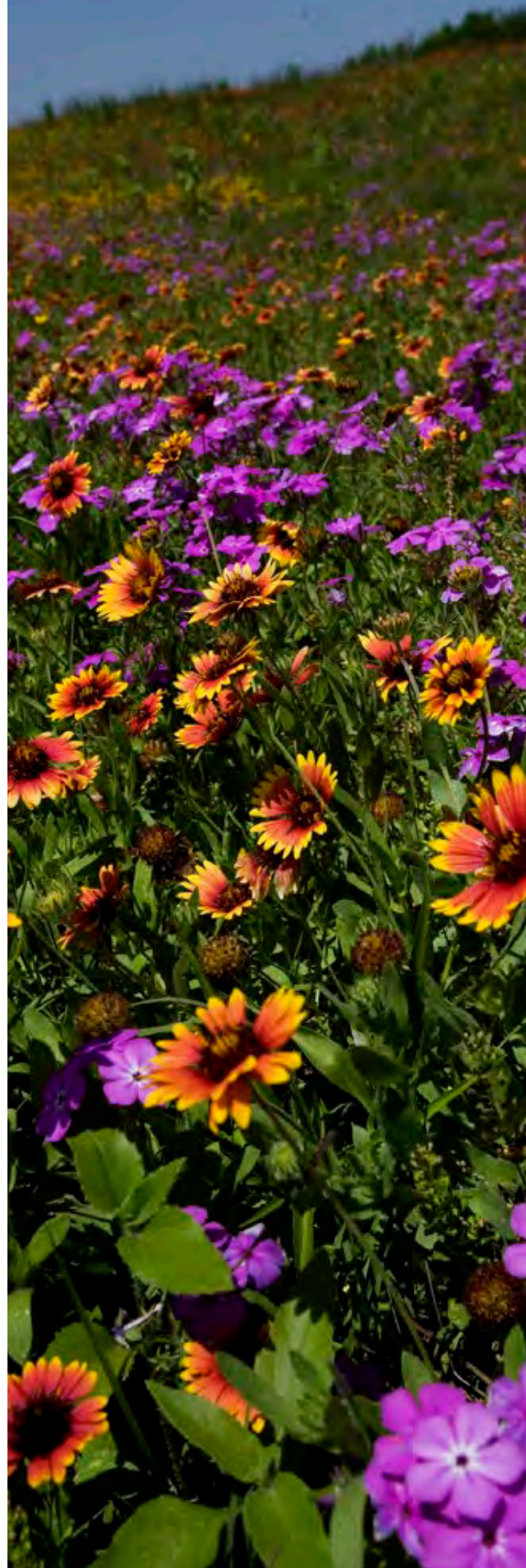
Community engagement is necessary for success

To ensure commitment and sustained support from the public, CBBEP has found it important to consistently engage with stakeholders regarding goals, objectives, and actions and to provide updates on progress achieved. Understanding participants' motivations for their involvement is important, and highlighting visible impacts of their participation can help inspire their continued involvement.

Build on successes

The CBBEP is seen as a community leader on environmental issues in the Coastal Bend, and the organization has good relationships with agencies, foundations, and private businesses. CBBEP has a strong track record of implementing successful and effective projects, which has resulted in further investment in the program.

WILDFLOWERS TRANSFORM THE LANDSCAPE at the Nueces Delta Preserve. (Photo by Charlie Spiekerman)



CHAPTER

1

The Landscape

CONTENTS

The Estuary

The Watershed

Human Role – Past and Present

Population

Economy

Ecosystem Services

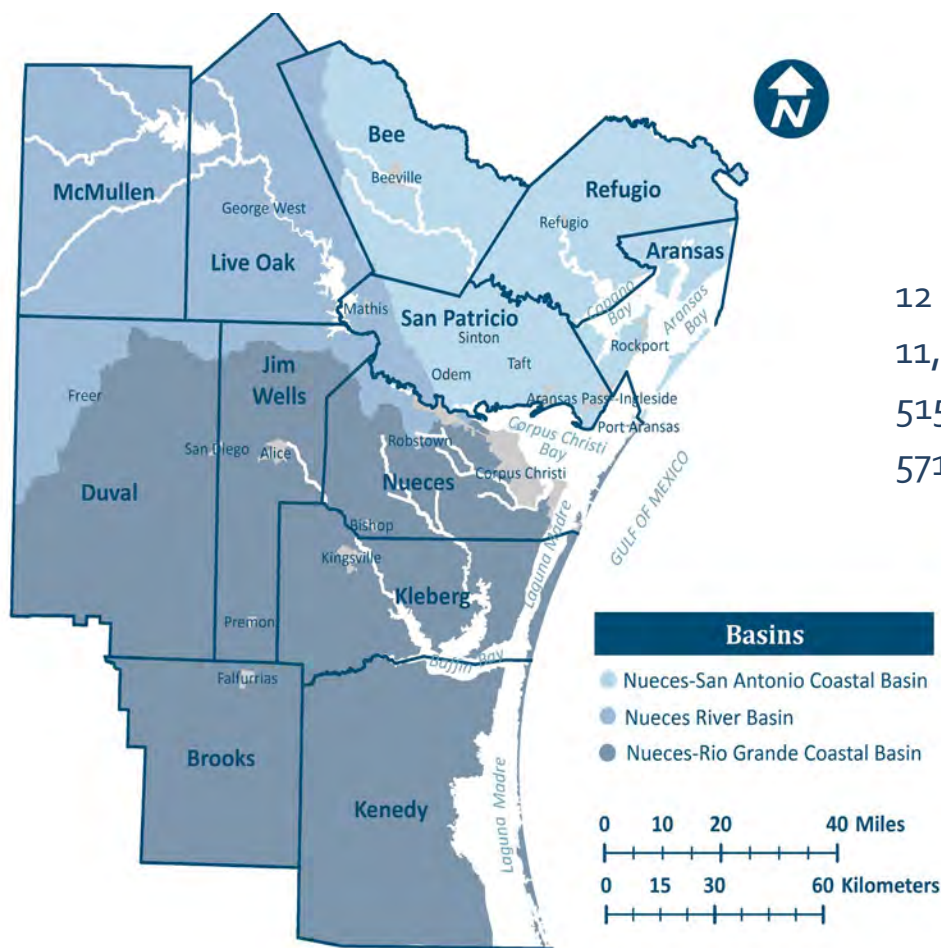
The CBBEP program area includes 75 miles of estuaries and adjacent watersheds along the south-central coastline of Texas. This area, known as the Coastal Bend, encompasses 12 counties, 11,500 square miles (29,785 square km) of land, 515 square miles (1,334 square km) of bays, estuaries, and bayous, and just over 570,000 residents.

The Estuary

Estuaries are waterways, such as bays and bayous, where fresh water drained from the surrounding watershed mixes with salt water from the ocean. This mixing of fresh and salt water creates biologically productive areas that support many kinds of fish, shellfish, marshes, seagrasses, and microscopic marine life. Since estuaries have economic, aesthetic, and recreational value to people, they are attracting a growing number of coastal residents and commercial activities, and aquatic life and scenic values are affected in many ways by these growing populations.

The Coastal Bend contains three of the seven Texas estuary systems - the Aransas, Nueces, and Upper Laguna Madre estuaries (Figure 1). Broad belts of mostly flat coastal prairies, chaparral pastureland, and farmlands can be found adjacent to the expansive bays that characterize the transition zone between the mid- and lower-coast. A nearly unbroken string of barrier islands provide definition to the bays, estuaries, and one of only three hypersaline lagoons in the world.

Hydrographic conditions in the Coastal Bend are influenced primarily by climatic conditions, freshwater inflow, and, to a lesser extent, tidal exchange. Regional climate is characterized as sub humid-to-semiarid, and subtropical, with extreme variability in precipitation, generally high humidity, and infrequent but significant freeze events. Generally, the area experiences high temperatures along with low levels of rainfall, especially to the south. Major climatic factors are temperature, precipitation and evaporation, wind, tropical storms, and hurricanes.



CBBEP Program Area

- 12 counties
- 11,500 square miles of land
- 515 square miles of water
- 571,987 residents

FIGURE 1. DETAILED MAP OF THE CBBEP PROGRAM AREA.

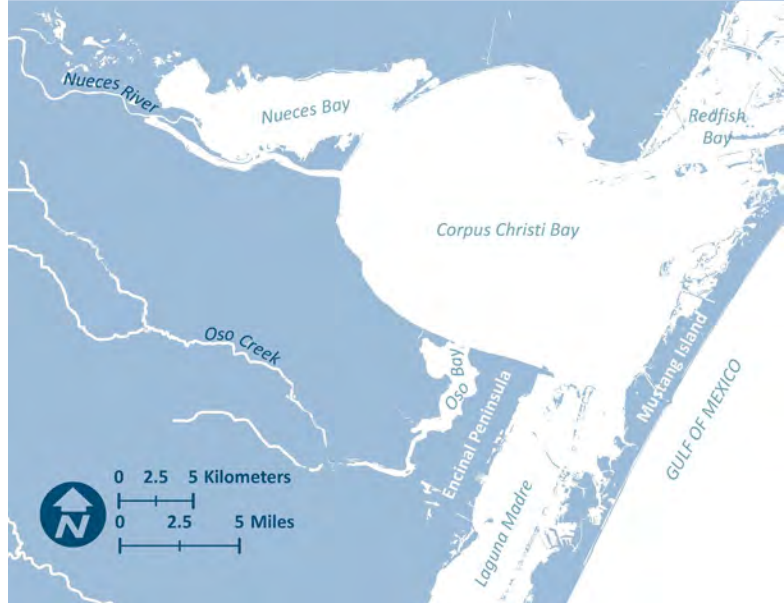
THE ESTUARIES OF THE COASTAL BEND are a mosaic of habitats from salt marshes to tidal flats to seagrass beds. (Photo by CBBEP)

Mission-Aransas Estuary



Southeasterly winds dominate the Coastal Bend wind regime, broken by northwesterly and northeasterly winds as cold fronts pass. Cold fronts produce intense temperature changes, which bring drops in temperatures for a certain time period and can lead to major impacts on aquatic wildlife such as fish and turtles. Significant climatic events in this region also include tropical storms and hurricanes, which can be responsible for alterations to habitats and impacts on living resources (both positive and negative), in addition to losses of both life and property. Since 1851, thirty-four tropical storms or hurricanes have made landfall in the Coastal Bend (NOAA, 2018). These storms are most frequent during the months of August and September. Most recently, Hurricane Harvey made landfall in the Coastal Bend on August 25, 2017. This strong Category 4 storm brought high winds and storm surge, which resulted in devastating impacts to the communities of the Texas Coastal Bend. In addition to the impacts this major storm had on people, it also had a significant affect on the natural resources, and the long-term impacts are still being determined.

Nueces Estuary



The Mission, Aransas, and Nueces rivers contribute the primary freshwater inflow to the Coastal Bend bays and estuaries, but overall, the system receives limited inflow in proportion to its drainage area. The three river basins drain 22,595 square miles (58,521 square km). The project area exhibits the north-to-south, moist-to-dry gradient that is characteristic of the entire Texas coast. Freshwater inflows, with attendant nutrients and sediments, are vital to sustaining the health of the estuaries. Great variability in these inflows is characteristic of the area and, coupled with increased water needs by an expanding human population, has reduced water availability for both humans and the bays in low-flow years. The region currently has two reservoirs, Lake Corpus Christi and Choke Canyon Reservoir, which are both situated in the Nueces River watershed.

Upper Laguna Madre Estuary



The program area includes one major tidal pass to the Gulf of Mexico (the Aransas Pass), as well as two smaller passes (Packery Channel and Cedar Bayou). Astronomical tides within the project area are predominantly diurnal (one high and one low per day), but they also have a semi-diurnal component (two highs and two lows per day). Average tidal range is about 1.5 feet (0.5 m) on the Gulf beaches and generally less than 0.5 feet (0.2 m) in the bays. Seasonal high tides occur during the spring (May) and fall (October), and seasonal lows occur during winter (February) and summer (July). Tidal exchange between the estuaries and Gulf of Mexico is due to astronomical tides, as well as meteorological conditions (winds, barometric pressure). Due to shallow bay depths and a relatively small tidal prism, wind exerts a greater influence on bay circulation than astronomical tides (Ward, 1997).

Seagrass Meadows



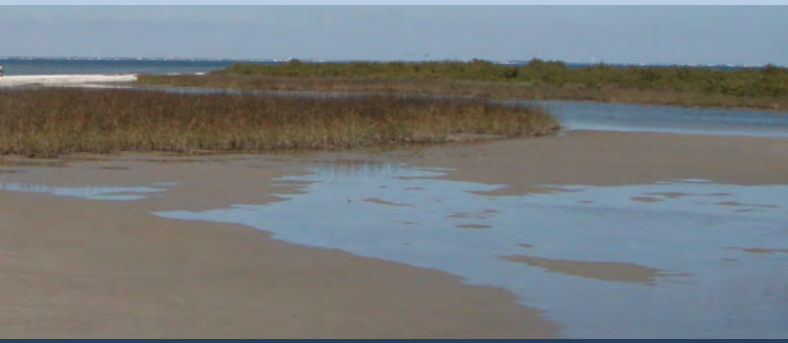
Saltwater Marsh



Freshwater Marsh



Tidal Flats



Oyster Reefs



Key Habitats

The habitats and living resources of the Coastal Bend are unique and diverse. The high-level of species diversity is due to the wide array of land and aquatic habitat types found in the region, including arid chaparral, riparian forests, oak savannas, oxbow lakes and swales, river deltas, coastal marshes and ponds, tidal flats, oyster reefs, seagrass meadows, open bay bottoms, barrier islands, jetties and other hard substrates, and sandy beaches. Several of the key bay and estuarine habitats are described below.

Seagrass Meadows

Seagrasses are submergent, flowering plants that grow in marine environments. Seagrass meadows are found primarily in shallow water (<1 m) in estuaries, hypersaline lagoons, and brackish water areas. They are among the most productive ecosystems in shallow waters. They provide nursery areas for estuarine fish and wildlife, and food sources for various fauna including fish and waterfowl. Within the CBBEP program area, extensive seagrass meadows are found in the Upper Laguna Madre and Redfish Bay (CBBEP, 2010).

Saltwater Marshes

Saltwater marshes are intertidal areas between upland and estuarine/marine systems, and they are dominated by marsh grasses and herbaceous plants. Saltwater marshes are important nursery and feeding grounds for a variety of invertebrates and fish. Extensive saltwater marshes occur in the northern part of the CBBEP area where freshwater inflow and precipitation are higher. Saltwater marshes are replaced by extensive wind tidal flats from Mustang Island southward, due to lower precipitation and higher evaporation rates (CBBEP, 2010).

Freshwater Marshes

Freshwater marshes represent transitional areas between terrestrial and freshwater aquatic environments. They perform numerous functions, including water purification, flood protection, shoreline stabilization, groundwater recharge, and streamflow maintenance. These areas also provide habitat for fish and wildlife, and in Texas, are especially important as a source of food and water for migratory birds that spend the winter on the coast. Freshwater wetlands generally occur along streams in poorly drained depressions and in the shallow water along the boundaries of lakes, ponds, and rivers. However, in the Coastal Bend, freshwater marshes are also unique features of the barrier island system. Extensive freshwater marshes occur along the Copano mainland, within the Mission River



valley, along the Aransas and Nueces rivers, and on Live Oak and Blackjack peninsulas (CBBEP, 2010).

Tidal Flats

The sand and/or mud environments bordering lagoons and bays may seem barren and relatively featureless, but they are actually highly productive and provide essential habitat to migrating shorebirds. Within the CBBEP area, most tidal flats are wind-tidal flats, inferring that wind-associated tides are responsible for the frequent submergence that maintains this feature. Tidal flats are found on the bay sides of St. Joseph Island, Mustang Island, and Padre Island, and at the edges of Baffin Bay and its secondary bays (CBBEP, 2010).

Oyster Reef

Oysters are abundant in bays, lagoons, and estuaries. As generations of oysters grow on top of each other, they form reefs that provide habitat for many other animals. Oysters are capable of filtering as much as 50 gallons of water each in a single day, removing silt and contaminants from the water, and improving local water quality and clarity. Oysters are also an important commercial fishery in Texas. Despite their importance, oyster reefs are one of the most threatened marine habitats on earth, with losses resulting from water quality degradation, coastal development, destructive fishing practices, overfishing, and storm impacts.

Open Bay

The open bay community is defined as the unvegetated and soft-bottomed portion of the subtidal estuarine environment. Extent of the open bay community is determined primarily by factors limiting success of submerged plants and oysters, such as depth, turbidity, exposure to wave action, and salinity. The primary production is dominated by phytoplankton, which are the base of the food chain. Most of Corpus Christi Bay, Nueces Bay, Oso Bay, Mission Bay, and Aransas Bay, except for a few scattered areas of oyster reefs and seagrass meadows, can be characterized as open bay (CBBEP, 2010).

Barrier Islands

Barrier islands are elongate landforms that lie parallel to the mainland shoreline and are typically isolated from the mainland by bays and lagoons. Barrier islands extend along the easternmost boundary of the CBBEP area and include southern Matagorda, St. Joseph, Mustang and northern Padre islands. These islands function as protective barriers to the adjacent Texas mainland and to the adjacent shallow

◀ **SALT MARSHES** provide nursery and feeding grounds for many commercially and recreationally important fish and shellfish. (Photo by Mission-Aransas NERR)

bays and lagoons. In addition, unique flora and fauna inhabit the islands and increase the biologic diversity of the CBBEP area (CBBEP, 2010).

Gulf Beach

The Gulf beach habitat encompasses the sandy shoreline and associated shallow, nearshore waters of the barrier island chain that fringes the Texas coast. This habitat community is often highly diverse and highly productive due to the transport of food by currents. Matagorda, St. Joseph, Mustang, and Padre islands serve as protective barriers to the three principal estuarine systems within the Coastal Bend (CBBEP, 2010).

Threatened/Endangered Species and Species of Greatest Concern

Fifty-four species that inhabit or use the twelve-county CBBEP program area are listed by the State of Texas as endangered or threatened. Of these, 21 are also federally listed and one species is a candidate for federal listing (Appendix B). Many of the 54 State-listed species utilize estuaries, including the Whooping Crane; American Peregrine Falcon; Piping Plover; Eskimo Curlew; Reddish Egret; opossum pipefish; and Kemp's Ridley, green, hawksbill, leatherback, and loggerhead sea turtles. It is worth noting that several species have been removed from the federal list of endangered and threatened species since the publication of the 1998 Bays Plan, including the Brown Pelican, Bald Eagle, Peregrine Falcon, and Arctic Peregrine Falcon. However, the Bald Eagle, Peregrine Falcon, and American Peregrine Falcon remain on the State list of threatened species (Appendix B).

The Texas Parks and Wildlife Department (TPWD) also designates certain species as "Species of Greatest Conservation Need" (SGCN). Native animals or plants designated as a SGCN are generally those that are declining or rare and are in need of attention to recover or to prevent the need to list under state or federal regulation. There are currently over 1,300 species listed on the State-wide SGCN list, and 70 of those are found within the CBBEP program area (Appendix C). Among those species listed as SGCN, several utilize estuarine habitats, including the Texas diamondback terrapin, Red Knot, and Texas pipefish.

ALTHOUGH WHOOPING CRANES REMAIN AN ENDANGERED SPECIES,

they are an inspirational symbol of conservation, having rebounded from around 15 birds in 1941 to reach several hundred birds today.

(Photo by Linda Fuiman)



Slender Rushpea

The Slender Rushpea is listed as endangered by the State of Texas.



Texas Diamondback Terrapin

The Texas Diamondback Terrapin is considered a Species of Greatest Conservation Need by the State of Texas.



Golden Orb

The Golden Orb is a candidate for federal listing.



Marine mammals, such as the bottle-nosed dolphin, are also considered to be a protected species under the Marine Mammal Protection Act. Bottle-nosed dolphins are commonly found in the bays and estuaries of the Coastal Bend, particularly in the Aransas Pass area (Tunnel et al., 1996).

The Watershed

Land use/land cover and water use in the counties that comprise the watersheds of the Coastal Bend bays and estuaries can greatly affect the water quality and health of estuarine habitats and living resources. The counties that lie within the Coastal Bend include: Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, Refugio, and San Patricio. Six of these counties, Aransas, Kenedy, Kleberg, Nueces, Refugio, and San Patricio, contain both uplands and open bay habitat.

The watersheds of the Coastal Bend bays and estuaries are primarily comprised of small, rural communities transitioning into more densely populated urban areas along the coast. The urban areas are primarily confined to cities such as Corpus Christi, Rockport/Fulton, and Kingsville.

Land Use / Land Cover

Patterns of land use/land cover within a watershed can provide an indication of the spatial extent of human alteration and can be a valuable tool in determining how the natural resources in the area are utilized by humans. In particular, land use/land cover can help explain non-point source pollution, patterns of natural habitat, water quality, aesthetic characteristics of developed lands, and can also help identify areas for conservation.

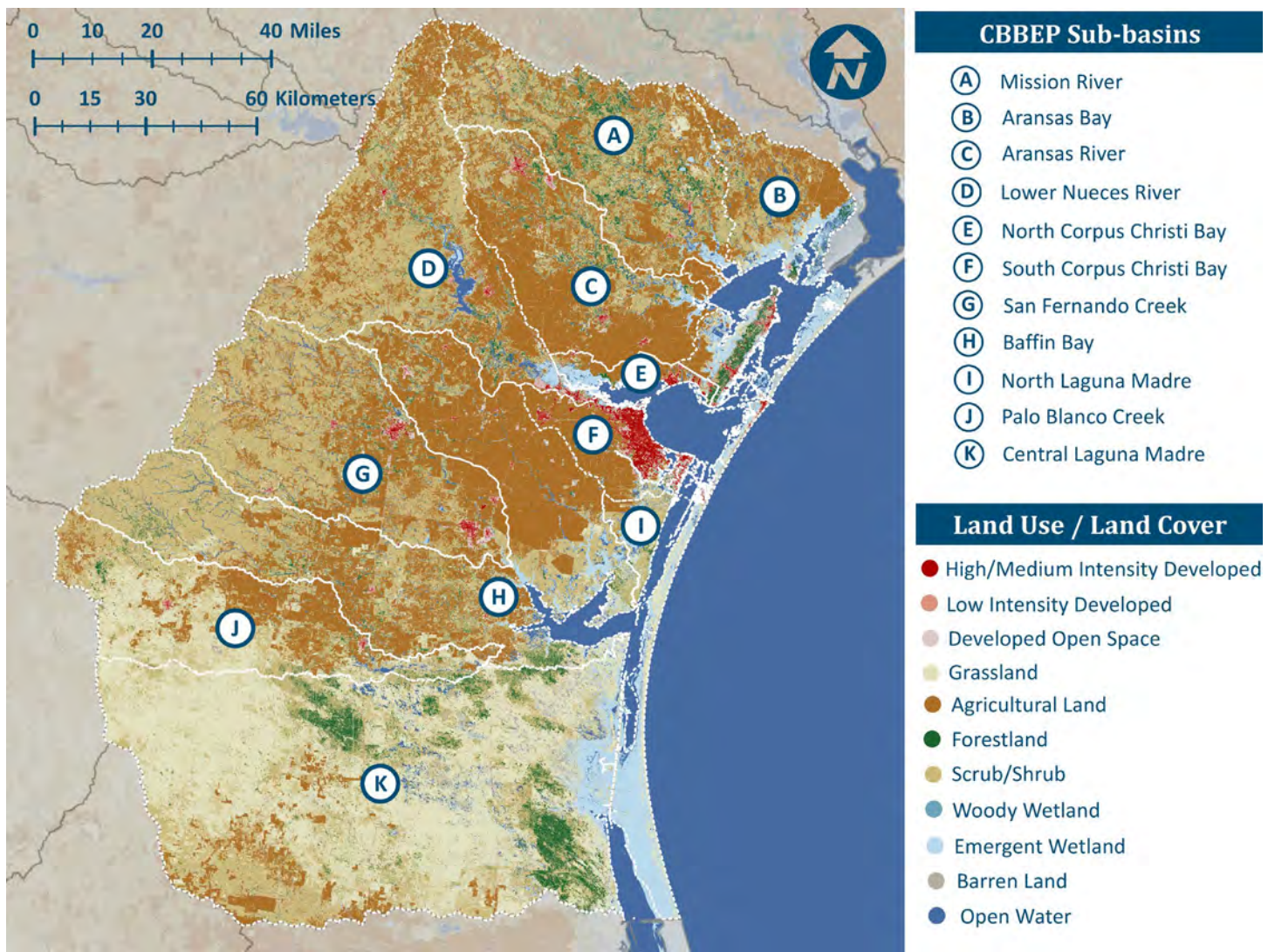


FIGURE 2. LAND USE/LAND COVER IN THE 11 SUB-BASINS DRAINING INTO THE COASTAL BEND BAYS AND ESTUARIES. (SOURCE: NOAA CCAP, 2010)

According to the National Oceanic and Atmospheric Administration's Coastal Change Analysis Program (NOAA, 2016a), the eleven sub-basins (Hydrologic Unit Code 8) that drain into the Coastal Bend bays and estuaries contained 309 square miles (800 sq km) of developed land in 2010 (Figure 2). This represents a 6% increase over the amount of developed lands present in 1996 (290 sq mi/752 square km). It is worth noting, that the largest increase in developed land was in the high/medium intensity land use category (11.5% increase). This land use type is characterized by significant amounts of impervious surfaces, which result in increased runoff and could impact water quality. The South Corpus Christi sub-basin was responsible for much of the observed increase in high/medium intensity developed land (5.5 sq mi/14 square km increase), with primarily agricultural lands being converted to developed lands (NOAA, 2016a).

In 2010, the dominant land cover/land use categories within the eleven sub-basins of the Coastal Bend bays and estuaries were: scrub/shrub (4,085 sq mi/10,580 sq km), agriculture (including both cultivated cropland and pasture/hay; 3,637 sq mi/9,420 sq km), and grasslands (2,424 sq mi/6,278 sq km) (NOAA, 2016a). Each of these categories has shown relatively little change in total acreage since 1996. Agriculture is the dominant land use in the Aransas River, Aransas Bay, Baffin Bay, South Corpus Christi Bay, and North Corpus Christi Bay watersheds. Scrub/shrub is the leading land cover type in the Mission River, Lower Nueces, North Laguna Madre, San Fernando, and Palo Blanco watersheds. However, agriculture is the secondary land use type within almost all of these sub-basins (Figure 2). The Central Laguna Madre watershed is the only sub-basin in which grasslands is the dominant land cover. In the NOAA CCAP land cover classification scheme, grasslands include areas that are not subject to intensive management, such as tilling, but these lands can still be utilized for grazing. The presence of large cattle ranches within the Central Laguna Madre sub-basin explains the presence of the large amounts of grassland compared to other sub-basins.

All eleven sub-basins showed a decrease in the amount of forestland present from 1996 to 2010, with the largest decreases occurring in the Baffin Bay, Central Laguna Madre, and Mission River watersheds. Closer examination shows that in all three of these sub-basins, forestland has primarily been converted to scrub/shrub and grasslands, although smaller amounts have also been lost to agriculture and urban development (NOAA, 2016a).

Similarly, all eleven sub-basins showed a net loss from 1996 to 2000 in the total acreage of woody wetlands. The largest losses occurred in the Central Laguna Madre, Lower Nueces, and Baffin Bay watersheds. Closer examination of these three sub-basins showed that the greatest losses were in palustrine scrub/shrub wetlands and unconsolidated shore (i.e., silt, sand, or gravel that is subject to inundation and redistribution due to the action of

THE MISSION, ARANSAS, AND NUECES RIVERS contribute the primary freshwater inflow to Coastal Bend bays and estuaries. (Photo by CBBEP)



water). In the Baffin Bay and Lower Nueces watersheds, lost wetlands were primarily transformed to open water habitats with some conversion to agriculture as well. In the Central Laguna Madre watershed, lost wetlands were primarily converted to barren land and open water (NOAA, 2016a). Interestingly, ten of the eleven sub-basins show an increase over the same time period in emergent wetlands. In most cases, the increase in emergent wetlands was attributed to an increase in both palustrine and estuarine emergent wetlands, with the largest increases in palustrine emergent wetlands.

Water Use

The Coastal Bend Region relies primarily on surface water sources for municipal and industrial water supply use. The three major surface water supply sources include: (1) the Choke Canyon Reservoir/Lake Corpus Christi System in the Nueces River Basin, (2) Lake Texana on the Navidad River in Jackson County, and (3) the Mary Rhodes Pipeline to the Colorado River in Matagorda County. Some areas within the region are dependent on groundwater. There are two major aquifers that lie beneath the region, the Carrizo-Wilcox and Gulf Coast aquifers (Figure 3). The Gulf Coast Aquifer underlies all counties within the Coastal Bend Region and yields moderate to large amounts of both fresh

and slightly saline water. The Carrizo-Wilcox Aquifer only underlies parts of McMullen, Live Oak, and Bee Counties and contains moderate to large amounts of either fresh or slightly saline water (HDR, 2015).

With increasing population and growing industry comes increased demand for water resources. Total water use for the 12-county CBBEP program area is projected to increase from 168,782 acre feet in 2010 to 345,746 acre feet in 2070, more than doubling. The different types of water use and associated demands are shown in Figure 4. The current major water user groups are manufacturing and municipal, which includes homes and businesses. Future water demand projections indicate that manufacturing and municipal users will continue to be the primary water consumers in this region, with manufacturing showing a major increase over time (Figure 4). Although it is only a small proportion of total water use at this time, steam-electric power is expected to also show a major increase in the amount of water used over the next 50 years. Because irrigation is only used in a few locations, agricultural water usage is relatively minimal in this area. However, this water user group is also expected to increase their water demand over the next several decades. Water use for livestock is low and is expected to show little change over time (HDR, 2015).

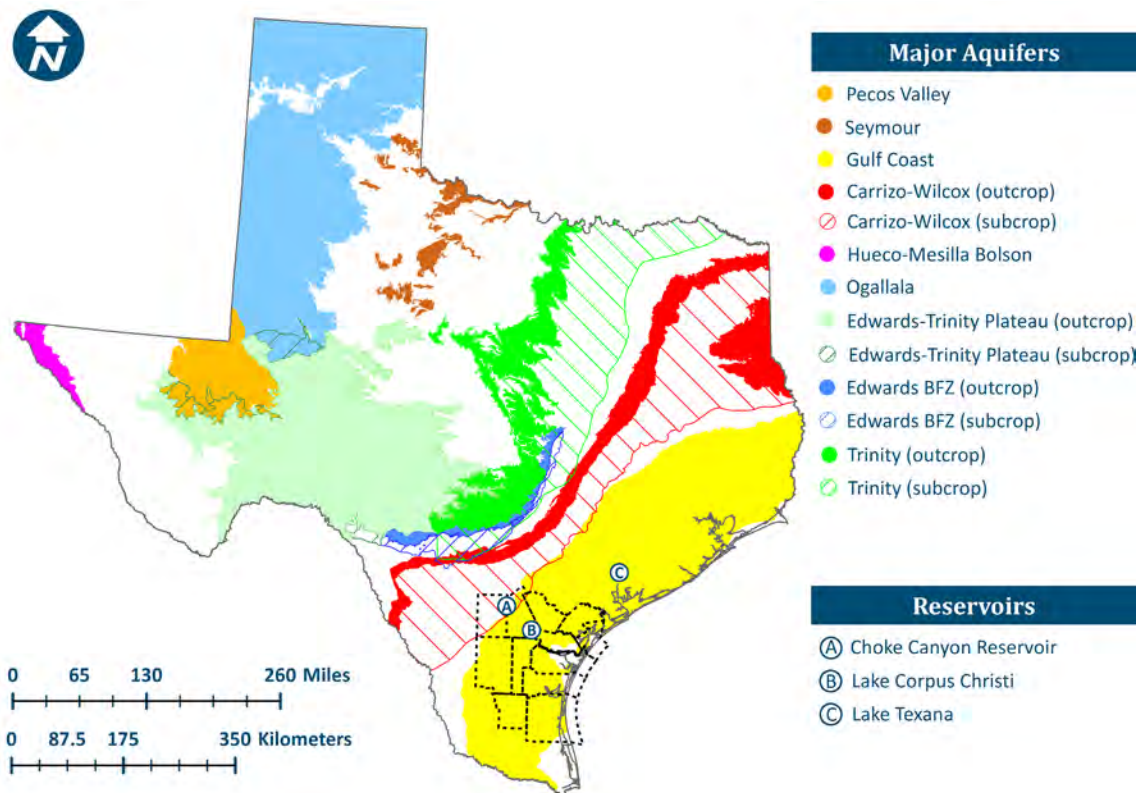


FIGURE 3. MAJOR AQUIFERS OF TEXAS AND RESERVOIRS THAT SUPPLY WATER TO THE TWELVE-COUNTY CBBEP PROGRAM AREA. (SOURCE: TWDB)

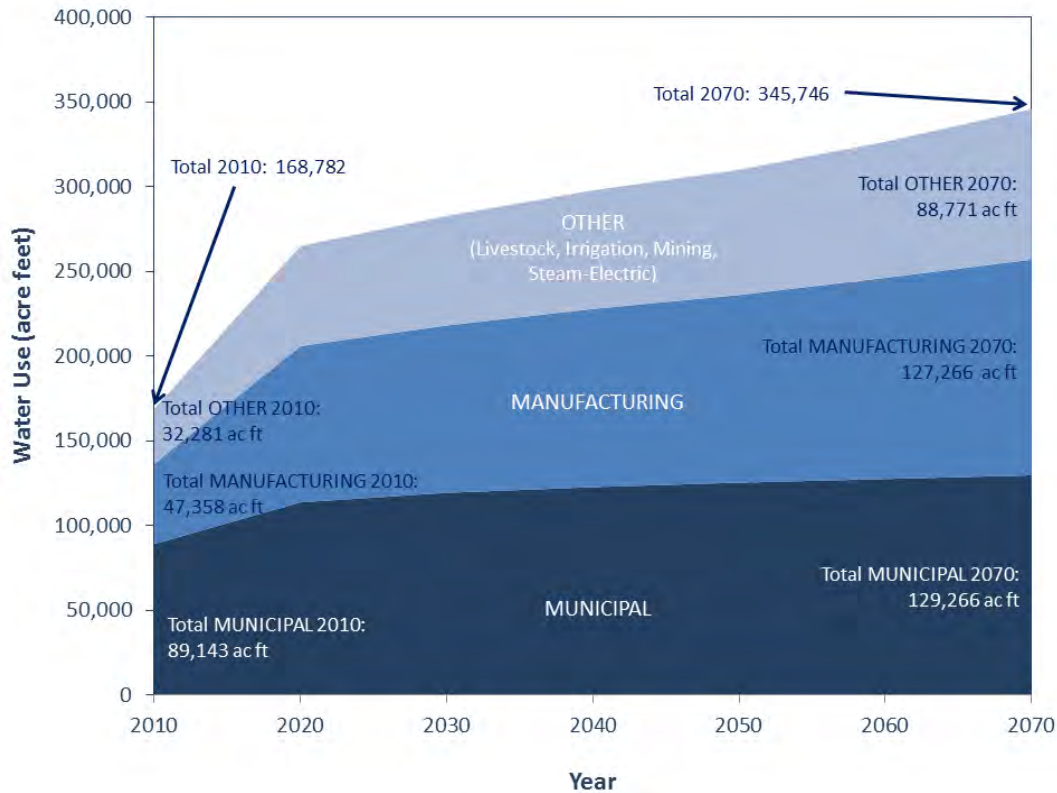


FIGURE 4. WATER USAGE IN 2010 AND PROJECTED WATER USE THROUGH 2060 FOR THE TEXAS COASTAL BEND REGION (SOURCE: TWDB).

Five counties in the region have a projected shortage in at least one of the water user groups in the county. These are Duval County (City of San Diego 2040 & 2070), Jim Wells County (City of San Diego 2040 & 2070), McMullen County (mining shortage 2040; irrigation shortage 2040 & 2070), Nueces County (City of Robstown 2040 & 2070; manufacturing 2070; steam-electric power 2070), and San Patricio County (manufacturing 2040 & 2070; irrigation 2070). None of the water user groups in Aransas, Bee, Brooks, Kenedy, Kleberg, Live Oak, or Refugio counties have projected shortages (HDR, 2015).

Future water management strategies for the Coastal Bend include: (1) improved water conservation strategies (primarily in municipal, manufacturing, mining, and irrigation), (2) additional reuse of reclaimed wastewater supplies, (3) seawater desalination (converting saline water to potable water), (4) brackish groundwater desalination, (5) new reservoirs, (6) water treatment plant improvements, (7) water system interconnections, and (8) additional Gulf Coast Aquifer supplies (HDR, 2015). While the Coastal Bend has made important strides in researching water conservation opportunities, it is imperative that education and outreach become more intensive as population increases along the coastal areas.

Human Role

Although it is estimated that humans have inhabited the Coastal Bend area for at least the last 12,000 years, evidence of the earliest inhabitants is scarce due to the post-Pleistocene inundation of coastal archaeological sites by sea level rise. However, radiocarbon dating of archaeological deposits provides good documentation of prehistoric human occupation of the area for the last 7,500 years. Data from these deposits indicate that from 7,500 to 4,200 years before the present (B.P.), prehistoric hunter gatherers fished for estuarine-dependent shellfishes and fishes in the Coastal Bend. The archaeological evidence suggests that these people occupied cool-season, estuarine fishing camps from fall through early spring and riverine hunting camps during the warmer months. By 3100 B.P. exploitation of estuarine resources intensified dramatically. This intensification may have occurred as sea level stabilized, allowing the development of the modern estuarine environment (Ricklis, 2004).

In 1528, the shipwrecked Alvar Núñez Cabeza de Vaca and his companions encountered native occupants of the central Texas Coast who were almost certainly Karankawas or their relatives. This historic encounter is the earliest recorded contact between Europeans and native



SHIPPING COTTON on the "Pilot Boy" from Corpus Christi, Texas.
(Courtesy of DeGolyer Library, Southern Methodist University)

inhabitants of the Texas coast. The Karankawas navigated coastal bays in dugout canoes, from Matagorda Bay to Corpus Christi Bay, and exploited the seasonal offerings of the estuarine environment. They collected oysters and clams and fished for redfish, black drum, and spotted sea trout during the fall, winter, and early spring. During warmer months they moved further inland to hunt deer and collect plant foods along the rivers (Ricklis, 1996; Krieger, 2002). Despite their superb adaptation to the local environment, the Karankawas eventually succumbed to the combined effects of European diseases, warfare, dispersal, and absorption into other native populations and they became culturally extinct by the mid-19th century. Although less is known about the Malaquite Indians, this band of Coahuiltecas was also known to fish the waters and hunt bison and deer on inland prairies in the southern portion of the Coastal Bend (Ricklis, 1997).

Spanish explorer Alonzo de Pineda is credited with discovering Corpus Christi Bay in 1519, naming it after the Roman Catholic feast day on which he arrived. Two hundred years would pass before Spanish settlers established the first trading posts in the region, laying claim to vast sections of a barren land named El Desierto de los Muertos, Desert of the Dead. The first European settlement in this region occurred with the development of Spanish missions during the early 18th century (CBBEP, 1998). In 1785, the Spanish established the port of El

Copano on the northwestern shore of Copano Bay. El Copano became the main supply port for the Spanish settlements at Refugio, Goliad, and San Antonio. Early 19th century Texas colonists from Ireland and Mexico passed through the Port of El Copano en route to Spanish land grant settlements. The Port was used by Mexicans and those fighting for Texas independence during the Texas Revolution and by blockade runners during the Civil War. As railroads gained prominence, the port of El Copano and the town that formed around it declined until the towns were abandoned in 1880 (Huson, 1935).

By the 1840s, towns had sprung up wherever a living could be made in the territory between the Nueces and the Rio Grande rivers, land claimed by both Mexico and the Republic of Texas. By the late 1870s, commercial harvesting of oysters and turtles prospered. Inland, the King and Kenedy ranches made their starts in the sun-baked western and southern counties of the program area. Corpus Christi claimed one of the largest wool markets in America with more than a million sheep grazing in Nueces and Duval Counties. Within a decade, soaring land and cattle prices forced many shepherds to sell or move their herds (Jones, et al., 1996).

As Corpus Christi grew, increased shipping through a deepened channel bolstered the region's economy. Coastal factories processed and shipped tallow, hides, and

pickled beef on schooners destined for New Orleans, Cuba, and England. The arrival of railroads in the mid-1880's opened new markets for agricultural produce. By the turn of the century, commercial fishermen harvested some three million pounds of seafood from the bay system each year. Turtles and oysters comprised one-third of the catch (CBBEP, 1998).

Despite devastating hurricanes and droughts, deadly yellow fever epidemics, and bloody wars, the area around Corpus Christi flourished. By 1926, the population had grown to 35,000. Agricultural commerce provided the impetus for constructing the deepwater Port of Corpus Christi, and after the discovery of oil and natural gas, the Port quickly adapted to the needs of that industry too. Military operations came to the region in a major way in 1941 with the establishment of the Naval Air Station – Corpus Christi and the world's largest naval aircraft pilot training program (CBBEP, 1998).

During the period of greatest expansion, the Naval Air Station, the Corpus Christi seawall, and causeways to Portland and North Padre Island were built. By 1960, however, regional development slowed dramatically, foreshadowing an economic downturn that would be punctuated by a March 1986 crash of world oil prices. The crash shattered the region's economic base, and precipitated five years of staggering unemployment and low wages (Jones, et al., 1997).

The region's economy has since rebounded with vigor and continues to grow today. As world oil prices rebounded, the economy boomed and oil production in Texas rose

explosively. In addition to high prices, advances in drilling technologies called fracking spurred oil exploration and drilling activities in the Eagle Ford and Permian basin formations. In recent years, the Coastal Bend has also experienced a wave of new economic growth due to several major industrial developments, including the Cheniere Energy liquefaction facility, the Voestalpine iron briquette manufacturing facility, the TPCO seamless steel pipe manufacturing facility, and the M&G resin production facility. While new industrial growth has been very beneficial for the economy of the Coastal Bend, it does present new environmental challenges, such as increased demand for water resources.

Population

The population of the 12-county CBBEP program area has increased by four percent between the years of 2000 and 2010, with a recorded population of 571,987 people in 2010 (Table 1, Figure 5). The Corpus Christi Metropolitan Statistical Area, consisting of Aransas, Nueces, and San Patricio Counties, accounted for 75 percent of the Coastal Bend population. In 2010, the counties of the Coastal Bend had an average density of 62.2 people per square mile. The primarily rural southern counties are characterized by extremely low population densities with Kenedy and McMullen counties only having 0.3 and 0.6 people per square mile, respectively. The counties that make up the Corpus Christi Metropolitan area have the highest densities at 89.3 people per square mile in Aransas County, 97.1 in San Patricio County, and 375.3 in Nueces County (Table 1, US Census Bureau, 2010).

TABLE 1. POPULATION AND POPULATION DENSITY IN 2000 AND 2010 FOR THE 12-COUNTY PROGRAM AREA. (SOURCE: US CENSUS BUREAU).

COUNTY	2000 POPULATION (No. of People)	2010 POPULATION (No. of People)	2000 POPULATION DENSITY (People per mi ²)	2010 POPULATION DENSITY (People per mi ²)
Aransas	22,497	23,158	89.3	91.9
Bee	32,359	31,861	36.8	36.2
Brooks	7,976	7,223	8.5	7.7
Duval	13,120	11,782	7.3	6.6
Jim Wells	39,326	40,838	45.5	47.2
Kenedy	414	416	0.3	0.3
Kleberg	31,549	32,061	36.2	36.4
Live Oak	12,309	11,531	11.9	11.1
McMullen	851	707	0.8	0.6
Nueces	313,645	340,223	375.3	405.8
Refugio	7,828	7,383	10.2	9.6
San Patricio	67,138	64,804	97.1	93.5
TOTAL:	549,012	571,987	AVERAGE: 59.9	AVERAGE: 62.2

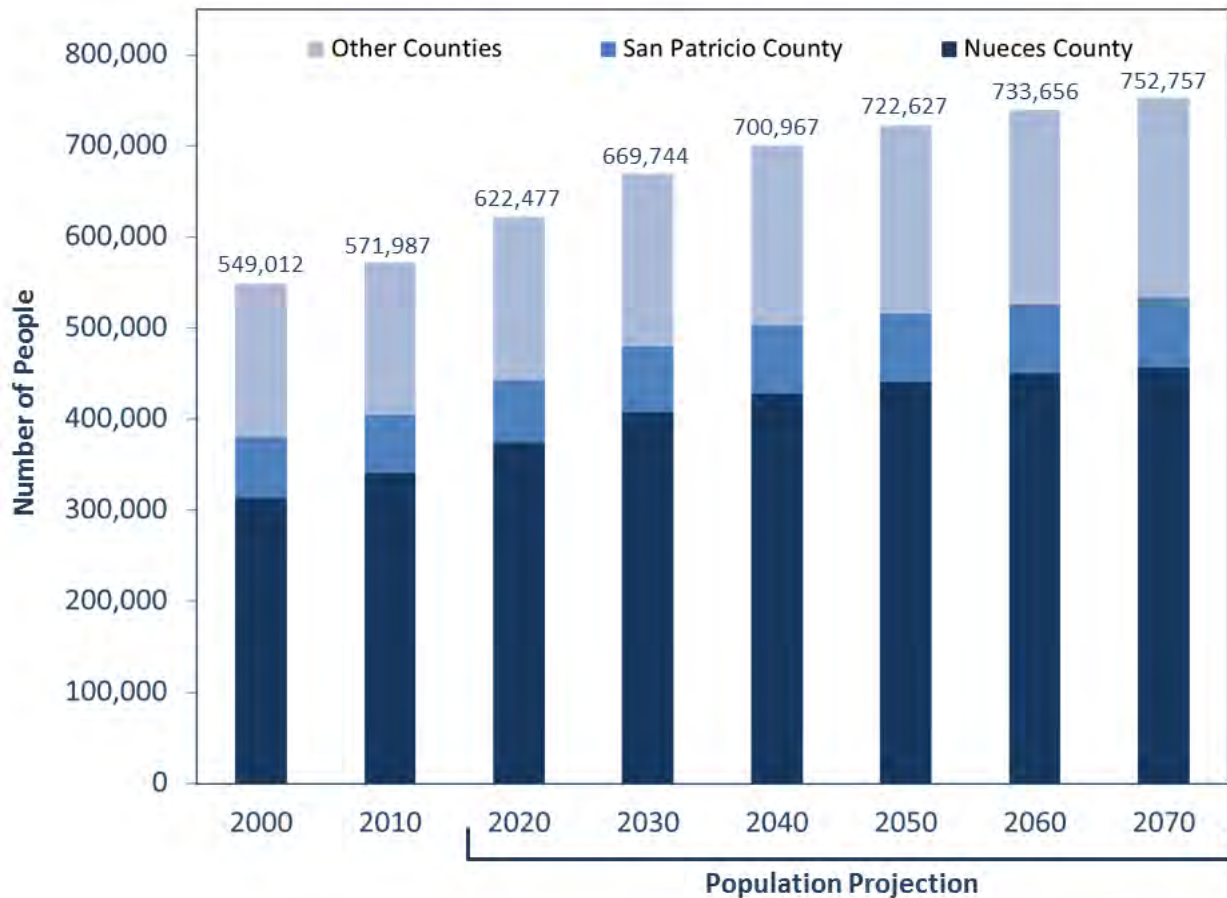


FIGURE 5. RECORDED POPULATION OF THE COASTAL BEND IN 2000 AND 2010 AND THE PROJECTED POPULATION THROUGH 2070. (SOURCE: US CENSUS BUREAU, TEXAS WATER DEVELOPMENT BOARD).

According to the Texas Water Development Board (TWDB), the Coastal Bend population is projected to increase by 32%, to 752,757 people by 2070 (Figure 5). The Corpus Christi Metropolitan Statistical Area is still projected to account for the majority (74%) of the total population in the Coastal Bend in the year 2070.

Population growth can be an underlying cause of ecosystem stress due to the expansion of housing, transportation, and other infrastructures needed to accommodate additional residents. Along with population growth, the CBBEP area will also experience a change in land use and water use, which could lead to an increase of pollutants released to the environment and depletion of natural resources.

Economy

American Communities Survey estimates show that the average per capita income for the 12-county program has increased substantially since 2000. In 2014, the average per capita income was \$21,884, ranging from \$14,353 in Brooks County to \$36,277 in McMullen County. This represents a substantial increase over the region’s average

per capita income of \$15,049 in 2000. In 2014, the total personal income in the Coastal Bend Region was nearly \$24.3 billion, representing an increase of \$12.1 billion over 2000 estimates. Much of the increase in per capita income during this time is attributable to increased oil and gas production and industrial growth activities. The Corpus Christi Metropolitan Statistical Area accounted for 77 percent of the total personal income in the region in 2014 (US DOC, 2016). Despite the growth in per capita income, many individuals living in the Coastal Bend region still measure below the national and state-wide average per capita income levels. As per capita income increased, the average poverty rate decreased from 22.4 percent of the population in 2000 to 19.1 percent in 2010. However, there was a slight increase again in 2014 to 21.6 percent. Poverty level estimates for the Coastal Bend are higher than national and state-wide values during all years.

The primary economic activities within the Coastal Bend Region include oil/gas production and refining, petrochemical manufacturing, military installations, retail and wholesale trade, agriculture, and service industries including education, health services, tourism/recreation industries, and governmental agencies. In 2012, these

industries employed over 180,000 people in the Coastal Bend Region with annual earnings over \$7 billion. The services sector had the biggest economic impact in 2012, with an economic contribution of \$3.3 billion, while employing 57% of the total workforce within the Region. Educational services, the largest economic service industry contributor, generated nearly \$1.3 billion in compensation to employees in 2012 (HDR, 2015).

Ocean-related Jobs

Ocean related jobs are a major factor in the economy of the Coastal Bend region. According to NOAA's Coastal County Ocean Jobs Snapshots for the six counties that contain open bay habitat (Aransas, Refugio, San Patricio, Nueces, Kenedy, and Kleberg), just over 29,000 people were employed in ocean-related jobs in 2013. These jobs generated close to \$1.2 billion in wages in the same year, and produced over \$2.9 billion in revenues from goods and services. The primary ocean-related jobs in these counties are tourism and recreation, offshore mineral extraction, and, to a much lesser extent, marine transportation (NOAA, 2016b).

Port of Corpus Christi

The presence of a deepwater port is of strategic economic importance to the Texas Coastal Bend. The Port of Corpus

Christi is the fifth largest U.S. port in total tonnage. Petroleum products make up the bulk of tonnage entering and exiting the Port. Ship and barge activity for the Port has increased over the last five years, and during 2015, dockings totaled 7,558 vessels (5,787 barges, 1,346 tankers, and 425 dry cargo ships) (PCCA Monthly Reports).

In 2015, the U.S. government repealed a 40-year ban on the export of crude oil and condensates to foreign countries. Since that time, the Port has passed its tipping point from being an importer to an exporter in cargo shipments (South Texas Economic Development Center, 2016).

In recent years, the Port of Corpus Christi Authority (PCCA) and South Texas have been faced with a period of fast-paced change, a dramatic shift in some cargo movements, and a wave of new industrial development opportunities. As these changes have occurred, the PCCA has developed strategies to meet these new challenges, giving top priority to supporting bulk cargo movements, which requires dredging and maintaining adequate deepwater channels and building and maintaining docks capable of handling large bulk carriers. Expansion in outbound traffic is expected to continue, beginning with exports of crude oil and condensates to foreign destinations. Exports of other commodities to Europe, South America, and Asia will also pick up when many of the areas newly developed

THE PORT OF CORPUS CHRISTI is a centerpiece in the Texas Coastal Bend's economy. (Photo by Port of Corpus Christi Authority)



industrial sites are complete. The PCCA is making strategic plans to expand its core operations by leveraging developments around the world, such as the expansion of the Panama Canal (South Texas Economic Development Center, 2016).

An economic impact study commissioned by the PCCA reported that the public and private marine cargo facilities at the Port generated 76,377 jobs in Texas and \$15.2 billion in total economic activity within the State in 2015. Over \$4.7 billion was generated in personal income, as well as \$353 million in tax revenue (Martin Associates, 2016).

Commercial Fishing

Commercial fishing exerts an effect upon the economies of the local region where these activities occur and upon the entire state. According to a 2015 Texas Parks and Wildlife Department report, landings of finfish and shellfish in the Texas Coastal Bend bays and estuaries totaled 77,470,015 pounds between 1994 and 2012. The ex-vessel value of this catch was just over \$114 million (Bohannon et al., 2015). The Aransas Bay System showed the largest landings for shrimp, blue crab, and oysters, while the Upper Laguna Madre System had the largest landings of finfish. Average yearly landings from 1994-2012 were just over 1.9 million pounds for the Aransas Bay System, amounting to an average yearly ex-vessel value of \$3.3 million. In the Upper Laguna Madre System, average yearly landings were slightly lower for the same time period at just over 1.3 million pounds, with an ex-vessel value of \$1.2 million. Finally, in Corpus Christi Bay System, average yearly landings totaled 831,853 pounds with an ex-vessel value of \$1.4 million (Bohannon et al., 2015).

The Texas Parks & Wildlife Department administers commercial fishing license buyback programs for the inshore shrimp, crab, and finfish fisheries. The goal of

the buyback programs are to stabilize fishing effort and support healthy fisheries stock. The Texas inshore shrimp fishery limited entry and buyback program was established in 1995, followed by the crab and finfish programs in 1998 and 2000, respectively. Through the 2014 license year, \$14.2 million has been spent to purchase and retire 2,145 commercial bay and/or bait shrimp boat licenses. This represents 66% of the original 3,231 licenses grandfathered into the fishery in 1995. Additionally, \$1.8 million has been spent purchasing 63 commercial crab fisherman's licenses and 241 commercial finfish fisherman's licenses, retiring 22% and 44% of the licenses respectively. The State also has a moratorium on oyster boat and Gulf shrimp licenses, meaning no new licenses are being issued for these fisheries (TPWD, 2017). In 2017, the State of Texas passed legislation to initiate an oyster license buyback program, in addition to the moratorium.

Recreation and Tourism

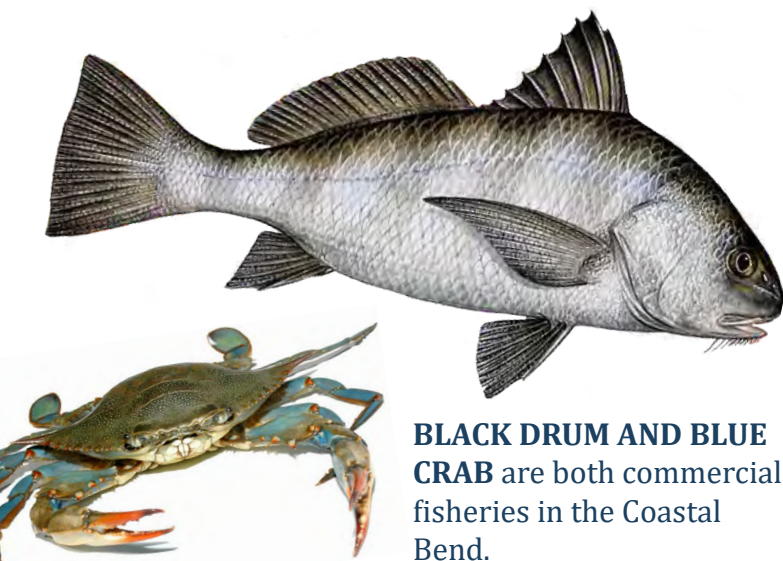
Recreational fishing, tourism, and other recreational activities are also big business in the Texas Coastal Bend. Corpus Christi is the sixth most popular tourist destination in Texas. A growing share of tourist activities in Corpus Christi are related to nature and wildlife, particularly beach strolling, bird-watching, and hunting and fishing. The area's 113 miles of beaches and waterfront are above all the most popular destinations in Corpus Christi.

Continuously recognized as "America's Birdiest City," Corpus Christi is also part of TPWD's Great Texas Coastal Birding Trail, which starts near Matagorda Bay in the north and continues south to Kingsville. The Hummer Bird Festival in Rockport and the Celebration of the Whopping Cranes in Port Aransas are some of the most popular events in Texas for birdwatchers. The Texas SandFest in Port Aransas is also one of the largest sand sculpture festivals in Texas, and the area is also home to the Aransas National Wildlife Refuge.

Nature tourism now accounts for 47 percent of all visitor-trips. Annual destination spending by nature-oriented visitors is estimated at \$674 million for 2012-13, which represents over 50 percent of overall visitor spending. The total economic impact of nature tourism, including both direct and secondary effects, is estimated at \$987 million in business revenues, \$549 million in value-added activity and 12,914 jobs. (Lee, 2014).

Ecosystem Services

Ecosystem services are the benefits provided by nature, which contribute to human well-being. These benefits can range from tangible products such as food and fresh water



BLACK DRUM AND BLUE CRAB are both commercial fisheries in the Coastal Bend.

to cultural services such as recreation and aesthetics. These benefits also include such services such as pollination, disturbance regulation, and soil and sediment balance. Several studies have focused on evaluating ecosystem services at the state and local level.

GecoView

In 2015, Scientists with the Harte Research Institute (HRI) at Texas A&M University-Corpus Christi (TAMUCC) developed a new online tool, called GecoView, that shares the value we place on the ecosystem services provided by three key habitats in the Gulf of Mexico (Table 2). The goal of the tool is to provide information about how much people in each state would be willing to pay, if at all, for the conservation of Gulf habitats. This willingness-to-pay concept is a standard approach to measuring economic value for non-market benefits, and in this study, passive-use services. Passive use values are not associated with any direct use of the ecosystem, so estimating these values requires using a technique that asks people to state their preferences. Online surveys were used to determine how much Gulf residents value salt marsh, mangroves,

and oyster reefs. Using the survey results, the team was able to develop an annual dollar value for the passive-use services (e.g., water quality, aesthetics, and spiritual and historic use) that salt marshes, mangroves and oyster reefs provide. The team also used existing data to calculate the values of other services, including storm protection, recreation, and carbon sequestration.

Ecosystem-Based Management Plan

Work has also evaluated the ecosystem services provided by key habitats at the local scale. Funding from the CBBEP was used to develop an Ecosystem-Based Management Plan (EBMP) that used ecosystem services to direct habitat preservation, creation, and/or restoration activities in the Corpus Christi/Nueces Bay area and facilitate the application of fiscal opportunities and resources associated with coastal development, impact restitution, supplemental environmental, and community service projects and grants. The EBMP focused on Nueces and Corpus Christi bays, but the planning area did also include the Upper Laguna Madre, Redfish Bay, and the southern portion of Aransas Bay (Montagna et al., 2011).

TABLE 2. ECOSYSTEM SERVICE VALUES ASSOCIATED WITH KEY ESTUARINE HABITATS. VALUES ARE FOR THE ENTIRE TEXAS COAST. (SOURCE: GECOVIEW.ORG)

ECOSYSTEM SERVICE	SALTWATER MARSH	MANGROVE	OYSTER REEF
PASSIVE USE VALUES *			
General Population	\$268.2 million per year (\$30.2 per household per year)	\$119.5 million per year (\$13 per household per year)	\$132 million per year (\$15 per household per year)
Recreationists	\$139.6 million per year (\$35.7 per household per year)	\$71.9 million per year (\$18.4 per household per year)	\$54.7 million per year (\$14 per household per year)
Coastal Population	\$56.7 million per year (\$31.9 per household per year)	\$43.4 million per year (\$24.4 per household per year)	\$47.8 million per year (\$26.9 per household per year)
Off-coastal Population	\$200 million per year (\$28.1 per household per year)	\$41.9 million per year (\$5.9 per household per year)	\$46.9 million per year (\$6.6 per household per year)
STORM PROTECTION			
	\$171.5 million per year	n/a	n/a
RECREATION			
	\$411,225 per year	n/a	n/a
CARBON SEQUESTRATION			
	\$34.2 million per year \$200 per hectare per year	\$467,184 million per year \$384 per hectare per year	n/a
FOOD			
	n/a	n/a	\$23.5 million per year
RAW MATERIAL			
	n/a	n/a	\$93,095 per year

*Examples of "Passive Use Values" include water quality, aesthetics, and spiritual and historic value. Dollar values are based on annual willingness-to-pay (W.T.P.) for conservation of habitat (10% of total area).

During the development of the EBMP, stakeholder input was used to determine the ecosystem services provided by habitats within the study area and to obtain ecosystem services valuation data. The number of ecosystem services provided by habitats was determined based on results of the stakeholder surveys. For each habitat, a value for total number of ecosystem services provided was calculated per habitat. Freshwater and salt marsh wetland habitats ranked highly, as they were perceived to provide the most ecosystem services to stakeholders. Rookery island habitat was ranked the lowest of all habitats assessed. Average number of ecosystem services per habitat was used to create a heat map of ecosystem services within the study area. Dark blue represents lowest average number of ecosystem services and dark red represents highest average number of ecosystem services. Thus, dark red signifies “hot” areas on the “heat map” (Figure 6; Montagna et al., 2011).

Social Values of Ecosystem Services

Additional research on ecosystem services was performed at the local scale by the National Centers for Coastal Ocean Science (NCCOS). They partnered with the Mission-Aransas National Estuarine Research Reserve (MANERR) to

examine the relationship between the social valuation of ecosystem services and land use/land cover in the Mission-Aransas Estuary watershed, paying particular attention to the spatial and geographic assessment of the relationship to underlying environmental characteristics (Loerzel et al., 2015).

The study explored the spatial quantification of social values of ecosystem services and their relationship to underlying environmental characteristics. Data was collected using three methods: an online, interactive mapping survey delivered to users intercepted on site; randomly selected residents using mail back surveys; and, snowball sampling of interested environmentally oriented stakeholder groups. All groups were offered a paper-based survey instrument as well. The data were analyzed using a geographic information system tool called Social Values of Ecosystem Services (SoLVES). The SoLVES model was used to analyze spatially explicit social value data and supplementary use perception data and their connection with underlying environmental characteristics. This process results in the production of landscape metrics that describe the respective relationships across a given landscape (Loerzel et al., 2015).

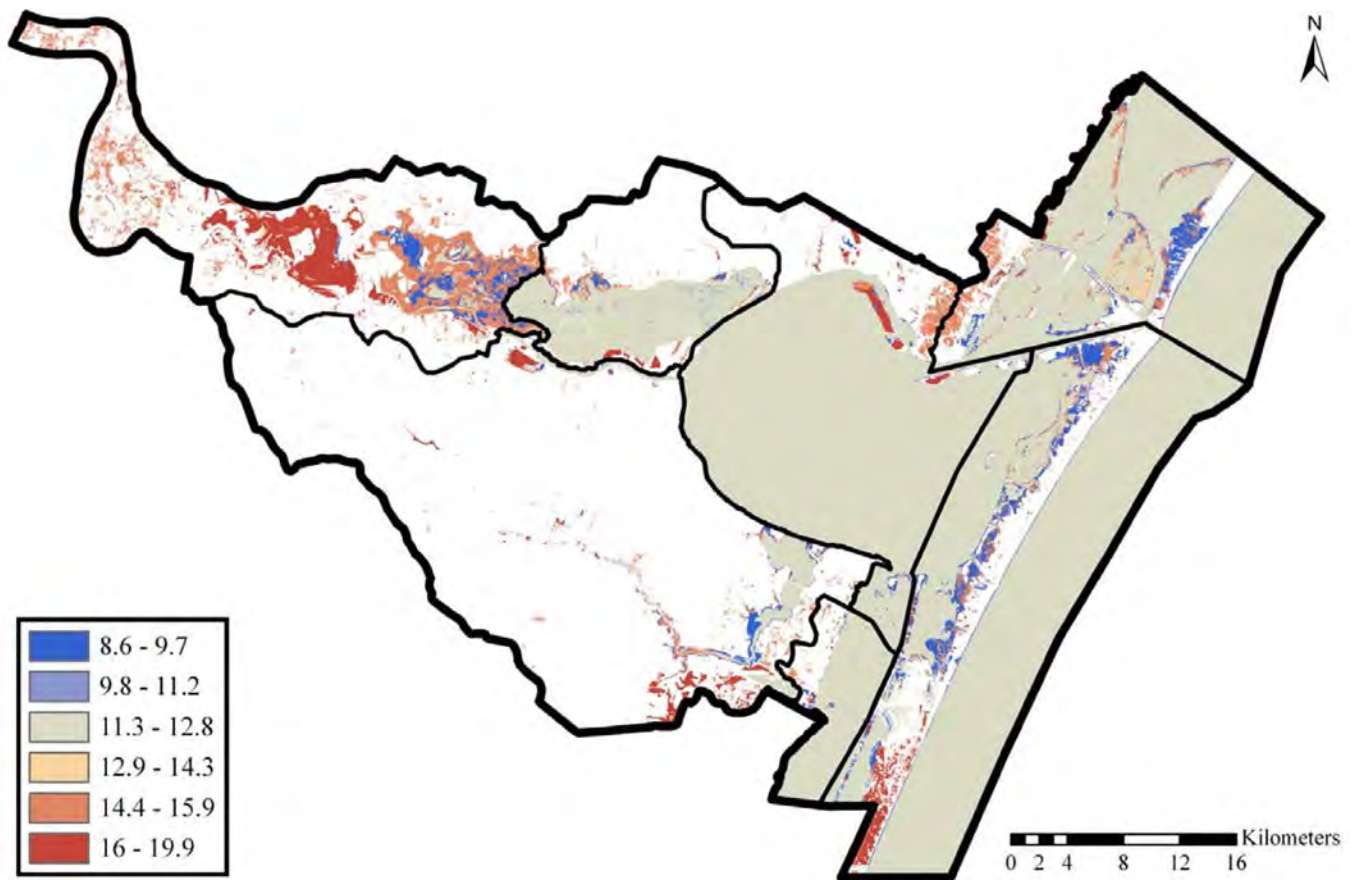


FIGURE 6. HEAT MAP SHOWING AVERAGE NUMBER OF ECOSYSTEM SERVICES PROVIDED BY HABITATS IN EBMP STUDY AREA. (SOURCE: MONTAGNA ET AL., 2011)



CHAPTER

2

Status and Trends

CONTENTS

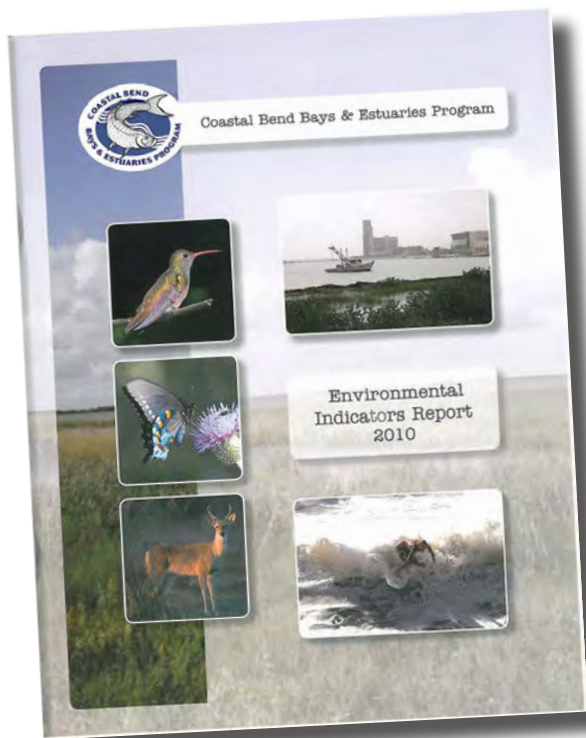
Environmental Indicators

Climate Change Vulnerability Assessment

Environmental Indicators

The CBBEP utilizes monitoring data from partners to track environmental variables and determine status and trends of important indicators (e.g., number of impaired water bodies) on a periodic basis. These types of reports bring together data collected by researchers from the academic and agency communities as it applies to understanding the environmental dynamics of the Coastal Bend bays and estuaries. These data sources are considered useful for measuring the effectiveness of management actions/ programs and for tracking progress towards environmental goals and objectives.

In 2010, CBBEP released an “[Environmental Indicators Report](#),” which provided citizens of the Coastal Bend with important information about the health of the bays and estuaries and presented data on observed trends. The results were also useful for determining the success of the 1998 Bays Plan implementation progress and for evaluating and modifying the actions outlined in the Bays Plan revision. A summary of the major results of that report are provided in the following pages. Results have been updated with recent data wherever possible.



MONITORING DATA is used by the CBBEP to track the effectiveness of management actions and for evaluating progress towards environmental goals. (Photo by Mission-Aransas NERR)

CATCH RATES FOR BLUE CRABS have been decreasing in the Coastal Bend. (Photo by Dr. Elizabeth Smith)



Q: Is it safe for people to come into contact with bay water?

A: Generally yes, but not all the time.

Fecal Bacteria
Good Under the Texas Beach Watch Program, many of our area’s public beaches are monitored for bacteria. The beaches are generally safe for swimming. One exception is after a storm event when rain water washes pollutants into bay waters.

Vibrio bacteria
Good *Vibrio vulnificus* infections have been reported along the Gulf Coast for many years. With proper precautions, such as limiting exposure with open cuts, the risk of infection is low in healthy individuals.

Q: Is it safe to eat seafood caught in area bays?

A: Generally yes, but not in all areas.

Seafood Tissue
Good Overall levels of fish tissue contamination in the Coastal Bend region are relatively low and consumption of fish is safe as long as consumption rates of fish follow the Texas Department of State Health Services guidelines.

Seafood Consumption Advisories
Good All sport fishes (i.e., spotted seatrout, red drum, and Atlantic croaker) are safe to eat. However, there is one fish-consumption advisory for the Coastal Bend area specifically for Gulf species - the statewide king mackerel advisory due to mercury contamination.

Shellfish Harvesting Areas
Improvement Needed Several areas within the Coastal Bend are classified as restricted for shellfish harvesting by TDSHS based on risk levels associated with fecal pollution, contaminants, and human pathogens. The areas closed to shellfish harvesting include all of Nueces Bay, Redfish Bay, Mission Bay, and Port Bay and portions of San Antonio Bay, Aransas Bay, Copano Bay, Corpus Christi Bay, and Upper Laguna Madre.

Q: Are water and sediment quality improving or degrading?

A: There are some areas within the Coastal Bend that do not meet TCEQ Water Quality Standards.

Water Quality Standards
Good Although there are a few areas of low dissolved oxygen (<2.0 mg/L) and a few contaminants are above screening levels in certain areas of the Coastal Bend area, the bays and estuaries are considered fairly clean.

Impaired Segments
Improvement Needed Within the Coastal Bend, TCEQ listed 22 segments (15 rivers and creeks, 1 lake, and 6 bays) for ‘primary concerns’ on the 2014 published 303(d) list. Most segments are listed due to high bacteria levels.

Harmful Algal Blooms
Improvement Needed In the 1990’s, Baffin Bay was plagued by one of the longest algal blooms ever recorded, and sporadic blooms of brown tide have been documented in the Laguna Madre since that time. Red tide blooms occur in the Coastal Bend during the later summer/fall months. Most recently, a red tide bloom was observed in Corpus Christi Bay and the Upper Laguna Madre during the fall of 2016. Reports of discolored water, respiratory irritation, and fish kills were associated with the bloom.

Nutrients
Good Some nutrient levels exceeded the TCEQ screening values in the Texas Coastal Bend region. There was one ammonia exceedance level in Baffin Bay that warranted little concern. Nueces Bay and the Copano Bay each had exceedances of orthophosphorus. Chlorophyll a, which is used as an indicator tool for nutrients, was found to be high in Copano, Nueces, Oso, and Baffin bays.

Q: Are fish and wildlife populations stable, increasing, or decreasing?

A: Varies by species.

**Recreational
Important Species**
Good

Coastal Bend populations of spotted seatrout and red drum have an upward trend due to management of the fisheries by TPWD starting in the 1980's. Flounder populations have stabilized since TPWD implemented management changes in 1995.

**Ecologically
Important Species**
Good

Atlantic croaker abundance in Texas bays has almost doubled since 1994, and 2007 marked a record high catch in TPWD bay trawls. Similarly, TPWD bay trawls show a slight increase for bay anchovies over the same time period.

**Commercially
Important Species**
Improvement Needed

TPWD bay trawl catches for brown shrimp appear to be stable for the Corpus Christi Bay and the Upper Laguna Madre, but results for Aransas Bay show slight declines in recent decades. Catch rates for blue crabs have been declining since 1982, but there is an indication of some stabilization following 1998. However, only 3.1 million pounds were landed in 2005, an amount well below the historic average of 6.3 million.

**Colonial Nesting
Waterbirds**
Improvement Needed

Analysis of the Texas Colonial Waterbird Survey data from 1973-2000 show that 7 of the 14 bird species in the Coastal Bend showed significant decreases (Great Blue Heron, Tricolored Heron, Reddish Egret, Snowy Egret, Black-crowned Night Heron, Black Skimmer, Gull-billed Tern), while two showed significant increases (American White Pelican, Brown Pelican).

Q: Are habitats for fish and wildlife increasing or decreasing?

A: Varies by habitat type.

Seagrass
Good

According to reports published in 2006 and 2008 by The Bureau of Economic Geology, seagrass communities are increasing in the Coastal Bend. The geographic area with the largest increase in seagrasses is Corpus Christi Bay, while other areas experiencing an increase in seagrasses include Lamar Peninsula, Live Oak Peninsula, Port Bay, and Oso Bay.

Saltwater Marsh
Good

According to reports published in 2006 and 2008 by The Bureau of Economic Geology, salt marshes in the Coastal Bend are increasing due to relative sea level rise, where estuarine marsh spread into areas previously occupied by tidal flats.

Freshwater Marsh
Good

According to a 2008 report by The Bureau of Economic Geology, there has been a 20% decrease in the extent of freshwater marshes within the Coastal Bend between the 1950's and 2004. Construction of drainage ditches, in addition to a long term drought, may account for this loss, as well as an increase in sea level and landward movement of the salt/freshwater boundary. A 2006 report showed similar results for the barrier island complex with a decrease in acreage from 1979 to 2004. On the barrier islands, palustrine marshes are decreasing due to island development, agricultural practices, and drier conditions.

Rookery Islands
Improvement Needed

Approximately 185 rookery islands exist within the Coastal Bend region that have at some time in the last 30 years been used by nesting waterbirds. From 2000-2010, one island (New Island in Nueces Bay) was created, and a few such as Pelican Island (Corpus Christi Bay) have received dredge deposits and a breakwater to provide erosion protection. Most other rookery islands have been eroding away at varying rates. Some have lost functionality as rookeries, most likely due to recreational activities and human disturbance, especially in Redfish Bay.

Q: Are freshwater inflows adequate to maintain a healthy bay system?

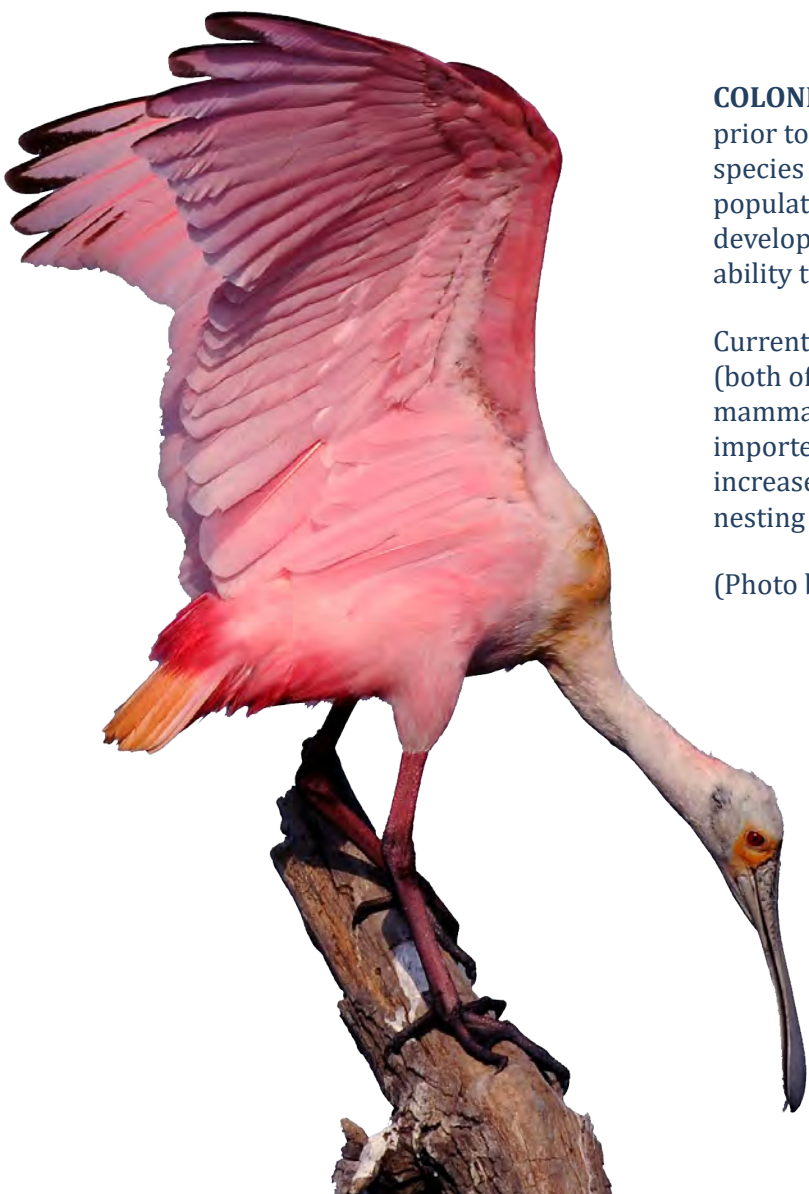
A: Maybe, additional studies and information are needed.

Quantity and Timing of Freshwater Inflows
Good

Freshwater inflows to Nueces Bay are regulated by 'pass through' targets that require a certain amount of freshwater flow into the Nueces River each month from the Choke Canyon and Lake Corpus Christi Reservoirs. Since the pass through targets were established, new information is available on how the reservoir system works and how the pass-throughs effect the quantities of water reaching the bay. Scientists now postulate that seasonal pulses could be more beneficial and critical for the biota than the strictly-defined monthly inflows currently in place. Efforts are underway to determine if their might be opportunities to modify the pass through targets and better manage (e.g., SMART Inflow) the limited freshwater resources reaching the Nueces Estuary

Bay Salinity Levels
Improvement Needed

The Conrad Blucher Institute's Division of Nearshore Research at Texas A&M University-Corpus Christi maintains salinity monitoring stations within the Corpus Christi Bay system and posts a salinity relief check page that is updated daily. Salinity ranges vary for the Corpus Christi Bay system depending on proximity to the river and season, but in general, salinities can be between 1 to 30 ppt. In 2008, average salinity was around 28 ppt in Nueces Bay, compared to an average salinity of 39 ppt in 2009.



COLONIAL WATERBIRD POPULATIONS were decimated prior to the early 1900's, mainly for the plume trade. Some species suffered nearly to the point of extinction. Since then, populations have been struggling to rebound. Further coastal development and other human impacts have limited their ability to recover to pre-settlement abundance.

Current challenges to waterbird recovery include habitat loss (both of nesting and feeding areas), proliferation of predatory mammals such as raccoons and coyotes, spread of the imported red fire ant, invasion of non-native trees and shrubs, increased human disturbance, pollution, scarcity of adequate nesting substrate, erosion and subsidence.

(Photo by Wendy McSwain)



Climate Change Vulnerability Assessment

A growing body of knowledge shows that climate change poses major threats to our nation's estuaries. Predictions of climate change suggest that sea level rise, storm intensity and surge, drought, rainfall and hydrology, and acidification will be impacting our coastal zones during this century. With all these possibilities for the future, conserving and maintaining the valuable biodiversity and communities in the Coastal Bend area is more crucial than ever. The failure in designing and implementing effective avoidance, mitigation, minimization, and adaptation strategies will result in large costs for addressing the climate change problem to the citizens of the Coastal Bend (Murdock and Brenner, 2016).

Climate change is expected to intensify the historical pattern of variable and extreme climate in Texas. The Texas coast is likely to experience severe climate change impacts due to a combination of factors including the regional climate regime and coastal geology. Specifically within the Coastal Bend, there will most likely be alterations in freshwater inflows from rivers, changes in estuarine ecosystem structure and function, more frequent and longer-lasting droughts, increased salinity within some coastal ecosystems, saltwater intrusion, changes in habitat extent due to continued sea level rise, further reductions in some estuarine dependent species and range expansions of other species.

The Texas Coastal Bend area is already experiencing the effects of some of the stressors of climate change. In recent years the establishment of biota more characteristic of tropical habits has been observed, with range expansions of red and black mangrove, mangrove snapper, snook, and other species (i.e., Montagna, 2011). In addition, more droughts and hypersaline conditions have been observed, indicating that the region is experiencing more intense rainfall events with longer, dry periods in between (Evans et al, 2012).

In 2016, using funding from the EPA Climate Ready Estuaries Program, the CBBEP collaborated with The Nature Conservancy to complete the Texas Coastal Bend Regional Climate Change Vulnerability Assessment (CCVA). The CCVA identified potential changes caused by a changing climate and environment in the Coastal Bend area and assessed how current changes in climate stability could have future effects on sea level, storms, hydrology, geomorphology, natural habitats and species, land use, economy, human health, infrastructure, and cultural resources. It also used future scenarios of climate to identify the impacts and vulnerabilities of the different sectors that represent relevant coastal environments and communities in the study area. Stakeholders of the Coastal Bend area provided input at a workshop regarding aspects that they considered relevant about their vulnerabilities and opportunities for building resiliency. The study concluded with a series of recommendations for reducing vulnerabilities and promoting natural and community resiliency.

◀ **LONGER DRY SEASONS** will put more pressure on water sources and less water will flow into coastal bays and estuaries.

CLIMATE CHANGE EXPOSURE



Air Temperature

Observed Changes



Since 1948 air temperature has averaged 72.1° F (22.3° C) annually in the Coastal Bend, with an increasing trend of 0.01 °F (0.006° C) per year (1948-2014). However, when focused on only the past 30 years (1984-2014), the trend increases 600% to 0.05° F (0.03° C) per year. In addition, the number of days over 90° F (32° C) per year has steadily increased over the past century with less than 10 days per year in the 1890's to 127 days in 2014.

Predicted Changes



An annual increase in air temperature of 0.05° F (0.03° C) from 2014 would lead to an increase of 4.64° F (2.58° C) by 2100. Moreover, the American Climate Prospectus projects that by the end of the century, under an intermediate greenhouse gas emission scenario, there will be over 100 days per year that are 95° F (35° C) or hotter in Texas (a ~150% increase). Since this projection is for the entire state, we can assume that the hotter regions of the state will see even more extreme heat days.



Coastal Water Temperature

Observed Changes



Literature was reviewed to assess long-term trends in water temperature. Lluch-Cote et al. (2013) analyzed sea surface temperature datasets from NOAA's National Climatic Data Center in waters surrounding Mexico from 1910 to 2011. They found that the western Gulf of Mexico has been warming for more than three decades.

Predicted Changes



Sea surface temperature is likely to continue increasing in the Gulf of Mexico due to increasing surface air temperatures. The high scenario projects up to a 3.6° F (2.0° C) increase in the top 100 meters of ocean water by 2100 (IPCC, 2013a).



Water Chemistry

Observed Changes



The ocean absorbs atmospheric CO₂ causing the pH to decrease and carbonate concentrations to decrease. Hu et al. (2015) investigated estuarine carbonate chemistry by utilizing a long-term dataset provided by the TCEQ. They found that most of the bays in the CBBEP area are suffering from long-term acidification and decreasing alkalinity. With both water parameters decreasing, it will become increasingly more energy intensive for calcifying marine organisms (shellfish, corals, plankton, echinoderms) to maintain skeletons.

Predicted Changes



By 2100, global-mean surface pH may decrease by 0.145 to 0.31 for low to high emission scenarios, respectively (IPCC, 2013a). Currently global pH is around 8.1 so a decrease of 0.31 (pH = 7.8) corresponds to a 100% increase in acidity.



Rainfall

Observed Changes



Rainfall in the central Texas coast has been highly variable with the highest amount of rainfall occurring in 1991 (35.7 cm/14.1 in) and the lowest in 1917 (13.6 cm/5.4 in). Areas of the Coastal Bend have been in “abnormally dry” to “drought” conditions over the past 12 years. Due to high variability, there is not a perceptible trend in precipitation in the area. For instance, when comparing the last century with the past half century, opposite linear trends are observed.

Predicted Changes



IPCC scenarios project relatively little change in precipitation for the Coastal Bend area. The Coastal Bend area may see a 10% decline in precipitation by 2100 based on a low emissions scenario (IPCC, 2013b) but could see up to 20% decrease in all seasons except Fall under a higher emissions scenario (Shafer et al., 2014). Total precipitation may change very little, but the change in delivery may be more important. By 2100, the number of consecutive dry days is projected to increase by 2 (lower emission scenario) to 3 (higher emission scenario) days (Shafer et al., 2014).



Sea Level

Observed Changes



Since 1900, global mean sea level has been increasing at a rate of 1.7 mm/yr (0.07 in/yr) (Church and White 2011). However, local estimates for the Coastal Bend region suggest a higher rate of 3 - 6 mm/yr (0.12 - 0.24 in/yr). For example, in Rockport (Aransas County), mean sea level has been rising at 5.33 mm/yr (0.21 in/yr) according to a long-term tide gauge.

Predicted Changes



The lowest sea level rise scenario is a linear extrapolation of the current mean sea level rate for the Coastal Bend area, 4.385 mm/yr (0.17 in/yr). Under the low scenario, mean sea level will increase by 0.5 m relative to 1992. The intermediate scenario takes into consideration the impacts of ocean warming which increases sea level by thermal expansion of water molecules and yields a 1.2 m increase in mean sea level by 2100. The highest scenario represents the possible acceleration of sea level rise caused by ocean warming and ice sheet loss, resulting in a 2 m sea level rise by 2100.



Storm Severity and Intensity

Observed Changes



The past decade has resulted in significantly higher numbers of extreme storm events (i.e., thunderstorms, winter storms, hurricanes), but it is unclear if this trend will continue as temperatures increase (Walsh et al., 2014). There has also been an increasing trend in tropical storm severity and power dissipation index, a measure that combines intensity, lifetime, and frequency of storms in a season (Biasutti et al., 2011; Geophysical Fluid Dynamics Laboratory, 2015). The occurrence rate of Atlantic hurricanes has slightly increased in the past three decades with 0.13 hurricanes per year.

Predicted Changes



Some studies suggest that thunderstorms are likely to increase due to increased surface temperatures which result in the increased ability of the atmosphere to hold water, as well as, increasing evaporation rates (Trapp et al. 2007; Diffenbaugh et al. 2013). The existing knowledge that hurricanes are only likely to form in areas of relatively high sea surface temperature, has created the causal relationship between increasing sea surface temperature by global warming and increasing hurricane formation. While the relationship is not scientifically proven, it should draw some concern.

CLIMATE CHANGE SPOTLIGHT: RELATIVE SEA LEVEL RISE

Global mean sea level has been rising at a rate of 1.7 mm/yr (0.07 in/yr) since 1900 (Church and White 2011), but local trends in the Coastal Bend suggest a higher rate of 3 - 6 mm/yr (0.12 - 0.24 in/yr). The mean sea level trend is 5.53 mm/yr (0.21 in/yr) with a 95% confidence interval of +/- 0.55 mm/yr (0.02 in/yr) based on monthly mean sea level data from 1948 to 2013 at the Rockport Tide Station (Figure 7). Sea level rise impacts in the Coastal Bend are exacerbated due to the low lying coastal plains and high rates of subsidence. The rate at which sea level rise occurs will determine the ability of coastal ecosystems and communities to adapt to the change. Coastal habitats such as salt marshes may be able to migrate landward as sea level rise occurs. However, coastal habitats that are backed by development or inhospitable habitat are at risk of being lost (Murdock and Brenner, 2016). Additionally, the rate of mean sea level rise is projected to increase compared to the current rate, resulting in a mean sea level that is up to 2 meters (6.6 ft) above 1992 levels by 2100 (Parris et al. 2012), which will only exacerbate these issues.

The Sea Level Affecting Marshes Model (SLAMM) is used to compute the impacts of local sea level rise on coastal wetlands. The model incorporates aspects that may influence sea level rise inundation, such as erosion/accretion, subsidence, and barriers that may protect areas against sea level rise. The SLAMM outputs in Figure 8 were obtained from the Gulf-wide SLAMM project completed by Warren Pinnacle Consulting (Warren Pinnacle Consulting, 2015).

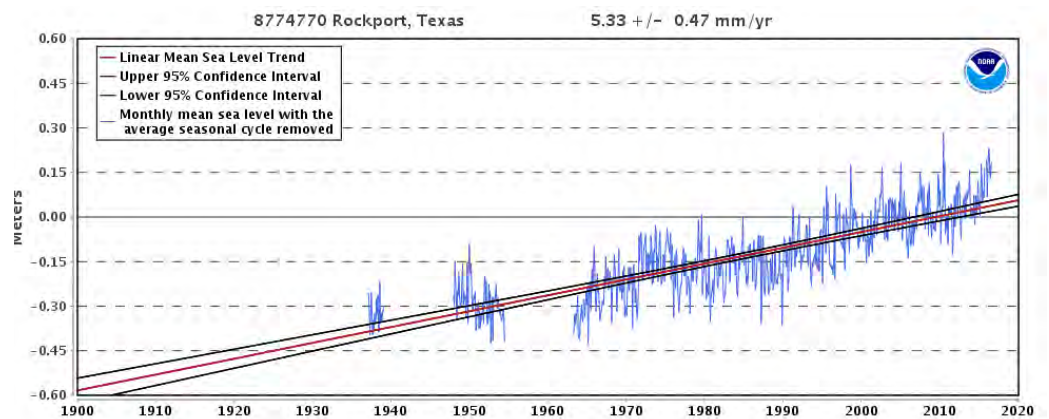


FIGURE 7. MEAN SEA LEVEL TREND FROM 1937 TO 2016 AT NOAA STATION 8774770 IN ROCKPORT, TEXAS. (SOURCE: NOAA TIDE AND CURRENTS)

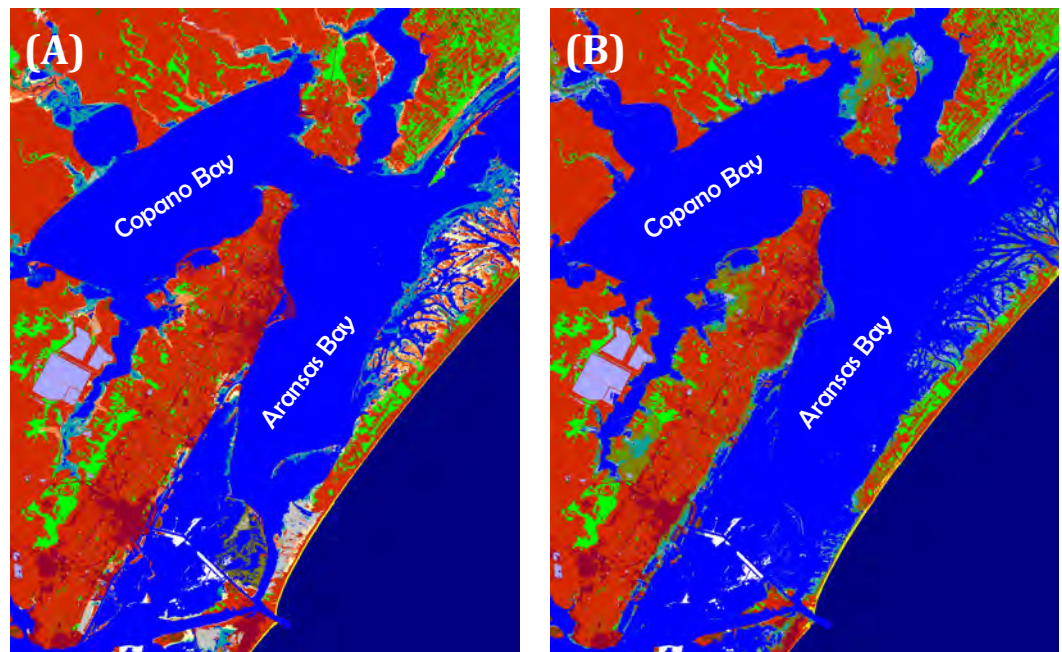


FIGURE 8. SLAMM RESULTS SHOW THE IMPACT OF LOCAL SEA LEVEL RISE ON COASTAL HABITATS. FIGURE (A) SHOWS THE INITIAL CONDITION AND (B) SHOWS THE YEAR 2100 UNDER A SEA LEVEL RISE SCENARIO OF 1.5 METERS.

CLIMATE CHANGE IMPACTS BY SECTOR

Human Health

Climate change impacts threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. The severity of these health risks will depend on the ability of health and safety systems to address these changing threats, as well as factors such as an individual's behavior, age, gender, and economic status. Impacts will depend on where a person lives, how sensitive they are to health threats, how much they are exposed to climate change impacts, and how well their community is able to adapt to change.

1. The direct stress from higher temperatures will increase the risk of heat-related illnesses (heat cramps, heat exhaustion, and heatstroke) and mortality - age, health status, income, and land cover affect the vulnerability of individuals to heat-related illness. Farmers, construction workers, fisherman, and outdoor enthusiasts are all examples of people that may have to take special precautions in the future as temperatures rise.
2. The counties of the Coastal Bend region are at risk for water shortages due to climate change. On a scale ranging from extreme to low risk, all counties in the region are considered high-risk, except San Patricio and Kleberg counties, which are considered to be at extreme risk.
3. As sea level rises, saltwater invades freshwater areas in the Coastal Bend, threatening surface and groundwater supplies.
4. The presence of waterborne diseases is positively correlated with temperature and certain foodborne pathogens (*Vibrio*, *E.coli*, *Salmonella*) are also positively correlated with temperature.
5. Heavy precipitation deteriorates surface water quality as runoff contains pesticides, fertilizers, and animal waste and has been linked to outbreaks of waterborne diseases.
6. Since warm water holds less dissolved oxygen, warmer waters are likely to decrease water quality.
7. More intense precipitation events will lead to increased runoff, increasing delivery of sediments, nutrients, pesticides, herbicides, animal waste, pathogens, and other pollutants to surface waters.
8. Drought conditions combined with warmer temperatures concentrate particulates in water bodies as water is removed from the system by natural processes and higher evaporation rates
9. If storm surge is able to reach waste facilities or floods sewage systems, surface waters could be contaminated with untreated human, industrial, and commercial waste
10. As temperatures increase, detrimental effects of ground-level ozone will likely increase - ozone effects human health by decreasing lung function and inflaming lung tissue.
11. More frequent droughts will increase the likelihood of wildfires that deposit particulate matter into the air in the form of smoke and debris. Drought conditions will also increase the availability of dry soils to be swept into the air column as dust.
12. Increased temperatures are likely to cause an earlier onset of pollen season and potentially increase the length of the season due to a longer growing season.

Water Resources

In Texas, water regulation is split up into five classes: surface water, ground water, water quality, drinking water, and interstate waters. Water resources are managed by a number of agencies in accordance to State and Regional planning documents that are approved by the Texas Water Development Board (TWDB). While regional water plans are guided by the principals of protecting water as a natural resource, they fail to incorporate future climate change impacts that affect water supply.

1. The majority of the Coastal Bend region relies on surface water, and higher temperatures could reduce surface water supplies through higher evaporation rates.
2. Due to the threat of saltwater intrusion, many smaller communities and user groups in the Coastal Bend that are largely dependent upon groundwater from the Gulf Coast Aquifer (Kenedy County, Refugio County; mining, livestock, and irrigation user groups), should consider alternative water supplies.

Wildlife and Ecosystems

The fate of coastal habitats is strongly dependent on climate change variables and anthropogenic stressors. Changes in the underlying habitat on which species depend, will ultimately change the distribution, survival, and community structure of species.

1. The increase in frequency of extreme weather events (heat stress, hurricanes, floods, wildfire) may lead to a loss of a habitat because species do not have enough time to recover between traumatic events.
2. The shift to warmer temperatures may decrease the viability of species by disrupting their growing cycle.
3. Projections of marsh movement and viability under a 2.0 meter (6.6 feet) SLR scenario show that Aransas and Refugio counties have the lowest marsh viability in the Coastal Bend area with an overall net loss of marsh, while Kenedy County has the highest marsh viability.
4. As air temperatures increase and the chance of frost decreases, frost-intolerant species, such as mangroves, will be able to become established in more areas, eventually yielding a mangrove-dominant community.
5. Sea level rise threatens current seagrass extent as light attenuates with depth and seagrasses require light to survive.
6. Reduced freshwater inflows will increase the salinity of coastal waters, and some species that are adapted to particular salinities may be threatened by prolonged exposure to higher salinities.
7. Changes in salinity regimes may allow diseases, predators, and other competitors to spread to areas that were once not suitable, threatening native wildlife (e.g., oysters).
8. Ocean acidification will make it more difficult for oysters and other calcifying organisms to thrive.
9. Increasing air and water temperatures may remove environmental constraints on some tropical or sub-tropical invasive species, leading to native species displacement in the Coastal Bend area.
10. Temperature changes are likely to change the timing of reproduction, migration, and growth of many bird species, ultimately affecting survival.
11. Based on the intermediate sea level rise scenario, 135 colonial waterbird rookery islands will be submerged by 2100 or almost half (47%) of the rookery islands currently present in the area - erosional forces from increased wave action and storm severity will further decrease the area of habitat available if no action is taken to protect these islands.

Coastal Resources

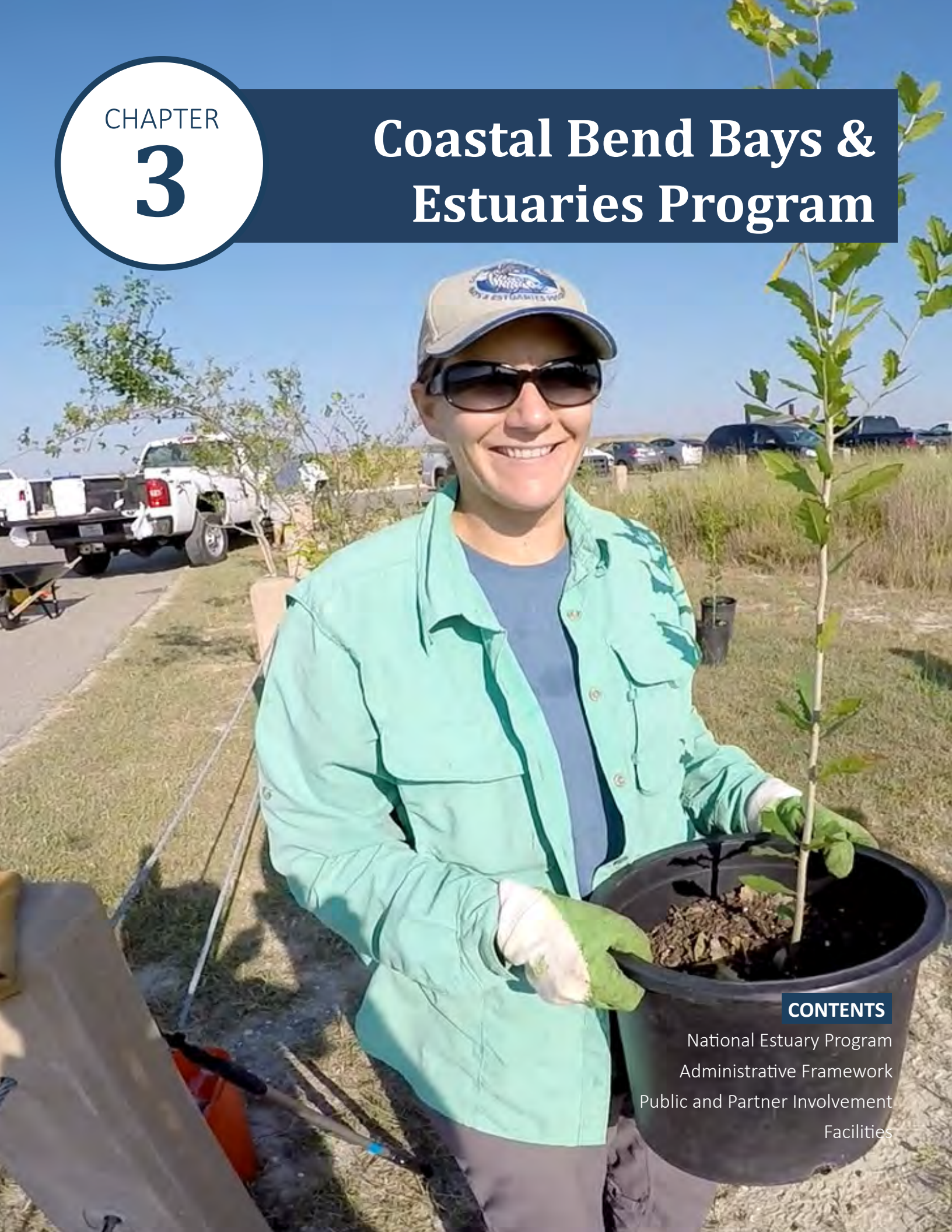
Coastal shorelines are dynamic systems that are influenced by sea level rise, storm frequency and severity, subsidence, and sediment transport. Texas is fringed by a system of barrier islands that protect the mainland from wave action and storm energy. Sea level rise and storm severity threaten barrier islands by compromising the protective dune system that lies on the seaward side, causing the island (sediments) to migrate landward. This ultimately poses a major threat to the mainland as it loses the first line of defense against storms and erosional forces.

1. The majority of Coastal Bend shorelines have moderate to high erosion rates, and these rates are expected to increase with climate change. Sea-level rise will increase erosion caused by high tides and small storms, as well as major storms. Around 30% of shorelines already have high erosion rates (over 1 m/yr or 3.3 ft/yr), due to factor like a lack of sediment supply and exposure to wave energy.
2. Communities at high risk to erosional forces are North Padre Island and Flour Bluff - sea level rise is partially responsible for the erosion suffered, but shoreline armoring is also a relevant factor as bulk heads, jetties, and other structures have replaced natural habitats that used to border and protect the shoreline.
3. Under the low-end sea level rise scenario, there is a 10% increase in area affected by a Category 3 hurricane. This storm would submerge all barrier islands, and the majority of Aransas County including the Rockport/Fulton area.
4. Aransas County has the highest percentage of the population in the floodplain, but Nueces County has developed the most land in the floodplain.
5. Under the intermediate sea level rise scenario, a 100-year flood will become 20% more likely to happen by 2030 in Rockport and by 2080, the likelihood increases to 100%.
6. The increase in severity of precipitation events will likely lead to a higher frequency of floods, particularly flash floods.

CHAPTER

3

Coastal Bend Bays & Estuaries Program



CONTENTS

- National Estuary Program
- Administrative Framework
- Public and Partner Involvement
- Facilities

National Estuary Program

Established by Section 320 of the Clean Water Act, the National Estuary Program (NEP) is an EPA place-based program to protect and restore the water quality and ecological integrity of estuaries of national significance. Currently, 28 estuaries located along the Atlantic, Gulf, and Pacific coasts and in Puerto Rico are designated as estuaries of national significance. Each NEP focuses within a study area that includes the estuary and surrounding watershed. The NEPs are responsible for developing and implementing comprehensive management plans that contain actions for addressing water quality and living resources challenges and priorities within a particular geographic boundary encompassing the estuary and surrounding environments.

The NEPs are administered through a variety of institutional settings, including state and local agencies, universities, and nonprofits. In overseeing and managing the national program, EPA provides annual funding, national guidance, and technical assistance to the NEPs. NEPs are guided by a director and staff that are housed in a program office located within the estuarine watershed.

The CCBNEP was added to the NEP in 1994, and the CBBEP, a nonprofit organization, took over its administration in 1999 once its CCMP (*The Coastal Bend Bays Plan*) was complete and approved. As part of the NEP, the CBBEP does not have regulatory or taxing authority, does not have a formal permit review role, and does not affect private property rights nor supersede existing local, state, and federal authority in any way. Rather, the Program helps focus limited technical and financial resources in a voluntary, cooperative, and goal-oriented manner to effect resource management at the regional scale.

Administrative Framework

The CBBEP is a 501(c)3 organization that operates under the direction of a Board of Directors. The administration and operation of the CBBEP is outlined in the Bays Plan, the Interlocal Agreement, and the CBBEP By-laws. The administrative framework of the CBBEP, including the relationship of the Board of Directors, Bays Council, Bays Council Coordination Team, Implementation Teams, and CBBEP staff, is shown in Figure 9. The roles and responsibilities of each of these components are detailed below.

STAFF FROM THE CBBEP work with partners to restore native vegetation following the removal of invasive plants. (Photo by CBBEP)

Board of Directors

The property, business, and fiscal affairs of the CBBEP is managed by its Board of Directors, which may exercise all such powers of the CBBEP and do all such lawful acts and things as are authorized by statute, the Interlocal Agreement, the Bays Plan, and CBBEP By-laws. The Board of Directors may establish any committees, task forces, or advisory groups as it deems necessary. The designated members of the Board of Directors of the CBBEP shall consist of seven members, as follows:

1. The Mayor of the City of Corpus Christi, or a person designated by the Mayor;
2. The County Judge of San Patricio County, or a person designated by the County Judge;
3. The County Judge of Nueces County, or a person designated by the County Judge;
4. The Chair of the Port of Corpus Christi Authority, or a person designated by the Chair;
5. A representative of the Port Industries of Corpus Christi designated by their Board;
6. A representative of the Coastal Bend Bays Foundation designated by their Board; and
7. The Chair of the Bays Council.

Staff

Implementation of the Bays Plan is dependent upon adequate staffing levels for the CBBEP. Although staffing levels may change through time and with availability of resources, a minimum number of administrative and project management staff are needed to manage and coordinate CBBEP activities and projects.

The primary role of the CBBEP administrative staff is to provide organizational and logistical support for the Board of Directors and subcommittee meetings and to coordinate and communicate as necessary with appropriate groups, including stakeholder groups, state and federal agencies, local governments, and professional groups relevant to the implementation of the Bays Plan.

The role of the CBBEP Project Management staff is to develop and implement partnership projects with local governments, state and federal agencies, and private organizations. This involves ongoing coordination and communication with stakeholder implementation teams. Project Management staff also monitor, track, and report on implementation performance by implementing partners, and work to maintain implementation commitments. They also play a key role in developing a prioritized annual work plan and budget

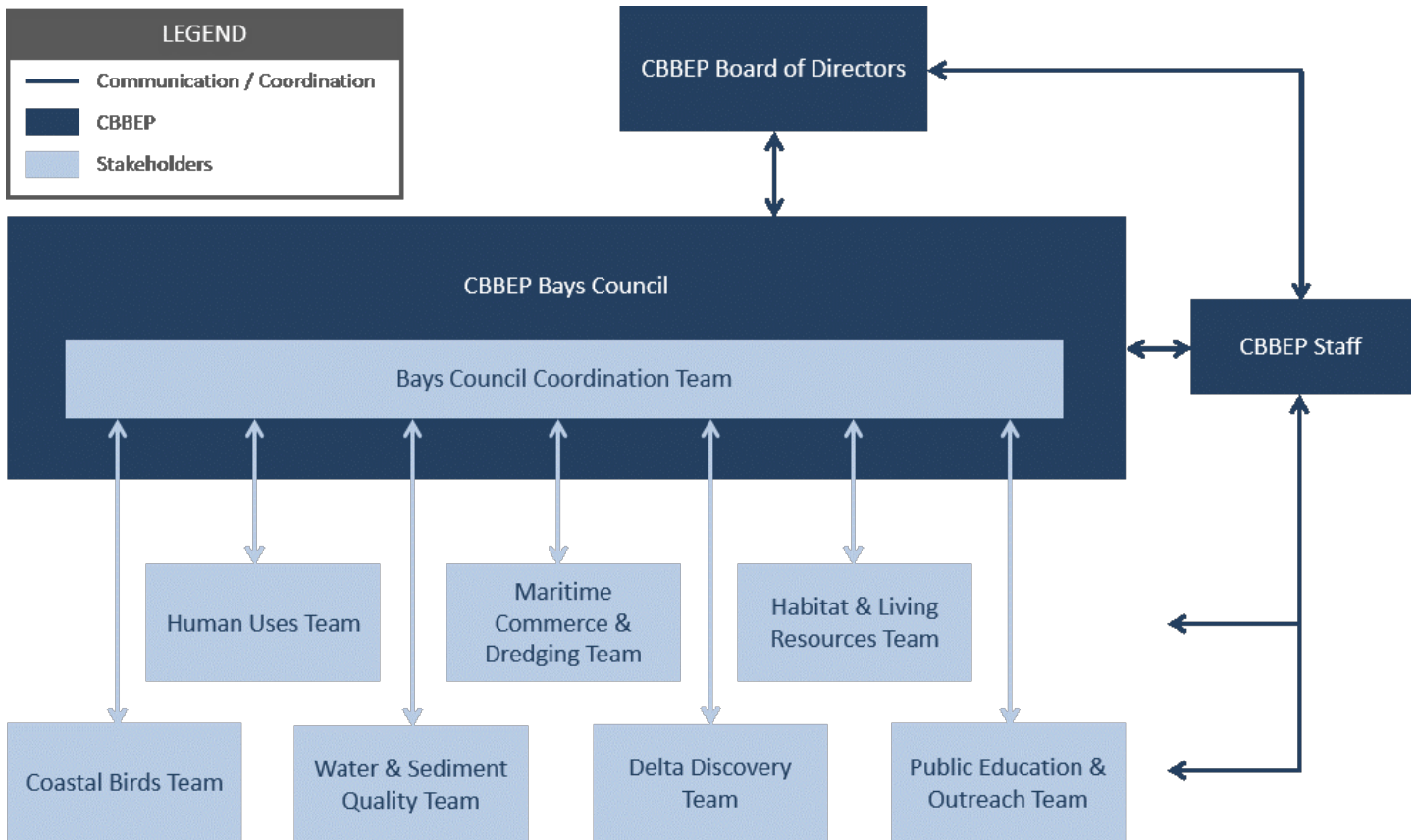


FIGURE 9. ADMINISTRATIVE STRUCTURE OF THE CBBEP SHOWING THE RELATIONSHIP BETWEEN THE BOARD OF DIRECTORS, BAYS COUNCIL COORDINATION COMMITTEE, IMPLEMENTATION TEAMS, AND CBBEP STAFF.

for Board of Directors review and approval. Finally, Project Management staff provide for overall program coordination, including quality control/quality assurance procedures with EPA Region 6 and TCEQ.

Public and Partner Involvement

Stakeholder involvement has been key to the to both the development and implementation of the 1998 Bays Plan. Local representatives of industry, commercial shrimping and fishing, agriculture, ranching, recreational activities, environmental organizations, municipal and county governments, scientists, and federal and state resource managers were all involved in the development of *The Coastal Bend Bays Plan*, and for nearly twenty years, the CBBEP has relied on the continued involvement of these community members and key partners to implement the Plan. Sustained involvement of a broad spectrum of stakeholders has been achieved through representation on Implementation Teams, the Bays Council Coordination Team, and the Bays Council (Figure 9), the roles of which are described below. The involvement of these stakeholder groups will continue in the future and will be

important for the successful implementation of the *The Bays Plan, 2nd Edition*.

Implementation Teams

Following the development of *The Coastal Bend Bays Plan*, the CBBEP formed Implementation Teams to focus on addressing the priority issues and implementing the action items identified in the Plan. Current Implementation Teams include: (1) Human Uses, (2) Maritime Commerce & Dredging, (3) Habitat and Living Resources, (4) Coastal Birds, (5) Water and Sediment Quality / Freshwater Resources, (6) Delta Discovery, and (7) Public Education and Outreach. These Implementation Teams were formed to provide oversight and guidance for ongoing projects and related monitoring and research initiatives, to help identify needs within specific priority issue areas, and to recommend projects to be considered for inclusion in the CBBEP Annual Work Plan. Implementation Teams typically meet at least once a year with CBBEP staff, and meetings are open to a diversity of stakeholder groups with interests and expertise in the issues addressed by a particular implementation team.

Bays Council

The Bays Council is comprised of one designated representative of each of the partners and implementers of the Program, and such additional persons designated by the Board of Directors from time to time. The Bays Council shall provide guidance and oversee the programs, projects, and research of the CBBEP, with final approval of the Board of Directors.

Bays Council Coordination Team

The Bays Council Coordination Team is responsible for assisting the CBBEP by supporting the efforts of the Implementation Teams described earlier. The Chairs of the Implementation Teams are responsible for serving on the Bays Council Coordination Team. The Coordination Team helps resolve differences over substantive, procedural, and budgetary issues resulting from deliberation of the implementation teams, and helps to determine how to deal with issues that do not fall within the scope of any of the standing Implementation Teams.

Facilities

The CBBEP facilities provide functional space for programmatic work, while also serving as the face to the public by providing venues for education and outreach activities. The CBBEP facilities face all of the pressures that come with working and building in the coastal zone including withstanding storms, surge, erosion, and elements of wind, salt, sand, and humidity among others. Additionally, a changing climate will exacerbate these pressures resulting in increased erosion, frequency and intensity of storm events and associated surge, sea level rise, and associated salt water intrusion. These challenges will require the CBBEP to carefully consider sustainability and resiliency as they build new and improve existing facilities.

The CBBEP Headquarters is currently based in downtown Corpus Christi and provides office and meeting spaces for the CBBEP. However, the CBBEP also utilizes partner facilities, such as the Port of Corpus Christi Administration building and the Mission-Aransas National Estuarine Research Reserve Headquarters, as needed for meetings and workshops. Corpus Christi is the largest metropolitan area within the CBBEP program area, and the downtown office location provides a centralized spot within the CBBEP program area that can be reached easily by various stakeholder groups.

In addition to its downtown office, the CBBEP also operates the Delta Discovery program at the Nueces Delta Preserve, a 10,500 acre property near Odem, Texas. Acquisition by the CBBEP began in 2003 and included a number of different funding sources. Hands-on field experiences for K-12 students are offered at the site through the Delta Discovery Program, and workshops are also offered to help educators incorporate outdoor experiences into formal classroom instruction/programming. Currently, a small, permanent building provides on-site office and meeting space for the Delta Discovery program staff. The education programs also utilize an outdoor pavilion that was built in 2007, a screened-in classroom that was constructed in 2009, and restroom facilities that were completed in 2015. The Nueces Delta Preserve is also the site for various monitoring and freshwater inflow projects, as well as wildlife and habitat restoration projects.

The CBBEP vision for the Nueces Delta Preserve includes improvements that will enhance the opportunities for education, research, exploration, and management. This vision includes an Estuary Learning Center and a Visitors Center to be built on the Rincon Unit's highest ground. The center would have informational exhibits, touch and interactive elements, a lecture hall, a laboratory, offices and adequate restrooms for students. An observation tower and hillside amphitheater are also part of the future vision. Hiking trails with improved rest areas and interpretive signage will allow visitors to venture deep into the varied delta habitats. A conceptual master plan was developed in 2010 and funding opportunities are being explored to make this plan and vision a reality.

The CBBEP has also worked to acquire either fee simple title or conservation easements for several additional properties throughout the Coastal Bend. Since 2002, close to 13,000 acres of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat have been conserved by the CBBEP. Locations of acquired properties have include the Nueces Delta, Mustang Island, South Padre Island, Lamar Peninsula, the Aransas River Delta, and the Mission River Delta. By conserving these properties, the CBBEP has reduced threats of land fragmentation, preserved open space, and provided habitat for wildlife, including migratory and threatened/endangered species. The CBBEP also works to manage these lands responsibly and sustainability for the long-term benefit of both wildlife and people.

CHAPTER

4

The Bays Plan



CONTENTS

Guiding Principles
History of The Bays Plan
The Bays Plan, 2nd Edition

Guiding Principles

The vision of *The Bays Plan* is a Coastal Bend that continues to support a high quality of life for its inhabitants and a thriving bay system which is sustained throughout generations. To achieve this vision, local stakeholders involved in the development of *The Bays Plan* agreed to work cooperatively with all interests to forge lasting relationships, based on mutual respect, which provide for the needs of all inhabitants of the Coastal Bend. They also established several guiding principles, which directed the development of the *The Bays Plan*. These same principles were applied to the revision process and will be used in the implementation of the *The Bays Plan, 2nd Edition*. These guiding principles include:

- Promote healthy and diverse economic, social, and ecological systems;
- Facilitate enlightened public action through education and dialogue with all interested parties;
- Maintain a balance of people and nature;
- Achieve equity among competing uses; and
- Seek and implement sustainable solutions.

History of The Bays Plan

The Bays Plan was designed to be a detailed, yet flexible, regional framework for action that could be used by implementing partners to realign their own resources and programs to voluntarily participate in *The Bays Plan* implementation. Implementation of the *The Bays Plan* has been ongoing since 1998 and the results have benefited local governments, the private sector, and communities in a number of ways, such as greater consistency and continuity in regional and/or local decision-making, ability to address cross-boundary issues and develop solutions, public understanding of the critical linkages between the economy and environment, leveraging of local dollars with state, federal, and private foundation dollars, and decision-making based on sound science and consensus.

The collaborative decision-making process used during the creation of *The Bays Plan* required participation from local representatives of industry, commercial shrimping, agriculture, ranching, recreational activities, environmental organizations, municipal and county governments, scientists, and federal and state resource managers. These individuals invested more than 35,000 hours in the design,

review, and discussion of more than 30 characterization studies and early-action projects. These stakeholders participated in the development of *The Bays Plan* through a group of committees collectively referred to as the Management Conference.

The Management Conference worked cooperatively to identify priority issues and specific actions to reverse negative short- and long-term environmental impacts in the Coastal Bend. *The Bays Plan* was focused on seven priority issues:

1. Alteration of freshwater inflow into bays and estuaries,
2. Condition of living resources,
3. Loss of wetlands and estuarine habitats,
4. Degradation of water and sediment quality,
5. Altered estuarine circulation,
6. Bay debris, and
7. Selected public health issues.

Each of these priority issues was addressed in the Plan under the following categories of action plans:

1. Human Uses
2. Maritime Commerce and Dredging
3. Habitat and Living Resources
4. Water and Sediment Quality
5. Freshwater Resources
6. Environmental Education and Outreach

The action plans were developed and refined through a series of workshops and committees that involved numerous individuals representing over 100 organizations. Each action plan was accompanied by an “implementation strategy,” which outlined the goals and objectives addressed by a particular action and provided detailed information about why the action was needed and how the action would be accomplished and evaluated.

While in draft stage, *The Bays Plan* was revised, not only through public comment but also through numerous meetings with local governments, state and federal agencies, and key stakeholders who all had an important part to play in implementing the *Plan*. Four Town Hall meetings were held with participation by 130 people, and over 185 comments were received, reviewed, and addressed in *The Bays Plan*. Upon approval of the *Plan* by the Governor and EPA Administrator, the CBBEP became eligible to receive federal funding support to assist in the implementation of *The Bays Plan*.

PROVIDING EDUCATION AND OUTREACH opportunities at the Nueces Delta Preserve is a key component of The Bays Plan, 2nd Edition. (Photo by CBBEP)

The Bays Plan, 2nd edition

For over 20 years, the CBBEP and its partners have been translating *The Bays Plan* into actions that have resulted in a Texas Coastal Bend with cleaner water and sediment, healthier habitats, greater public access, and a more aware and engaged public. However, the CBBEP recognizes that its action plans cannot remain static and must be modified to respond to the changing needs of communities, incorporate new programmatic, scientific, and technological advances, and address new environmental challenges and priority issues. In 2016, the CBBEP initiated a new collaborative effort to revise *The Bays Plan* in order to incorporate developments that have occurred since the previous plan was drafted and to ensure that new priorities are being addressed.

Priority Issues

Despite the progress made since *The Bays Plan*, most of the priority issues identified in the previous *Plan* still affect the Coastal Bend today. In addition, several new challenges have emerged, such as declining coastal bird populations and impacts of climate change, which must also be addressed. The 2010 Environmental Indicators Report and the Texas Coastal Bend Regional Climate Change Vulnerability Assessment were valuable tools in determining what priority issues remain from *The Bays Plan* and identifying new issues that must be addressed. As *The Bays Plan* and its action plans were being revised, the priority issues were also reviewed with stakeholders and their feedback was gathered. Finally, programmatic changes within the CBBEP (e.g., development of new programs; acquisition of property) were also considered when adding new priority issues to *The Bays Plan, 2nd Ed.*

The list below shows the priority issues addressed in the *The Bays Plan, 2nd Ed.* – items in italics indicate new issues that were not previously addressed.

1. Alteration of freshwater inflow into bays and estuaries,
2. Condition of living resources,
3. Loss of wetlands and estuarine habitats,
4. Degradation of water and sediment quality,
5. Altered estuarine circulation,
6. Increasing amounts of bay debris,
7. Selected public health issues,
8. *Declining coastal bird populations,*
9. *Resilient coastal ecosystems and human communities that can adapt to changing conditions,*

10. *Implementation of effective adaptive management practices at CBBEP properties, and*
11. *Well-educated public to be wise stewards of the environment.*

Action Plans

The Bays Plan, 2nd Ed. contains a total of 15 action plans, which are organized into the following categories: (1) Human Uses, (2) Maritime Commerce and Dredging, (3) Habitat and Living Resources, (4) Coastal Birds, (5) Land Conservation and Stewardship, (6) Water and Sediment Quality, (7) Freshwater Resources, (8) Public Education and Outreach, (9) Delta Discovery, and (10) Coastal Resilience. However, many of the actions will achieve progress in multiple theme areas. Table 3 lists the 15 action plans of *The Bays Plan, 2nd Ed.* by category and shows how they relate to the action plans included in the *The Bays Plan*.

Each action plan is designed to meet a specific goal(s) and objective(s). Action plans typically contain multiple action items, each of which is accompanied by an implementation strategy. The implementation strategies identify which specific goals and objectives will be addressed by a particular action item, and they also provide detailed information about how the action will be accomplished and evaluated. The action plans and their accompanying implementation strategies are provided in Chapter 5-14.

Every Implementation Strategy Includes:

- Description and background about the proposed action.
- Detailed steps that must be implemented to accomplish the action.
- The lead agency or organization.
- Potential collaborating agencies and organizations.
- Potential sources of funding and the level needed:
 - \$ Less than \$25,000
 - \$\$ \$25,000 to \$150,000
 - \$\$\$ \$150,000 to \$1,000,000
 - \$\$\$\$ Greater than \$1,000,000
- Implementation status of the action – either new or underway.
- Approximate timeframe for completion of steps.
- Metrics that will be used to measure the success of the implementation action. *

* Metrics are included only for implementation actions which involve tracking of environmental parameters.

TABLE 3. COMPARISON OF ACTION PLANS IN "THE BAYS PLAN" AND "THE BAYS PLAN, 2ND EDITION."

CATEGORY	THE BAYS PLAN	THE BAYS PLAN, 2ND EDITION
Human Uses	Bay Tourism and Recreation Shoreline Management Bay Debris Public Health	Tourism and Recreation Shoreline Management Bay Debris Public Health
Maritime Commerce and Dredging	Maritime Commerce Dredging	Maritime Commerce Dredging
Habitat and Living Resources	Habitat and Living Resources	Habitat and Living Resources
Coastal Bird Program	n/a	Coastal Bird Program
Land Conservation and Stewardship	n/a	Land Conservation and Stewardship
Water and Sediment Quality	Water and Sediment Quality Nonpoint Source Management	Water and Sediment Quality Nonpoint Source Management
Freshwater Resources	Freshwater Resources	Freshwater Resources
Public Education and Outreach	Public Education and Outreach	Public Education and Outreach
Delta Discovery	n/a	Delta Discovery
Coastal Resilience	n/a	Coastal Resilience

The CBBEP will assess implementation progress yearly as part of the Annual Work Plan development process, as well as regularly reporting on the performance metrics. *The Bays Plan, 2nd Ed.* has a 20-year horizon, but the CBBEP will revisit the outcomes, objectives, and strategies based on implementation successes and on new priority issues every five years. New implementation actions will then be developed for the next five-year planning cycle to support attainment of the goals set forth in each action plan, allowing for adaptive management and adjustment of priorities and actions.

Public Participation in the Revision Process

The goal of the Bays Plan revision process was to create a *Bays Plan, 2nd Ed.* that continues to meet the needs of stakeholders in industry, local government, academia, and resource management and can be used for years to come. The CBBEP recognizes the importance of stakeholder involvement in both the development and implementation of comprehensive management strategies, and therefore, initiated a collaborative effort to gather feedback from stakeholders and revise *The Bays Plan* based on the most recent priority issues and the current and future needs of local communities. While this consensus-building process is often difficult and can take time, the result is a product for which stakeholders feel personal responsibility and commitment. Development of the *The Bays Plan, 2nd Ed.* occurred over a two-year period and included direct

input from all CBBEP staff members, the CBBEP Board of Directors, the CBBEP Implementation Teams, and the general public (Appendix D).

Local stakeholders were allowed opportunities to provide input to *The Bays Plan, 2nd Ed.* throughout the course of its development through special meetings of the CBBEP Implementation Teams. These special sessions were used to discuss *The Bays Plan* and seek feedback from local partner agencies and organizations about a particular focus area of the *Plan* (e.g., water and sediment quality, habitat and living resources, human uses). Workshops began with team members reviewing action plans from *The Bays Plan* and discussing accomplishments that had been made over the last nearly 20 years. Many of the goals, objectives, and action items were found to still be relevant, but changes were often needed to ensure that accomplishments were noted and that action plans reflected the current terminology, technology, and scientific developments. Time was also spent discussing the need to add new goals, objectives, and action items to *The Bays Plan, 2nd Ed.* to ensure that current and potential future issues were being addressed. Discussion time provided the opportunity for consensus-building, which is so important to the development and implementation of comprehensive management plans. In addition to the special sessions, Implementation Team members were also allowed the opportunity to comment on a full draft of *The Bays Plan, 2nd Ed.* prior to its submission for review by EPA. Due to the cross-cutting nature of coastal resilience, feedback was



sought from multiple Implementation Teams on the Coastal Resilience Action Plan.

Once a draft of *The Bays Plan, 2nd Ed.* was complete, notices were published on the CBBEP website and social media pages to notify the general public of the opportunity to comment on the *Plan*. Individuals had the opportunity to submit written comments via the website. Additionally, a public meeting was held on April 9, 2018 in Corpus Christi, Texas to provide the public with the opportunity to hear an overview of *The Bays Plan, 2nd Ed.* and provide comments orally or in writing. Specific comments received on *The Bays Plan, 2nd Ed.* are provided in Appendix E and are followed by a description of how the CBBEP addressed those comments within the revised plan.

◀ **STAKEHOLDERS DISCUSS WATER QUALITY** issues within the Coastal Bend and develop implementation strategies for addressing those issues. (Photo by CBBEP)

CHAPTER

5

Human Uses

CONTENTS

Introduction

Tourism and Recreation Action Plan

Shoreline Management Action Plan

Bay Debris Action Plan

Public Health Action Plan



ACCOMPLISHMENT: Packery Flats Improvements

Nestled on the backside of Mustang Island adjacent to Packery Channel, Packery Flats Coastal Habitat is a little known gem with lots to offer in terms of public access to our coastal areas. The one thousand acre protected area boasts extensive intertidal habitats that are heavily utilized by fish and wildlife, and also have many features that are appealing to passive recreation. Previous efforts by the CBBEP have constructed parking lots for public access, but increases in the popularity of the area prompted the CBBEP's Human Uses Implementation Team to prioritize additional improvements.

Costing a total of \$115,000, the improvements were funded by the CBBEP, NOAA, and the Texas General Land Office's Coastal Management Program. They include interpretive signage, improved road access and parking at two locations along Highway 361, and expanded bollard and cable systems to protect the sensitive habitats. Using bollard and cable systems are a good way to limit vehicular access to an area while still promoting pedestrian access.

The two public access points at Packery Flats offer different experiences. The main parking lot (1) on Highway 361 contains interpretive signage and entrance to a 1/3 mile long pedestrian trail that ends at the tidal flats adjacent to Packery Channel. The second access point (2) takes you from Highway 361, a quarter of mile through high marsh, to a parking area with direct access to the shallow waters of the backside of the island and Kate's Hole, a known fishing spot. The parking area is surrounded by *Spartina alterniflora* which immediately gives way to submerged seagrass meadows and open water. Here you can fish and bird watch from the shore, kayak, stand-up paddleboard, or wade out into the flats and fish.

Introduction

The Coastal Bend bays and estuaries contain a wealth of resources for people to enjoy and appreciate. Indeed, these resources are central to the quality of life for many who live or come here to recreate. The bays and estuaries also support an enormous segment of the local economy, supplying us with both recreation and dollars. However, our use of these waters -- what we put into them and what we take from them -- must be managed to ensure that the bay system remains healthy and productive.

Principal goals of the Human Uses Action Plans are to ensure that people continue to benefit from a safe, clean bay system and to promote stewardship of bay resources. To do this, it is important to inform the citizens of this community and our millions of visitors about how to enjoy the resources without degrading them. It is also important to plan for the ever-increasing number of people who visit the region to enjoy its natural resources. Well-planned and well-managed access areas will do much to curtail resource damage while providing enough parks and facilities for the growing numbers of users. Finally, ensuring that the waters are safe to swim in and that the fish, crabs, and shrimp are safe to eat are important goals.

Tourism and Recreation

Coastal Bend bays provide opportunities for many recreational activities, such as fishing, kayaking, and birding. However, some recreational uses have adverse impacts on our coastal natural resources, such as uprooting of seagrass by boat propellers, disturbance of nesting birds, and litter on beaches and bay shorelines. As the number of visitors and residents using the bays continues to increase in the future, there will be even more pressure placed on coastal natural resources. Therefore, it is important that the CBBEP and its partners work with tourism organizations to keep visitors informed and ensure that bay users understand their impact on bay resources and are aware of ways of reduce these impacts. Ensuring the safety of natural resources will also require implementation of actions that mitigate the impacts of human intrusion on critical habitats (particularly bird rookeries and seagrass beds), promote ethical angling practices, and encourage proper disposal of common trash items by recreational users.

The CBBEP will also work to improve existing public access sites (Figures 10 and 11) and develop the appropriate number of well-managed sites in order to protect the coastal resources and ensure their longevity for future bay users. This will be done in partnership with other

FISHING is just one of the many ways to enjoy the bays and estuaries of the Coastal Bend.

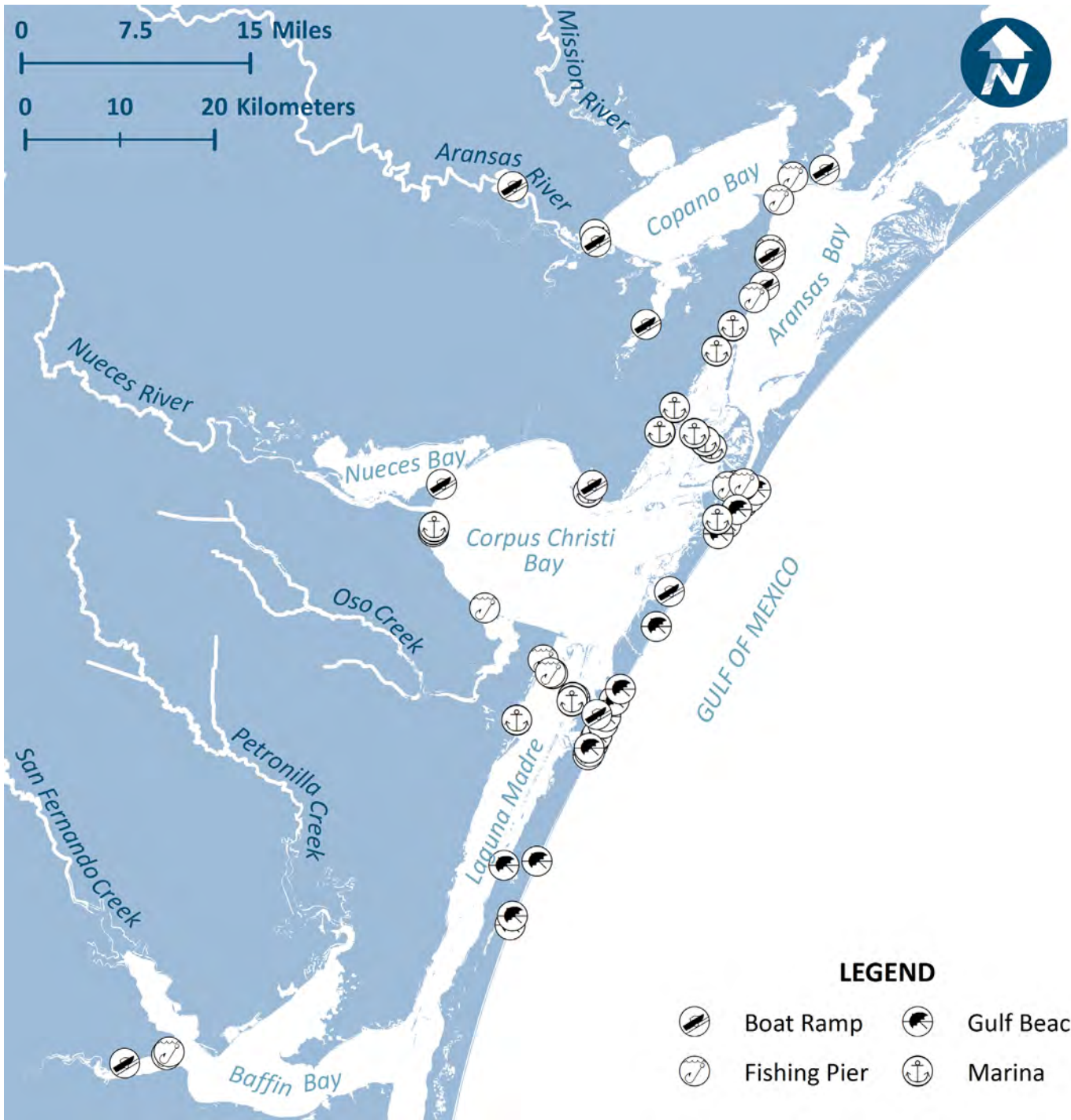


FIGURE 10. MAP OF BOAT RAMPS, MARINAS, FISHING PIERS, AND GULF BEACH ACCESS POINTS IN THE COASTAL BEND.

agencies, including the Texas General Land Office and local governments that issue beach access and dune protection permits. Finally, the increasing number of water craft using the bay system calls for additional actions which call attention to the kind and amount of services available to support this use. Therefore, *The Bays Plan, 2nd Ed.* calls for CBBEP and other partners to work with the owners and operators of marinas to develop plans and funding options

to make improvements to solid waste, sanitary pump-out, or fueling facilities.

Shoreline Management

Environmental impacts from poorly planned shoreline development can result in unnecessary habitat loss, reduced public access, altered bay circulation, and degraded water and sediment quality. Therefore, the

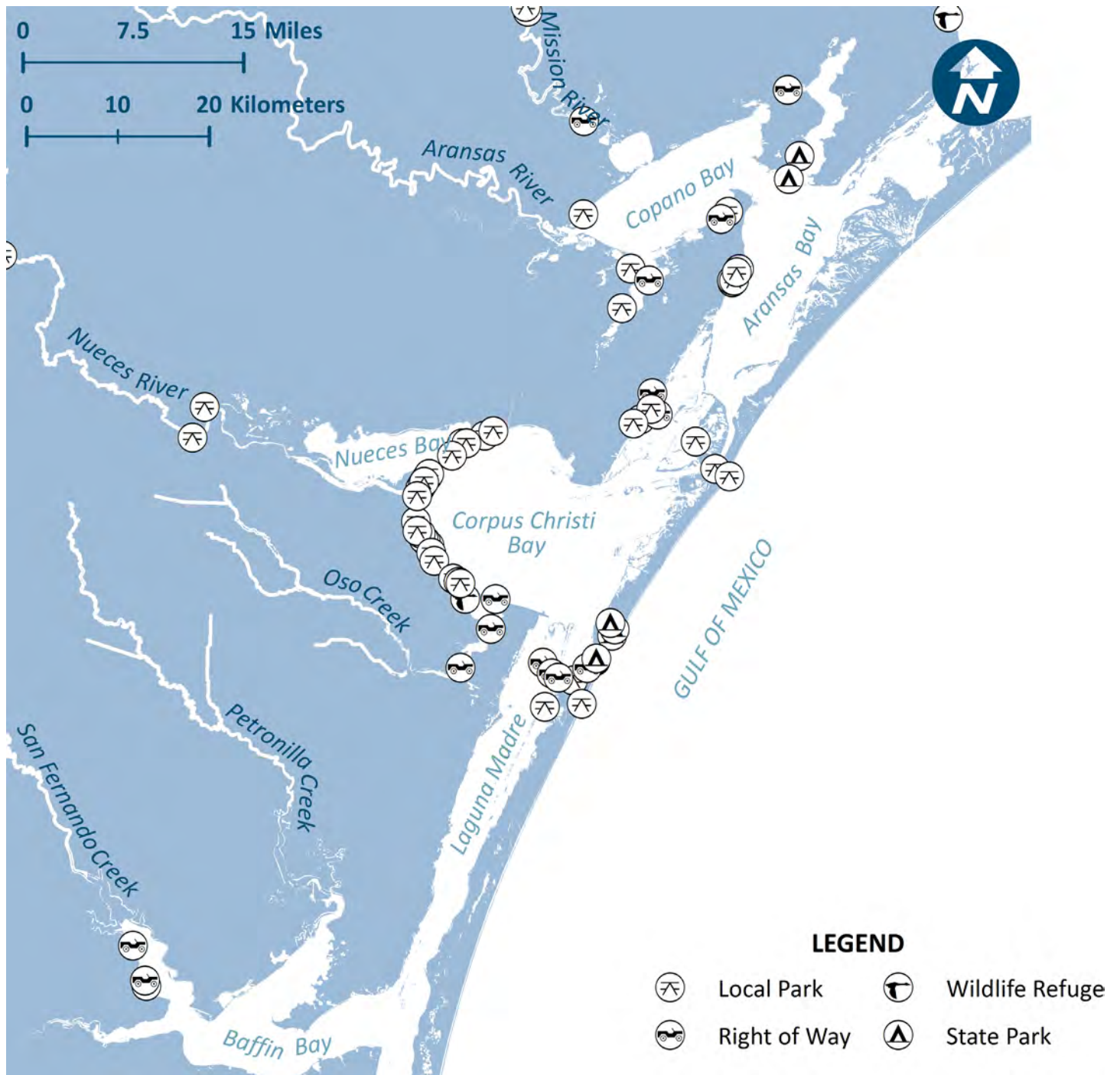


FIGURE 11. MAP OF LOCAL PARKS, STATE PARKS, WILDLIFE REFUGES, AND RIGHT OF WAY ACCESS POINTS IN THE COASTAL BEND.

CBBEP will work with local governments, landowners, and key resource management agencies to provide guidance on shoreline management techniques, focusing on the preservation of natural shoreline functions and features.

Proper shoreline management techniques are not only important in the bay but along riverine shorelines as well. The riparian habitats that border rivers and creeks perform

a number of important functions, such as filtering out nutrients, promoting deposition of sediments, acting as corridors that create important linkages between isolated forests, and regulating water temperatures in rivers and streams. Another action calls for CBBEP and partners to ensure the proper management of the vegetation along rivers and creeks in order to maintain these important functions.

Bay Debris

The debris in our bays comes from many sources -- runoff from land, including the debris carried by storm sewers and tributaries; debris discarded or blown from vessels and offshore operations; the trash that blows out of vehicles; the trash that beach goers leave behind; and the debris that washes and blows into the bays from festivals held on the shoreline. Bay debris poses public health risks, reduces the aesthetic appeal of the bay system, degrades habitats, and ensnares wildlife. These impacts result in costs: to the shrimper who tears his net by hanging up on debris; to the windsurfer who steps on a broken bottle; to the tourism industry when hotel rooms are unfilled because potential visitors would rather visit cleaner beaches; and to agencies and organizations who devote thousands of hours to cleaning the beaches along the bays.

The CBBEP and its partners will work with local governments to improve solid waste management procedures, reduce solid waste inputs from stormwater drainage systems, implement litter enforcement efforts, and educate citizens on ways they can help achieve the goal of a cleaner environment. Although it is typically less cost-effective than prevention programs, clean-up efforts are also needed to help remove debris once it reaches the bay. Volunteer clean-up events hosted by CBBEP and its partners help to remove small-scale debris items from Coastal Bend bays and their shorelines, but larger items, such as derelict vessels, deteriorating oil/gas infrastructure, and storm debris, are more difficult and costly to remove, often requiring special funding and the assistance of state partners.

Public Health

While significant threats to public health from water contact or seafood consumption are not found in the CBBEP program area, shellfish closures, harmful algal blooms, and isolated cases of waterborne illness have occurred. Fortunately, there are already several county, state, and federal agencies working to safeguard public health from bay-related maladies, and continued support of proactive monitoring programs that assess and monitor recreational waters is needed. Better public education on a variety of health issues could avoid unnecessary problems and provide important, positive information about the overall health of the bay system. Such assurance is desired by residents and visitors alike.

Another action will focus on the consumption of fish and shellfish. Although the government tightly regulates commercial seafood harvesting, little is known about



ACCOMPLISHMENT:

Shoreline Protection at Indian Point

Indian Point Park encompasses 55 acres and is a prime location for fishing, birding, and nature watching. This popular nature park is immediately adjacent to the City of Portland's Sunset Lake Park. Indian Point Peninsula is constantly impacted by waves from wind blowing across Corpus Christi Bay and the shoreline has retreated about 85 feet in the time period between 2005 and 2011. The CBBEP, TGLO, and the City of Portland completed construction on a project to protect and to provide long-term protection to sensitive marsh habitat as well as important park infrastructure.

A combination of shoreline revetment and off-shore breakwaters was determined to provide the most functional and cost-effective solution with minimal environmental impacts. Lester Contracting out of Port Lavaca, TX, was selected to construct the project. This first phase of the project included the crushing and recycling of old broken concrete previously used as shoreline protection and the construction of approximately 1,040 linear feet of limestone revetment and offshore breakwaters. The structures are designed to lessen the impact of the waves on shorelines and structures behind them. As waves hit the rock structures, they will break and dissipate energy. The reduction in wave energy lessens erosion along the shoreline, protecting any structures, parking areas and wetland habitats.

The first phase of the project was successfully completed on budget and ahead of schedule in 2014. The second phase of the project will begin in 2018 and will involve construction of additional breakwater structures. Funding for the second phase is being provided by the Natural Resource Damage Assessment associated with the Deepwater Horizon oil spill.



the safety of consuming recreationally caught seafood. Additional analyses of fish and shellfish tissue is needed to determine the presence and concentration of harmful substances, such as polychlorinated biphenyls (PCBs), metals, and pesticides. The data will be submitted to the Texas Department of Health for a risk assessment evaluation.

ACCOMPLISHMENT:

Rookery Island Cleanup

Trash that washes up on the shores of rookery islands is very harmful to birds and other wildlife that utilize these habitats. Pieces of plastic are often mistaken for food and birds can easily become entangled in discarded fishing line or injured by hooks and lures. These types of casualties are preventable, and therefore, removing these materials from the rookery islands and shorelines that the birds utilize is a priority of the CBBEP.

Removal of the harmful trash from these remote islands is a big job, however, and requires a fleet of boats and captains to accomplish. So the CBBEP Coastal Bird Program, in conjunction with US Fish & Wildlife Service, began hosting Rookery Island Clean Ups back in 2006 to engage volunteers from the public, as well as agencies and non-profits within natural resource management to help clean the shorelines of these important waterbird rookeries. The effort has grown considerably, with 2016 marking the 10th year of the Upper Laguna Madre Rookery Island Clean Up, as well as the inaugural effort for the Lower Laguna Madre Rookery Island Clean Up.

Thousands of pounds of trash was removed by volunteers from sensitive rookery island habitat during this year's clean up! The Upper Laguna Madre effort removed 1,250 pounds of bagged trash as well as larger items such as buckets, pallets, 55 gallon drums, and crab traps. The Lower Laguna Madre effort removed 800 pounds of bagged trash as well as buoys, chairs, a porcelain toilet, and even a kitchen sink!



TOURISM & RECREATION

Action Plan

GOAL

Maintain, manage, and expand tourism and recreational opportunities in a way that enhances the local economy and protects the natural resources of the bays.

OBJECTIVES

- TR 1: Enhance the reputation of the Coastal Bend as being a premier ecotourism destination for people to experience Texas' coastal natural resources.
- TR 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.
- TR 3: Minimize adverse impacts to coastal natural resources caused by recreational uses of the bays and enhance resources for recreational use where appropriate.

ACTIONS

- TR 1.1: Collaborate with tourism organizations to adopt a theme of resource protection and stewardship in their promotion of tourism.
- TR 2.1: Provide for the appropriate number of improved, well-managed public access sites.
- TR 3.1: Support the development and implementation of management strategies that reduce or avoid impacts from recreational uses.



Tourism and Recreation 1.1

Collaborate with tourism organizations to adopt a theme of resource protection and stewardship in their promotion of tourism.

Coastal Bend bays provide for many recreational activities including fishing, windsurfing, birdwatching, waterfowl hunting, camping, jet skiing, kayaking, canoeing, surfing, swimming, sailing, power boating, shelling, beach combing, walking, and running. These recreational activities result in tremendous economic benefits to the regional economy. However, the ever-increasing number of bay users has resulted in impacts to natural resources, such as uprooting of seagrass by boat propellers, disturbance of nesting birds, and litter on beaches and bay shorelines. As the number of visitors and residents using the bays continues to increase in the future, there will be even more pressure placed on coastal natural resources. Therefore, it is important that bay users understand their impact on bay resources and are aware of ways of reduce these impacts.

STEP 1:

Promote the involvement of local tourism organizations in the “Human Uses Implementation Team.”

STEP 2:

Through the “Human Uses Implementation Team,” support projects that promote responsible tourism and protect the natural resources of local bays (e.g., public service announcements, signage, etc.).

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



The Human Uses Implementation Team will meet annually throughout the applicable life of this Plan (2020-2040). Projects will be identified at annual meetings and implemented as funding becomes available. Potential projects to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: Step 1 = \$; Step 2 = \$\$-\$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); Foundations; Local governments; Private industry

PARTNERS



LEAD: CBBEP

PARTNERS: Audubon Texas; CBBF; CCA; Local Chambers of Commerce; Conservation organizations (e.g., Surfrider, Sierra Club); Local governments; Regional Tourism Council; TPWD; USFWS

PERFORMANCE METRICS



1. Number of individuals from tourism industry participating in Human Uses Implementation Team.
2. Number of public service announcements, signs, brochures, etc. produced that promote responsible tourism.



Tourism and Recreation 2.1

Provide for the appropriate number of improved, well-managed public access sites.

Ensuring public access to Coastal Bend bays is critically important to maintaining the ecotourism economies of the coastal communities in the region. However, the need to provide public access must be balanced with the need to conserve and protect coastal habitats and resources from user impacts such as litter/debris, wildlife disturbance, and habitat alteration. As communities in the Coastal Bend continue to grow and tourism increases, the pressure to provide public access is becoming an increasing issue. Well-planned and well-managed access areas will do much to curtail resource damage, while providing enough parks and facilities for the growing numbers of residents and visitors. Although there are numerous existing public access sites within the Coastal Bend, there is still a need to improve some of these existing sites and to develop an appropriate number of new, well-managed sites in order to protect the coastal resources and ensure their longevity for future bay users.

STEP 1:

Through the “Human Uses Implementation Team,” develop funding and implementation strategies that provide new public access sites or improvements to existing sites.

STATUS



UNDERWAY: The CBBEP has worked with local partners to complete numerous projects that enhance public access sites within the Coastal Bend (e.g., installation of boat ramps, construction of boardwalks, and installation of educational signs and trash receptacles). Currently, CBBEP is working on: (1) installation of trails and educational signs at the Amos Rehabilitation Keep in Port Aransas, (2) installation of interpretive signs at the Oso Bay Wetlands Preserve, (3) installation of bollards at Blind Oso, (4) adding debris container lids at Hazel Bazemore Park, and (5) installation of bollards and educational signs at properties owned by CBBEP on Lamar Peninsula.

TIMEFRAME



The Human Uses Implementation Team will meet annually throughout the applicable life of this Plan (2020-2040). Projects will be identified at annual meetings and implemented as funding becomes available. Potential projects to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$\$-\$\$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; Local governments; Private industry; RESTORE Act; TPWD

PARTNERS



LEAD: CBBEP

PARTNERS: Local governments; NOAA; SABP; TGLO; TPWD; USACE; USCG; USFWS

PERFORMANCE METRICS



1. Number of new public access sites in the project area.
2. Number of existing public access sites in the project area that are improved.



Tourism and Recreation 3.1

Support the development and implementation of management strategies that reduce or avoid impacts from recreational uses.

Coastal Bend bays provide opportunities for many recreational activities, but some recreational uses have adverse impacts on our coastal natural resources. For example, boat propellers are known to disturb the bay bottom and uproot seagrass, destroying critical nursery habitat for many important commercial and recreational fisheries. Human disturbance at colonial waterbird rookeries has also become a growing concern in the Coastal Bend. Rookery islands are especially susceptible to disturbance from boaters, and if disturbed while nesting, birds may abandon their nests, which can leave eggs or baby chicks vulnerable to predators and heat. Litter and trash left behind by recreational users is another issue throughout the entire region. If left alone, some of this trash may persist in the environment for hundreds of years. In addition to being an eyesore, bay debris is a threat to wildlife that may ingest the trash or become entangled, and it can also engulf and smother the habitats that birds, fish, and other animals rely on for shelter and food. This debris also poses a safety hazard for humans if fishing gear or other types of trash become wrapped around boat propellers or clog seawater intakes. Management strategies are needed to ensure that these impacts can be minimized and the coastal natural resources that so many recreational users enjoy can be conserved for future bay users.

STEP 1:

Support implementation of the “Texas Seagrass Conservation Plan,” which monitors for impacts and recovery from boat propeller scarring in seagrass beds.

STEP 2:

Implement projects that mitigate the impacts of human intrusion on important critical habitats (e.g., signage, educational materials, bollards, etc.).

STEP 3:

Collaborate with CBBEP’s Coastal Bird Program to implement strategies that prevent impacts to rookery islands from human disturbance.

STEP 4:

Develop funding and implementation strategies for projects and programs that promote ethical angling practices.

STEP 5:

Develop funding and implementation strategies for projects and programs that promote proper disposal by recreational users of common trash items such as monofilament, fishing tackle, shot gun shells, plastic bottles, and cans.

STEP 6:

In conjunction with owners/operators, assess the operations of marinas to determine the types and scale of pollutant loadings and other impacts. Work with owners/operators to identify funding sources, and develop and implement site-specific BMPs. Encourage the installation and use of pump-out stations and trash receptacles at appropriate locations.

STATUS



UNDERWAY: CBBEP has worked with local partners to implement projects that help reduce or avoid impacts from recreational users (e.g., educational signs, installation of bollards, and public service announcements). Currently, CBBEP is working on the following projects: (1) installation of bollards at Blind Oso, (2) installation of bollards and educational signs at properties owned by CBBEP on Lamar Peninsula, (3) installation of signs at rookery islands notifyin.

TIMEFRAME



The schedule for implementation of Step 1 will be based on recommendations from the Texas Seagrass Working Group. Historically, seagrass monitoring has occurred on an annual basis, but the suggested monitoring interval may be modified in the future to reflect need and available funding. Steps 2-5 will be implemented based on priorities and recommendations from the Human Uses Implementation Team that will meet annually throughout the applicable life of the

Plan (2020-2040). Implementation of recommended projects will be based on funding available. Step 6 will most likely occur in first five years (2020-2025) of Plan implementation, and BMPs will be implemented as funding becomes available during the remaining life of the Plan (2025-2040).

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; Foundations; NOAA Marine Debris Program; Private industry; RESTORE Act

PARTNERS



LEAD: CBBEP

PARTNERS: Audubon Texas; CBBF; CCA; Conservation organizations (e.g., Sierra Club, NWF); Local governments; MANERR; Marina owners; NMFS; TPWD; SEA; USCG; USFWS



SHORELINE MANAGEMENT Action Plan

GOAL

Minimize impacts to natural resources from shoreline activities occurring within the program boundary.

OBJECTIVE

SM 1: Support environmentally sound shoreline management.

ACTIONS

SM 1.1: Advise and assist local partners with shoreline management issues.

SM 1.2: Support efforts to promote enhanced management of riverine shorelines and riparian habitat.



Shoreline Management 1.1

Advise and assist local partners with shoreline management issues.

Environmental impacts from poorly planned shoreline management can result in unnecessary habitat loss, reduced public access, altered bay circulation, and degraded water and sediment quality. CBBEP provides advice and assistance (i.e., resources) to local governments, landowners, and key resource management agencies on shoreline management issues as needed. Wherever practical, the preservation of natural shoreline functions and features, at both public and privately owned facilities, is encouraged to take advantage of natural defenses against wave and wind energy. Tax-paying citizens and users of the bay beaches, as well as private property owners along the shoreline, will benefit from the sound management and use of coastal shore areas.

STEP 1:

Provide local governments, landowners, and key resource management agencies with guidance on sound shoreline management techniques that will minimize environmental impacts while trying to maximize economic benefits.

STEP 2:

Ensure that all shoreline management projects proposed by the "Human Uses Implementation Team" and the "Habitat and Living Resources Implementation Team" incorporate preferred shoreline management techniques.

STEP 3:

Assist with acquisition of funding for projects that employ preferred shoreline management methods.

STATUS



UNDERWAY: CBBEP has frequently provided advisory support to local governments, landowners, and local resource managers regarding shoreline management issues. CBBEP staff perform this task on an as needed basis and will continue to do so throughout the applicable life of this Plan.

TIMEFRAME



CBBEP frequently provides advisory support to local governments, landowners, and local resource managers regarding shoreline management issues. Therefore, Steps 1 and 3 will be implemented upon request and as needed throughout the applicable life of the Plan (2020-2040). Step 2 will be implemented annually through meetings of both the Human Uses Implementation Team and the Habitat and Living Resources Implementation Team.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds)

PARTNERS



LEAD: CBBEP

PARTNERS: Local governments; MANERR; Navigation Districts; Private landowners; TGLO, TNC; TPWD; USACE; USFWS

PERFORMANCE METRICS



1. Linear feet of shoreline managed using preferred management techniques.



Shoreline Management 1.2

Support efforts to promote enhanced management of riverine shorelines and riparian habitat.

Riparian habitat is the term used to describe the areas located directly adjacent to rivers or streams. These habitats perform a number of important functions. Runoff from agricultural and urban areas can have high levels of nutrients and sediments, and riparian areas play a key role in maintaining the water quality of our streams and rivers by filtering out many of these nutrients and promoting deposition of sediments. Riparian habitats also act as corridors, creating important linkages between isolated forests - they serve as a “highway” on which animals and plants can travel and disperse to new locations. The vegetation in riparian areas also plays a key role in providing shade and helping control water temperatures in rivers and streams. Finally, the leaf litter and woody debris created by the canopy also provide food and habitat for aquatic animals. Proper management of the vegetation along rivers and streams can reduce erosion and sedimentation and is important for maintaining the important functions provided by these valuable riparian habitats.

STEP 1:

Promote buffer areas by protecting, enhancing, restoring, and creating riparian habitats along rivers and streams located within the project area.

STEP 2:

Support the implementation of conservation practices and the development of plans that enhance quality of rivers and streams and the habitats directly adjacent to them.

STEP 3:

When applicable, ensure that projects proposed by the “Human Uses Implementation Team” and "Habitat and Living Resources Implementation Team" include appropriate best management practices for riparian areas and riverine shorelines.

STATUS



UNDERWAY: CBBEP is already collaborating with local partners to secure funding to work with private landowners to restore and/or secure conservation easements in riparian areas.

TIMEFRAME



Steps 1 and 2 will be implemented as needed and as funding becomes available, throughout the applicable life of the plan (2020-2040). Within the first five years of the Plan (2020-2025), priority riparian areas include those along the Nueces River, Mission River, and creeks within the Baffin Bay Watershed. Step 3 will be implemented annually at meetings of the Human Uses Implementation Team and the Habitat and Living Resources Implementation Team.

COST



ESTIMATED COST: Steps 1 and 2 = \$\$ - \$\$\$ (varies by project type); Step 3 = \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds; TCEQ; Local funds); CMP; NRCS Conservation Stewardship Program; NRCS Environmental Quality Incentives Program; RESTORE Act; TSSWCB Nonpoint Source Grant Program, TPWD Landowner Incentive Program; TSSWCB Water Quality Management Plan Program

PARTNERS



LEAD: CBBEP

PARTNERS: BBASCs; Local governments; MANERR; NRCS; Private landowners; River authorities (i.e., GBRA, NRA, SARA); TGLO; TPWD; TSSWCB

PERFORMANCE METRICS



1. Acres of riparian habitat protected, enhanced, restored, or created.



BAY DEBRIS

Action Plan

GOAL

Reduce bay debris in the Coastal Bend to ensure minimal impact to people, aquatic life, and natural resources.

OBJECTIVE

BD 1: Reduce the amount of debris in the bays and estuaries throughout the Coastal Bend.

ACTIONS

BD 1.1: Support activities to reduce the amount of debris reaching the bays.

BD 1.2: Support activities to remove existing debris in the bay.



Bay Debris 1.1

Support activities to reduce the amount of debris reaching the bays.

Bay debris poses public health risks and reduces the aesthetic appeal of the bay system. It can also degrade habitats and ensnare aquatic and wildlife species. The debris in our bays comes from many sources, including runoff from land (i.e., storm sewers and tributaries); debris discarded or blown from offshore operations; trash that is discarded or blown out of vessels and vehicles; and trash that beachgoers and bay users leave behind. Bay debris is a large, multi-faceted, solid waste management problem, and prevention is typically the most cost-effective solution. Therefore, CBBEP and its partners support efforts by local governments to improve solid waste management and to educate citizens on ways they can help achieve the goal of a cleaner environment.

STEP 1:

Develop and implement improved solid waste management procedures for urban, rural, and unincorporated areas. Efforts should address illegal dumping and household hazardous waste.

STEP 2:

Enhance efforts to remove improperly disposed of solid waste from stormwater drainage systems, implementing pilot demonstration projects as appropriate.

STEP 3:

Work with elected officials and legal authorities to improve litter enforcement efforts and continue to encourage litter-related public assistance programs (e.g., rewards programs, neighborhood watch programs, etc.).

STEP 4:

Support efforts to educate citizens about the impacts of bay debris and ways to achieve a cleaner environment.

STATUS



UNDERWAY: The CBBEP is partnering with the City of Corpus Christi to purchase and install catch basin inserts at the highest priority storm drains where trash accumulates in the Cole Park drainage basin.

TIMEFRAME



Steps will be implemented, as priorities/projects are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040). Potential projects to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$-\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; Coastal Bend COG; EPA Trash Free Waters; NOAA Marine Debris Program; TCEQ; RESTORE Act

PARTNERS



LEAD: CBBEP

PARTNERS: CBBF; City of Corpus Christi; Coastal Bend COG; EPA; Local governments; MANERR; NOAA; Surfrider Foundation; TGLO; TPWD

PERFORMANCE METRICS



1. Amount of debris in vicinity of stormwater outfalls.
2. Number of illegal dumpsites within project area.
3. Number of household hazardous waste removal programs.
4. Number of stormwater improvement pilot projects implemented.
5. Number of tickets issued for littering.
6. Number of public assistance programs for littering.



Bay Debris 1.2

Support activities to remove existing debris in the bay.

Bay debris poses public health risks, reduces the aesthetic appeal of the bay system, degrades habitats, and ensnares aquatic and wildlife species. The debris in our bays comes from many sources and ranges in size from small-scale items such as plastic bottles and fishing gear (e.g., monofilament, abandoned crab traps) to large-scale items such as deteriorating docks/piers, abandoned vessels, deteriorating oil/gas infrastructure, and debris from extreme storms and hurricanes. Numerous volunteer clean-up events occur throughout the Coastal Bend on an annual basis, focusing on removal of small-scale items found on bay shorelines and beaches. Large-scale debris items located within the bay and along its shoreline are more difficult and costly to remove, often requiring special funding and involvement from resource management agencies such as the Texas General Land Office and Texas Parks and Wildlife Department.

STEP 1:

Update the inventory of existing large-scale bay debris (e.g., docks/piers, vessels, oil/gas structures, storm debris).

STEP 2:

Using the inventory created in Step 1, develop and implement strategies for the removal of different types of debris.

STEP 3:

Support Texas Parks and Wildlife Department's "Abandoned Crab Trap Removal Program."

STEP 4:

Support existing beach and shoreline clean-up efforts.

STATUS



UNDERWAY: CBBEP supports a number of on-going efforts to remove debris from the bay, including partnering with the CBBF and other partners on clean-up events.

TIMEFRAME



Crab trap removal and beach/shoreline clean-up efforts (Steps 3 & 4) will occur annually. The State's large-scale bay debris inventory (Step 1) will also be updated by relevant partners annually. Large-debris removal (Step 2) will take place as funding becomes available throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: Step 1 = No Cost; Step 2 = \$\$\$\$; Steps 3 & 4 = \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CCA; CMP; Foundations; NOAA Marine Debris Program; Private industry; RESTORE Act; TGLO

PARTNERS



LEAD: Step 1 = TGLO; Step 2 = TGLO; Step 3 = TPWD; Step 4 = CBBEP

PARTNERS: CCA; Coastal Bend COG; MANERR; Friends of PINS; NOAA Marine Debris Program; NPS; PINS; SABF; Surfrider Foundation; TCEQ; TMN; USCG

PERFORMANCE METRICS



1. Number of large-scale debris items removed from the program area.
2. Number of crab traps removed from the program area.
3. Number of beach/shoreline cleanups occurring in the program area.
4. Pounds of debris collected during beach/shoreline cleanup events.
5. Number of volunteers participating in beach/shoreline cleanup programs.



PUBLIC HEALTH

Action Plan

GOAL

Ensure public health associated with contact recreation and seafood consumption.

OBJECTIVES

PH 1: Minimize the threat of waterborne illness and disease.

PH 2: Reduce the risk of illness and disease associated with consumption and handling of fish and shellfish caught in local waters.

ACTIONS

PH 1.1: Support efforts to protect recreational water quality through studies on waterborne health issues, including pathogens, chemicals, and Harmful Algal Blooms.

PH 2.1: Support health risk assessments associated with consumption and handling of seafood.



Public Health 1.1

Support efforts to protect recreational water quality through studies on waterborne health issues, including pathogens, chemicals, and Harmful Algal Blooms.

The public wants to know that it is safe to visit local beaches and bays and to get in the water. While significant threats to public health from water contact are not found in the project area, shellfish closures, Harmful Algal Blooms (HABs), and isolated cases of waterborne illness have occurred. A public health concern anywhere in the area can have economic repercussions throughout the region. The best way to avoid this situation is to have a proactive approach to assess and monitor recreational waters, and thus be able to address any situation before it becomes a concern.

STEP 1:

Support water quality monitoring programs that provide notifications to recreational users (e.g., Texas Beach Watch, HAB hotline).

STEP 2:

Support efforts to better understand the impacts of waterborne pathogens (e.g., *Vibrio vulnificus*) and HABs (e.g., red tide) on recreational water quality.

STEP 3:

Support efforts to improve fecal bacteria problems through feral animal control programs.

STATUS



UNDERWAY: The Implementation Plan for Cole and Ropes Parks is completed and is expected to be approved by TCEQ in 2017. The Plan details voluntary management measures and control actions that government and citizens can take to reduce bacteria entering the bay at these sites. The CBBEP continues to participate in the Cole and Ropes Park Coordination Committee (CARP) and the Oso Creek and Bay Coordination Committee. The CBBEP also participates in the HAB Working Group and receives information regarding current HABs from the TPWD Kills and Spills Team. The CBBEP staff provides information to the public as needed.

TIMEFRAME



Steps will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040). Potential projects and programs to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$ - \$\$\$ (varies by project)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, and Local funds); CMP; EPA; Local governments; NOAA; TCEQ; Texas Sea Grant; TDSHS; TPWD

PARTNERS



LEAD: CBBEP

PARTNERS: Local health departments; TAES; TDSHS; Texas Beach Watch; TGLO; TMMSN; TPWD; Universities (e.g., TAMUCC; TAMU; UTMSI)

PERFORMANCE METRICS



1. Number of monitoring programs in project area that provide water quality notifications to recreational users.
2. Number of reports and publications about waterborne pathogens and HABs that are produced using CBBEP resources.
3. Number of feral animal control programs in the project area.
4. Number of impairments for fecal indicator bacteria in project area.



Public Health 2.1

Support health risk assessments associated with consumption and handling of seafood.

Several local and state agencies are working to ensure the safety of commercially caught seafood. Information regarding the safety of consuming and handling recreationally caught seafood is presently inadequate for some seafood types and areas.

STEP 1:

Support efforts to collect sufficient fish and shellfish data to be used in human consumption risk assessments from selected subsections of the project area. Analyze the tissue in a laboratory acceptable to Texas Department of State Health Services (TDSHS) for volatiles, semivolatiles, metals, pesticides, and PCBs. Submit data to TDSHS for risk assessment consultation, and disseminate results to the public.

STEP 2:

If risk is deemed unacceptable, determine sources of pollutants and implement controls through TDSHS.

STATUS



UNDERWAY: Previous research funded by the CBBEP has shown high contaminant levels (e.g., mercury, PCBs) in local fish and oysters. With continued population and industrial growth in the Coastal Bend, the CBBEP and its partners will need to continue examining contaminant levels in seafood in order to ensure public health.

TIMEFRAME



Steps will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040). Potential projects and programs to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$ - \$\$\$ (varies by project)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); CCA; EPA; NOAA; TCEQ; TDSHS; TPWD

PARTNERS



LEAD: CBBEP

PARTNERS: CCA; NMFS; SEA; TDSHS; TPWD; Universities (e.g., CCS; HRI; UTMSI)

PERFORMANCE METRICS



1. Number of fish and shellfish health risk assessments and monitoring sites supported by CBBEP resources.
2. Number of controls for fish and shellfish consumption implemented by TDSHS in program area.

CHAPTER

6

Maritime Commerce and Dredging

CONTENTS

Introduction

Maritime Commerce Action Plan

Dredging Action Plan



Introduction

Maritime commerce is vital and will continue as the cornerstone of the economy of the Coastal Bend region. Every year, more than 80,000 vessels of all types cross the bays of the Coastal Bend (Jones, et al., 1996), and the possibility of an accident that could impact the marine environment must be minimized through practical and cost-effective strategies. In addition, dredging is required to maintain the region's navigation channels and help keep maritime commerce flowing safely. A resolution is needed to the continuing debate about the best way to manage dredging and placement of dredged material. With proper planning, it is possible to minimize negative environmental impacts and maximize benefits to the bays and the regional economy.

Maritime Commerce

Much economic activity in the region is linked to waterborne commerce via the use of shipping or pipelines (Figures 12 and 13). Given the increase in vessel size/number and the widespread use of marine pipelines, there is a potential for accidents that could impact the marine environment, threaten human health and safety, and cause economic loss.

Fortunately, there have been relatively few vessel collisions or major spills in Coastal Bend bay systems. The soft bottoms onshore and offshore are relatively forgiving to ships or barges that run aground. Moreover, accidents have generally been concentrated within the Corpus Christi Inner Harbor where it is relatively easy to contain a spill and minimize damage to wildlife and the marine environment. Nevertheless, accidents involving both ships and pipelines have occurred, and incidents in recent years have increased awareness that we must do everything practical to minimize the potential for additional accidents.

Operators of all waterborne craft including ships, barges, towboats, harbor tugs, shrimp trawlers, passenger vessels, supply boats, ferries, Navy ships, and recreational vessels are part of the mix that is involved in channel traffic safety. Several agencies are also involved in maritime safety. The U.S. Coast Guard Marine Safety Office located in Corpus Christi is responsible for enforcing vessel safety and operational rules along the entire South Texas coast. It is assigned specific responsibility for inspection of vessels, crew members, bridges, and dock operations, to help avoid accidents and prevent pollution. It is also assigned the task

of maintaining adequate aids to navigation and issuing safety-warning notices to mariners.

Members of the local harbor pilots association, tug operators, line handlers, the Harbormaster, and even operators of the Tule Lake Lift Bridge also play a key role in preventing accidents. The Coast Guard, the Port Authority, and the Pilots Association have historically ensured that traffic safety in the ship channel is a high priority. For instance, when tankers above a certain size are underway, only one-way traffic is allowed in the channel. The Port of Corpus Christi Authority (PCCA) operates the Harbormaster's Office round-the-clock to assist mariners with traffic management.

In recent years, the Port of Corpus Christi has experienced a period of rapid growth, a shift in some cargo movements, and a wave of new industrial development opportunities. In 2015, the U.S. government also repealed a 40-year ban on the export of crude oil and condensates to foreign countries. Since that time, the Port has passed its tipping point from being an importer to an exporter in cargo shipments (South Texas Economic Development Center, 2016). Expansion in outbound traffic is expected to continue, beginning with exports of crude oil and condensates to foreign destinations. Exports of other commodities will also pick up when many of the regions newly developed industrial sites are complete. The PCCA is making strategic plans to expand its core operations by leveraging developments around the world, such as the expansion of the Panama Canal (South Texas Economic Development Center, 2016). As the PCCA prepares to face these new and exciting challenges, particularly those associated with being a major exporter of crude oil, it is important that safety continues to be a top priority.

The actions of *The Bays Plan, 2nd Ed.* call for the Pilots Association to provide continuing education and training for its members. Another action calls for the U.S. Coast Guard, South Texas Waterways Advisory Committee, and other partners to collaborate on improvements to navigational ranges and the area's Vessel Traffic Information System. In addition, the Plan calls for support of the setback policies on the Gulf Intracoastal Waterway (GIWW) which will decrease the likelihood of the encroachment of hazards that can impede commerce and affect the movement of goods. Actions associated with support of the PCCA's initiative to deepen and widen the Corpus Christi Ship Channel and to create a barge shelf that will significantly reduce the potential for vessel collision along that route are also included in the Plan.

Numerous pipelines crisscross the bays and estuaries of the Coastal Bend, carrying oil and other hazardous

◀ **THE PORT OF CORPUS CHRISTI** is an important driver in the Coastal Bend economy (Photo by Port of Corpus Christi Authority)

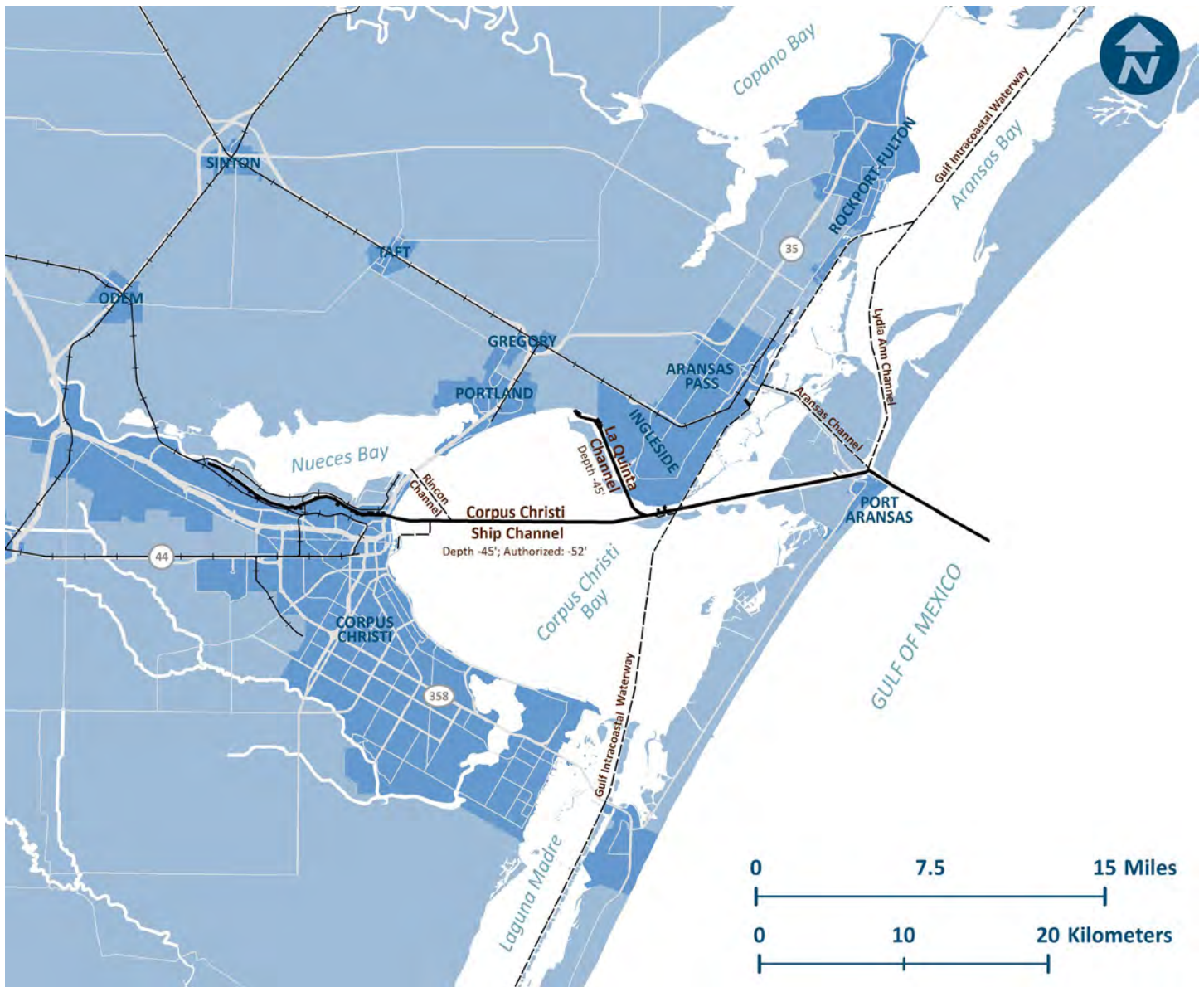


FIGURE 12. MAP SHOWING MAJOR DREDGED NAVIGABLE WATERWAYS IN THE COASTAL BEND.

materials. Efforts to protect the public, as well as environmentally sensitive habitats and species, in the eventuality of spills are an important focus of *The Bays Plan, 2nd Ed.* The Coast Guard serves as the federal on-scene coordinator responding to petroleum or chemical spills into the marine environment. The Texas General Land Office has responsibility as the state oil spill response coordinator and has been instrumental to ensure that substantial resources are prepositioned to reduce spill response times. In addition, the Corpus Christi Area Oil Spill Control Association, established in 1970 by the PCCA, responds to accidents in the Inner Harbor with equipment and trained personnel. The Texas Commission on Environmental Quality is the state chemical spill response coordinator. This responsibility is shared with the Coast Guard. The Local Emergency Planning Committee works

with TCEQ to improve hazardous material spill response planning.

Improvements have been made to the regional spill response capability since the publication of the 1998 Bays Plan, but there is a need to continue to support efforts such as spill drills, unified command drills, and evaluation/acquisition of equipment and supplies. *The Bays Plan, 2nd Ed.* calls for continued refinement of the area's oil spill contingency plan, improved response technologies, and enhanced public awareness of response plans and notification networks. The Plan also calls for an evaluation of the existing marine pipeline data management systems. The evaluation should identify the gaps and opportunities for improvements that would allow for more timely and effective response to marine pipeline incidents. There are,

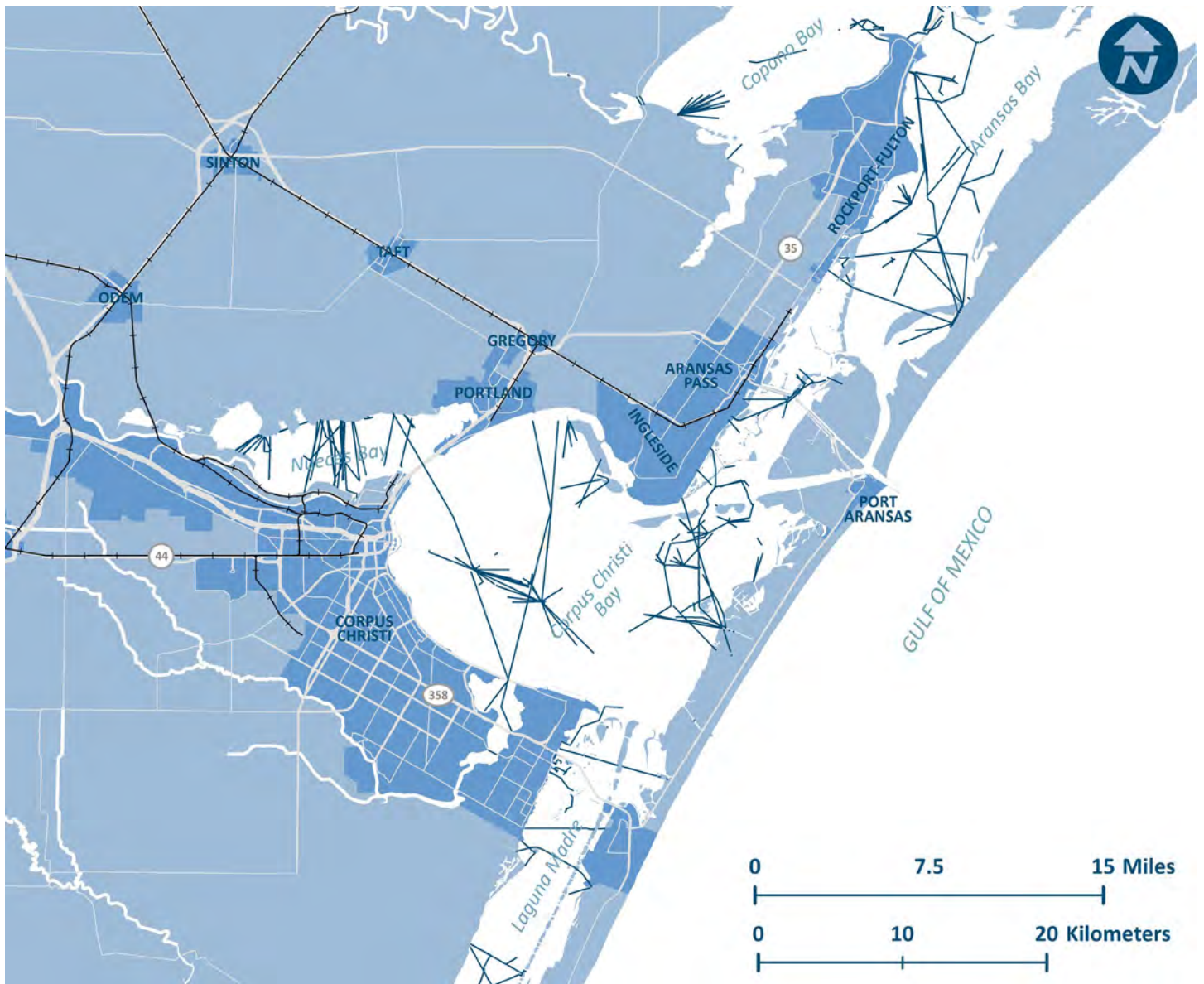


FIGURE 13. MAP OF HAZARDOUS MATERIAL PIPELINES WITHIN THE BAYS OF THE COASTAL BEND.

of course, many partners to these actions, including the Texas General Land Office, the Coast Guard, and the Texas Railroad Commission.

Finally, minimizing the potential for the introduction of non-native species through ship ballast water will be the target of another action within the Plan.

Dredging

Until the 1970's, almost all of the dredged material excavated in channel construction and maintenance was placed in unconfined areas, generally a short distance from the channel. This created 'spoil' islands (now referred to as dredged material placement areas) and covered large areas of shallow bay bottoms, creating either short-term or permanent disruption of biological productivity in

these areas. Such material created much of the land on the north side of the Inner Harbor and on the west end of Harbor Island. Dozens of islands created by dredged material placement exist along the ship channel west of Port Aransas, on the west side of La Quinta Channel, and along the Intracoastal Waterway, especially in the Laguna Madre. Despite losses of bay bottom habitat (largely due to the burial of seagrasses during dredging), dredged material placement has produced notable environmental enhancements, including the creation of nesting habitat on material placement islands. One such island, Pelican Island, is the largest brown pelican nesting area in Texas.

During the 1970's, minimizing wetland losses became an important public policy goal. The outcome was increased coordination between state and federal agencies regarding

dredged material placement practices (i.e., levee-confined areas). Concern about the release of potentially harmful contaminants trapped in bottom silts in the Inner Harbor was also a factor in the design of material placement areas. However, dredged material must be tested using nationally approved methods to ensure sediment quality is adequate for in-bay or Gulf placement. Not all dredged material must be confined. For example, material excavated during channel maintenance across Corpus Christi Bay and in the Gulf entrance channel is placed in designated open water areas.

Dredge and fill activities not specifically authorized by the United States Congress cannot be conducted without an approved federal permit under Section 10 of the Rivers and Harbors Act and, in most cases, a permit under Section 404 of the Clean Water Act. A permit is needed whether the job is a ship channel or a shallow residential canal planned by a single landowner. These and other permitting requirements provide the current management framework for dredging in the Coastal Bend. Project sponsors must apply to the U.S. Army Corps of Engineers, which seeks review and comment from federal and state natural resource agencies and the public. If it appears that a project will have significant impacts, an environmental assessment or an environmental impact statement is required. Each project is viewed individually in this management system, but assessing the long-term cumulative impacts of multiple and interrelated dredging projects has been difficult.

One action of *The Bays Plan, 2nd Ed.* calls for the creation of an interagency and public stakeholder committee that will examine the 'big picture' for maintenance dredging and give special attention to the possible beneficial use of clean dredged material. This 'Beneficial Uses Group' will identify opportunities to increase the volume of dredged material that is put toward beneficial uses. Such uses might include habitat creation or renourishment with suitable dredged material, or shore protection against erosive wave energy. The group will also work to identify potential funding sources to achieve these goals and ways to monitor success following implementation.

In conjunction with the work done by the 'Beneficial Uses Group,' *The Bays Plan, 2nd Ed.* also calls for an analysis (or consensus from resource agencies and the scientific community) identifying current ecological resource needs (e.g., more rookeries, more emergent marsh, more submerged aquatic vegetation, more reefs). The results of the ecological resource needs assessment could then be used in the development of a 'Regional Habitat Management Plan' that identified specific projects



ACCOMPLISHMENT: Beneficial Use of Dredge Material at Causeway Island

Causeway Island, in Nueces Bay, supports thousands of pairs of nesting colonial waterbirds each year, making it valuable habitat for many imperiled species in the Coastal Bend region. A geo-textile tube was installed to prevent erosion around the perimeter of the island in 2002 using funds from the Texas General Land Office Coastal Erosion Planning and Response Act (CEPRA) Program.

In 2012 a habitat improvement project, involving the placement of dredge material from the Rincon Channel, was made possible via a partnership between the Coastal Bend Bays and Estuary Program, the Port of Corpus Christi, and the U.S. Army Corp of Engineers. With funds from Cheniere Energy, Inc., approximately 40,000 cubic yards of dredge spoil from Rincon Channel was spread over the three-acre island. The goal of the project was to provide more habitat for ground nesting birds by increasing the elevation of the island.

Additional improvements to the island have included the construction of nesting platforms and the installation of an online streaming video monitoring station that allows public viewing of the nesting platforms.



ACCOMPLISHMENT: **La Quinta Channel Extension**

As part of the ‘Corpus Christi Ship Channel – Channel Improvement Project,’ several improvements have been made to the La Quinta Ship Channel as well. Beginning in November 2011, the La Quinta Channel was extended approximately 1.4 miles (to a depth of 39 feet). Costs for the projects were shared between the Port and the Federal government.

Extending the La Quinta Ship Channel was a major step forward towards the development of the La Quinta Trade Gateway Multipurpose Facility, one of the most important diversification projects of the Port of Corpus Christi Authority. Extension of the La Quinta Ship Channel will allow economic benefits to be achieved while enhancing the economy of the region by providing deep channel access to the Port’s La Quinta Gateway project.

The project also included an ‘ecosystem restoration’ component. An offshore rock breakwater and shore protection were built near Ingleside to protect and enhance approximately 45 acres of seagrass habitat. In addition, the improvements include the construction of approximately 200 acres of shallow water habitat created by the beneficial use of dredged material.

that were acceptable (e.g., habitat creation, habitat restoration, or conversion of one aquatic habitat type for another habitat) and could be implemented with the use of dredged material.

The PCCA is the local sponsor of the Corpus Christi Ship Channel and the branch La Quinta Channel. The CBBEP will support the Port’s effort, in conjunction with the Corps of Engineers and other stakeholders, to implement the Dredged Material Management Plan (DMMP) for the Corpus Christi Ship Channel. Maintenance dredging has been evaluated in the DMMP for beneficial use feasibility and has identified and regularly places maintenance material for beneficial use (e.g., Pelican Island for rookery enhancement).

Working in parallel fashion the CBBEP will assist the Texas Department of Transportation, the Corps of Engineers, and other partners to achieve consensus among stakeholders on a long-term dredged material management plan for the Gulf Intracoastal Waterway (GIWW), other navigation channels, channel subdivisions, private marine terminals, and private and public marinas.



MARITIME COMMERCE

Action Plan

GOAL

Enhance maritime traffic safety while reducing the rate of maritime incidents from shipping, terminal operations, and marine pipelines.

OBJECTIVES

- MC 1: Enhance commercial maritime traffic safety.
- MC 2: Reduce impacts from maritime oil and hazardous material spills.
- MC 3: Improve the response strategy to marine pipeline incidents.
- MC 4: Reduce the potential for introductions of non-native species caused by maritime operations.

ACTIONS

- MC 1.1: Support efforts to implement the Corpus Christi Ship Channel Improvement Project and other improvements.
- MC 1.2: Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.
- MC 1.3: Support efforts to maintain and improve the Vessel Traffic Information System and any additional navigational aids, such as the Physical Oceanographic Real-Time System (PORTS).
- MC 1.4: Continue to support vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.
- MC 1.5: Support the setback policies for the Gulf Intracoastal Waterway.
- MC 2.1: Continue to maintain and improve regional oil spill response capability.
- MC 2.2: Continue to maintain and improve hazardous spill response planning and resources to ensure public protection.
- MC 3.1: Support data management systems to locate existing pipelines and points of contact for current ownership.
- MC 4.1: Continue to support the prevention of the introduction of non-native species through improved ballast water management.



Maritime Commerce 1.1

Support efforts to implement the Corpus Christi Ship Channel Improvement Project and other improvements.

The number and size of vessels using the Corpus Christi Ship Channel (CCSC) continues to grow, and the Port of Corpus Christi Authority (Port) has been seeking needed channel improvements since soon after final achievement of the 45' Project, a 1968 Congressional Authorized project, not completed until 1989. The initial study for this generation of proposed improvements was in response to a congressional resolution adopted in 1990 by the Committee on Public Works and Transportation, U.S. House of Representatives, where it stated: "...to determine the feasibility of modifying the Corpus Christi Ship Channel, with particular emphasis on the La Quinta Channel... in the interest of commercial navigation and related purposes."

After having all Feasibility Reports and Environment Impact Statements completed and approved in 2004, the project for navigation and ecosystem restoration, CCSC, Texas, was authorized by Section 1001(40) of the Water Resources Development Act of 2007. The Authorized Project included the following navigation and ecosystem restoration features: (1) extend La Quinta Ship Channel; (2) deepen La Quinta Ship Channel extension to match original channel; (3) construction of ecosystem restoration features to protect endangered species, wetlands, and seagrass; (4) widening the CCSC to 530' from Port Aransas to the Harbor Bridge; (5) deepening the CCSC to -52' MLT; and (6) adding 200' wide Barge Shelves across Corpus Christi Bay.

Several components of the Corpus Christi Ship Channel Improvement Project (CCSCIP) have been completed, but efforts to deepen/widen the ship channel and create barge shelves are ongoing and continue to need support. The Port has a permit to complete the project but funding still needs to be obtained. The CCSCIP has a defined boundary but additional improvement projects may be needed outside of this area - action allows for improvements in these other areas as well.

STEP 1:

Obtain Congressional appropriation to fund the Corpus Christi Ship Channel Improvement Project.

STEP 2:

Coordinate with USACE and USCG on the creation of the barge shelf adjacent to the main ship channel.

STATUS



UNDERWAY: Several components of the CCSCIP have been completed, but efforts to deepen/widen the ship channel and create barge shelves are ongoing and continue to need support. The Port has a permit to complete the project but funding still needs to be obtained.

TIMEFRAME



Certain components of the deepening and widening of the CCSC will be underway when the Bays Plan, 2nd Ed. is approved, and additional steps will be implemented as funding becomes available. Other improvement projects (outside of the scope of the CCSCIP) will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$\$\$\$ (full project implementation)

POTENTIAL FUNDING: Congressional appropriation and non-federal cost-share

PARTNERS



LEAD: PCCA

PARTNERS: Aransas-Corpus Christi Pilots; Commercial and recreational vessel operators; PICC; USACE; USCG



Maritime Commerce 1.2

Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.

Existing navigation ranges are in need of updating to maintain safe vessel operations. Ongoing channel modifications and night lights from urban areas call for assessment of the proper placement and adequacy of ranges. Although navigation ranges are routinely updated by the United States Coast Guard (USCG), there still remains a need for additional improvements and new ranges (e.g., La Quinta Channel).

STEP 1:

Survey existing ranges and determine shortcomings.

STEP 2:

Determine priorities for updating ranges and determine which ranges require high intensity day and night lights.

STEP 3:

Obtain funding to implement improvements and coordinate on follow through with range improvements.

STATUS



UNDERWAY: Navigation ranges are routinely updated by the USCG.

TIMEFRAME



Earliest anticipated completion is 2019. Future updates will occur as funding becomes available during the applicable life of the Plan (2020-2040).

COST



ESTIMATED COST: \$\$\$\$ (full project implementation)

POTENTIAL FUNDING: Federal funding; Private industry

PARTNERS



LEAD: USCG

PARTNERS: STWAC



Maritime Commerce 1.3

Support efforts to maintain and improve the Vessel Traffic Information System and any additional navigational aids, such as the Physical Oceanographic Real-Time System (PORTS).

The Port of Corpus Christi Authority received a Congressional appropriation to establish a Vessel Traffic Information System (VTIS). As the number and size of vessels using the Corpus Christi Ship Channel continues to grow, it is important that the existing VTIS is both maintained and improved in order to ensure safe vessel operations. Installation of additional equipment associated with other monitoring programs, such as the Physical and Oceanographic Real-Time System (PORTS), would provide further beneficial navigation aids to the Port of Corpus Christi.

STEP 1:

Coordinate the location, installation, and modification of electronic monitors in Corpus Christi Bay and its approaches to provide real-time wind, tide, and current information to mariners via a phone, radio, or internet link.

STEP 2:

Promote utilization of the existing VTIS by improving current and up-to-date communication.

STEP 3:

Assess the need for a Vessel Traffic System.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Steps will be implemented as funding becomes available during the applicable life of this plan (2020-2040). However, increasing traffic in the CCSC makes these steps a high priority for implementation in the first 10 years of the Plan (2020-2030).

COST



ESTIMATED COST: Step 1 = \$\$\$-\$\$\$\$ (varies by project type); Step 2 = \$ (per year);
Step 3 = No cost

POTENTIAL FUNDING: TBD

PARTNERS



LEAD: STWAC

PARTNERS: Aransas-Corpus Christi Pilots; GICA; PCCA; PICC; USCG



Maritime Commerce 1.4

Continue to support vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.

The single largest contributor to vessel accidents and spills from marine vessels is human error. As the number and size of vessels using the Corpus Christi Ship Channel (CCSC) continues to grow, it is important that the vessel operators continue to be properly trained.

STEP 1:

Ensure continuing education and training of all ship pilots and tug/ barge captains. Establish and self-enforce minimum standards based upon recognized international studies and standards. Formalize training schedule utilizing internationally recognized facilities.

STEP 2:

Conduct training workshops (e.g., Blue Water – Brown Water Training) for all operators of commercial vessels, including tugs and barges, fishing vessels, and offshore supply vessels.

STEP 3:

At training events, raise operator awareness about shorelines that are highly susceptible to erosion caused by vessel wakes.

STATUS



UNDERWAY: Periodic trainings for commercial vessel operators are already being hosted locally in the Corpus Christi area (e.g., Blue Water – Brown Water Training).

TIMEFRAME



Steps are considered ongoing and will be implemented throughout the life of the Plan (2020-2040) based on the funds available.

COST



ESTIMATED COST: \$\$ (per year)

POTENTIAL FUNDING: Vessel fees

PARTNERS



LEAD: Aransas-Corpus Christi Pilots

PARTNERS: CBBEP; GICA; MANERR; Texas Shrimpers Association; STWAC; Texas Waterway Operators; USCG



Maritime Commerce 1.5

Support the setback policies for the Gulf Intracoastal Waterway.

Encroachment of hazards into the Gulf Intracoastal Waterway (GIWW) can cause operational inefficiencies in navigation that impedes commerce and affects the movement of goods. There is a need to address the problems of location and construction of structures along the waterways with two major categories of stakeholders: (1) those who build the structures and (2) those who permit the structures prior to their construction. Better cooperation between governmental agencies on permitting development and a focus on the agglomeration, clustering, and density of development on the waterway is needed. Additionally, there should be increased cooperation between developers, governmental agencies, and the barge industry in maintaining the GIWW for its primary use of moving goods effectively and efficiently to promote and support Texas and United States commerce.

STEP 1:

Create a formal design review team that includes developers, public authorities, industry members, and other waterway users. This team would be responsible for developing a master plan and reviewing all future development plans having potential impact on navigational operations on the Gulf Intracoastal Waterway, including “best practices.”

STEP 2:

Improve the permitting process by pursuing a more aggressive review of the “public use” and “reduction in navigable capacity” criteria under the permitting regulations of the US Army Corps of Engineers and having the Texas General Land Office be proactive in permitting by reviewing the impacts of structures on state commerce.

STEP 3:

Improve communication and coordination regarding the permitting process with local governments and industry representatives.

STEP 4:

Develop a guidebook that can be made available to developers and property owners along the GIWW.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Formal design review team referenced in Step 1 must be established prior to the completion of the remaining items in Step 1 (master plan; review of development plans) and implementation of Steps 2-4. Anticipate development of review team in 2020-2030. Anticipated completion of the master plan (Step 1) and guidebook (Step 4) is 2030-2040. Portions of Step 1 (review of future development plans), along with Steps 2 and 3, are considered ongoing and will be implemented throughout the 2030-2040 time frame, once review team is in place.

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: TBD

PARTNERS



LEAD: TXDOT

PARTNERS: Barge industry; CBBEP; Developers; GICA; Local governments; PCCA; TGLO; USACE; USCG



Maritime Commerce 2.1

Continue to maintain and improve regional oil spill response capability.

Oil spills have the potential for catastrophic environmental impacts. Rapid and effective spill response can greatly reduce impacts associated with spills. Improvements have been made to the Coastal Bend regional spill response capability, but there is a continued need to support efforts such as spill drills, unified command drills, and acquisition of equipment and supplies.

STEP 1:

Continue to evaluate and prioritize high-risk areas based on environmental, social, and public health vulnerabilities. Incorporate this information into contingency planning document updates, which typically occur annually.

STEP 2:

Explore and evaluate alternative spill response equipment and technologies in conjunction with equipment deployment. Develop guidelines and recommendations for spill responders.

STEP 3:

Increase public awareness of oil spill response plans and the notification network. Notify and provide key public servants with opportunities to participate in spill drills.

STATUS



UNDERWAY: CBBEP partners are continually involved in efforts to maintain and improve oil spill response efforts. For example, area contingency plans are typically updated on an annual basis.

TIMEFRAME



Efforts to maintain and improve oil spill response efforts are considered ongoing, and therefore, the steps in this action will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: TBD

PARTNERS



LEAD: USCG; TGLO

PARTNERS: EPA; NOAA; PICC; STCZAZ; TCEQ; TPWD; TRC; USFWS



Maritime Commerce 2.2

Continue to maintain and improve hazardous spill response planning and resources to ensure public protection.

Hazardous materials are moved daily across Texas Coastal Bend bays by maritime transport. Efforts to protect the public, as well as environmentally sensitive habitats and species, in the eventuality of spills are of paramount importance. Improvements have been made to the Coastal Bend regional hazardous material spill response capability, but these efforts require continued support.

STEP 1:

Develop a regional contingency plan in accordance with applicable regulations. Determine areas where the public is at greatest risk from accidental spills/releases of hazardous materials. Expand public input for plan development through the Local Emergency Planning Committee.

STEP 2:

Improve and expand the regional community alert/notification network. Ensure public awareness of emergency plans including evacuation routes, notification network, and emergency public communications.

STEP 3:

Establish a cooperative framework to coordinate deployment of response equipment and resources.

STATUS



UNDERWAY: CBBEP partners are continually involved in efforts to maintain and improve hazardous chemical spill response efforts.

TIMEFRAME



Efforts to maintain and improve hazardous spill response efforts are considered ongoing, and therefore, the steps in this action will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: TBD
POTENTIAL FUNDING: TBD

PARTNERS



LEAD: USCG; TCEQ
PARTNERS: EPA; LEPC; NOAA; PICC; STCZAZ; TPWD; USFWS



Maritime Commerce 3.1

Support data management systems to locate existing pipelines and points of contact for current ownership.

In order to respond in a timely and effective manner to marine pipeline incidents, responders need information about pipeline location, ownership, age, condition, substances carried, etc. There are existing data management systems that provide this type of information regarding marine pipelines, but continued support for the maintenance and updating of these systems is needed.

STEP 1:

For existing marine pipeline data management systems, identify data gaps and evaluate opportunities for potential improvements (e.g., digitization, web interface).

STEP 2:

Develop a planning document that outlines how to fill identified data gaps and implement improvement projects related to existing marine pipeline data management systems. Plan should include an estimate of potential funding needs.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Steps 1 and 2 will be implemented sequentially, as funding becomes available.

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: TBD

PARTNERS



LEAD: TGLO; TRC

PARTNERS: CBBEP; EPA; Industry; NOAA; Pipeline companies; TCEQ; TPWD; Universities (e.g., TAMUCC, UTMSI)



Maritime Commerce 4.1

Continue to support the prevention of the introduction of non-native species through improved ballast water management.

The introduction of non-native species through ballast water discharges can result in catastrophic environmental impacts. Introduced species can dramatically alter the composition and function of biological communities and result in significant economic loss. Improvements have been made through the passage of a number of regulations designed to control the introduction of non-native species in ballast water, but continued support of the implementation of these regulations is needed.

STEP 1:

Support the implementation of the National Invasive Species Act locally by educating ship owners, charter parties, PICC, and vessel operators frequenting the project area about the potential impacts of ballast operations.

STEP 2:

Encourage participation of maritime community in invasive species forums.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Steps are considered ongoing and will be implemented throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$
POTENTIAL FUNDING: TBD

PARTNERS



LEAD: USCG; CBBEP
PARTNERS: CBBF; EPA; MANERR; NMFS; PCCA; PICC; Texas Sea Grant; TPWD; USFWS; Vessel owners and operators



DREDGING

Action Plan

GOAL

Ensure that all dredging activities are planned 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

D 1: Improve dredged material management practices.

ACTIONS

- D 1.1: Support the activities of the Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material as required.
- D 1.2: Support the approved (50 year) Dredged Material Management Plan and strategy for the Corpus Christi Ship Channel.
- D 1.3: Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, other navigation channels, channel subdivisions, private marine terminals, and private and public marinas.
- D 1.4: Develop a long-term (50 year) Regional Habitat Management Plan that utilizes dredged material from private and public sources.



Dredging 1.1

Support the activities of the Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material as required.

Dredged material has been used beneficially for shoreline stabilization and habitat creation projects throughout the Texas Coastal Bend. The availability of dredged material coupled with the need to dispose of it in an environment-friendly manner call for the formation of a Beneficial Uses Group (BUG) to recommend creative ways to beneficially use dredged material. The BUG will identify opportunities to increase the volume of dredged material that is put toward beneficial uses, such as habitat creation/renourishment with suitable dredged material or shore protection against erosive wave energy. The group will also work to identify potential funding sources to achieve these goals.

STEP 1: Support a Beneficial Uses Group (BUG) to guide development of a Beneficial Use Plan.	STEP 2: Assess the results of related research on beneficial uses of dredged material.	STEP 3: Identify potential funding sources for beneficial use projects and recycling incentives.
	STEP 4: Design and implement beneficial use projects.	STEP 5: Monitor the success of beneficial use projects.

STATUS



NEW: Beneficial Use Plan Implementation Group was established as part of the Corpus Christi Ship Channel Improvement Project, but the group is not actively meeting at this time. There is a need to re-establish this group, and use it as a model for a regional BUG that includes other interested partners throughout the Coastal Bend Region.

TIMEFRAME



Sediment management planning efforts that aim for long-term, statewide coordination of valuable sand and sediment materials are currently underway. Therefore, efforts to coordinate and implement local beneficial use projects should be a priority within the first five years of the Plan (2020-2025).

COST



ESTIMATED COST: Steps 1-3 = \$; Steps 4-5 = \$\$\$-\$\$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); Mitigation dollars; State and federal grants

PARTNERS



LEAD: CBBEP

PARTNERS: Dredging Industry; EPA; NMFS; PCAA; PICC; TCEQ; TGLO; TPWD; TWDB; TXDOT; USACE; USCG; USFWS

PERFORMANCE METRICS



1. Number of projects in the program area implementing beneficial use of dredged material.
2. Acres of habitat created/restored using dredge material.
3. Number of cubic yards of dredge material diverted from disposal sites.



Dredging 1.2

Support the approved (50 year) Dredged Material Management Plan and strategy for the Corpus Christi Ship Channel.

Dredging is an ongoing activity necessary to maintain navigable waterways for the support of maritime commerce along the Corpus Christi Ship Channel. Management plans for dredging activities and dredged material handling and disposal are essential to minimize impacts to natural resources. A long term (50 years) Dredged Material Management Plan (DMMP) was developed for the Corpus Christi Ship Channel as part of the Corpus Christi Ship Channel Improvement Project. Maintenance dredging has been evaluated for beneficial use feasibility and has identified and regularly places maintenance material for beneficial use (e.g., Pelican Island for rookery enhancement). Continued support of this established DMMP is needed.

STEP 1:

Increase public awareness that DMMP for the Corpus Christi Ship Channel is in place.

STEP 2:

Update the Corpus Christi Ship Channel DMMP as needed.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Step 1 is considered ongoing and will be implemented throughout the applicable life of the DMMP. Step 2 will take place as needed for dredging plans related to the Corpus Christi Ship Channel.

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: TBD

PARTNERS



LEAD: PCCA; CBBEP

PARTNERS: Conservation organizations (e.g., Audubon Texas, CCA, DU); BUG; Dredging industry; EPA; NMFS; PICC; TCEQ; TGLO; TPWD; TWDB; TXDOT; USACE; USCG; USFWS



Dredging 1.3

Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, other navigation channels, channel subdivisions, private marine terminals, and private and public marinas.

Dredging is an ongoing activity necessary to maintain navigable waterways for the support of maritime commerce and recreational boating along the Gulf Intracoastal Waterway, other navigation channels (e.g., La Quinta Channel, Aransas Channel, Lydia Ann Channel), channel subdivisions, private marine terminals, and private and public marinas. Management of dredging activities and dredged material handling and disposal is essential to minimize impacts to natural resources. There is currently no dredged material management plan in place for these areas, and there needs to be support for stakeholder collaboration on this type of plan.

STEP 1:

Coordinate, in conjunction with the USACE and ICTs, the development of an economically feasible, 50 year dredged material management plan (to be updated every five years). Ensure that the plan reflects the goal of using Best Management Practices for handling dredged materials, and focuses on minimizing environmental impacts during all stages of dredging operations.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Sediment management planning efforts that aim for long-term, statewide coordination of valuable sand and sediment materials are currently underway. Therefore, efforts to coordinate dredged material management planning for the GIWW and other navigation channels should be considered a priority within the first five years of Plan implementation (2020-2025). Planning for channel subdivisions, private marine terminals, and private and public marinas may require a longer timeframe (2020-2040).

COST



ESTIMATED COST: TBD
POTENTIAL FUNDING: TBD

PARTNERS



LEAD: TXDOT; USACE
PARTNERS: CBBEP; Conservation organizations (e.g., Audubon Texas, CCA, DU); Dredging industry; EPA; Local governments; Navigation districts; NMFS; PCCA, Residential developers; TCEQ; TGLO; TPWD; TWDB; USCG; USFWS



Dredging 1.4

Develop a long-term (50 year) Regional Habitat Management Plan that utilizes dredged material from private and public sources.

Dredging is an ongoing activity necessary to maintain navigable waterways and berthing facilities in the program area. There is often a lack of consensus about the benefits and adverse effects of dredging and placement of dredged material. The “CBBEP Maritime Commerce and Dredging Implementation Team” believes that an analysis (or consensus from resource agencies and the scientific community) identifying current ecological resource needs (e.g., more rookeries, more emergent marsh, more submerged aquatic vegetation, more reefs) could be used to help identify and prioritize uses for material, should it become available.

The recognition for the needed ecological resources could then be used as guidance for the development of a “Regional Habitat Management Plan” that identified specific projects that were acceptable and could be implemented with the use of dredged material. The primary focus of the Plan would be on habitat creation, habitat restoration, or conversion of one aquatic habitat type for another habitat type deemed to be of higher ecological and social value in order to meet resource management and societal needs and facilitate economic development. The Plan would also strive to reduce permit processing time by providing a pre-coordinated buy-in for regulatory/mitigation decisions. This Plan would be available for use by resource agencies and industrial users alike in planning for maintenance, growth, and development within the Coastal Bend area.

STEP 1:

Develop a consensus based comprehensive “Regional Habitat Management Plan” that identifies habitat enhancement, creation, and conversion opportunities in Coastal Bend area and includes opportunities created from future dredging and dredged material placement activities.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Regional planning efforts may be accomplished in a short timeframe (2020-2025) through coordination with current statewide sediment management planning efforts. However, these ongoing efforts should be evaluated to ensure they meet the needs described above. Otherwise, funding must be sought to implement an independent planning effort, which will require a longer timeframe (2020-2030).

COST



ESTIMATED COST: TBD
POTENTIAL FUNDING: TBD

PARTNERS



LEAD: CBBEP
PARTNERS: BUG; Conservation organizations (e.g., Audubon Texas, CCA, DU); EPA; Local governments; NMFS; PCCA; TCEQ; TGLO; TPWD; TWDB; TXDOT; USACE; USFWS; Universities (e.g., CCS, HRI, UTMSI)

CHAPTER

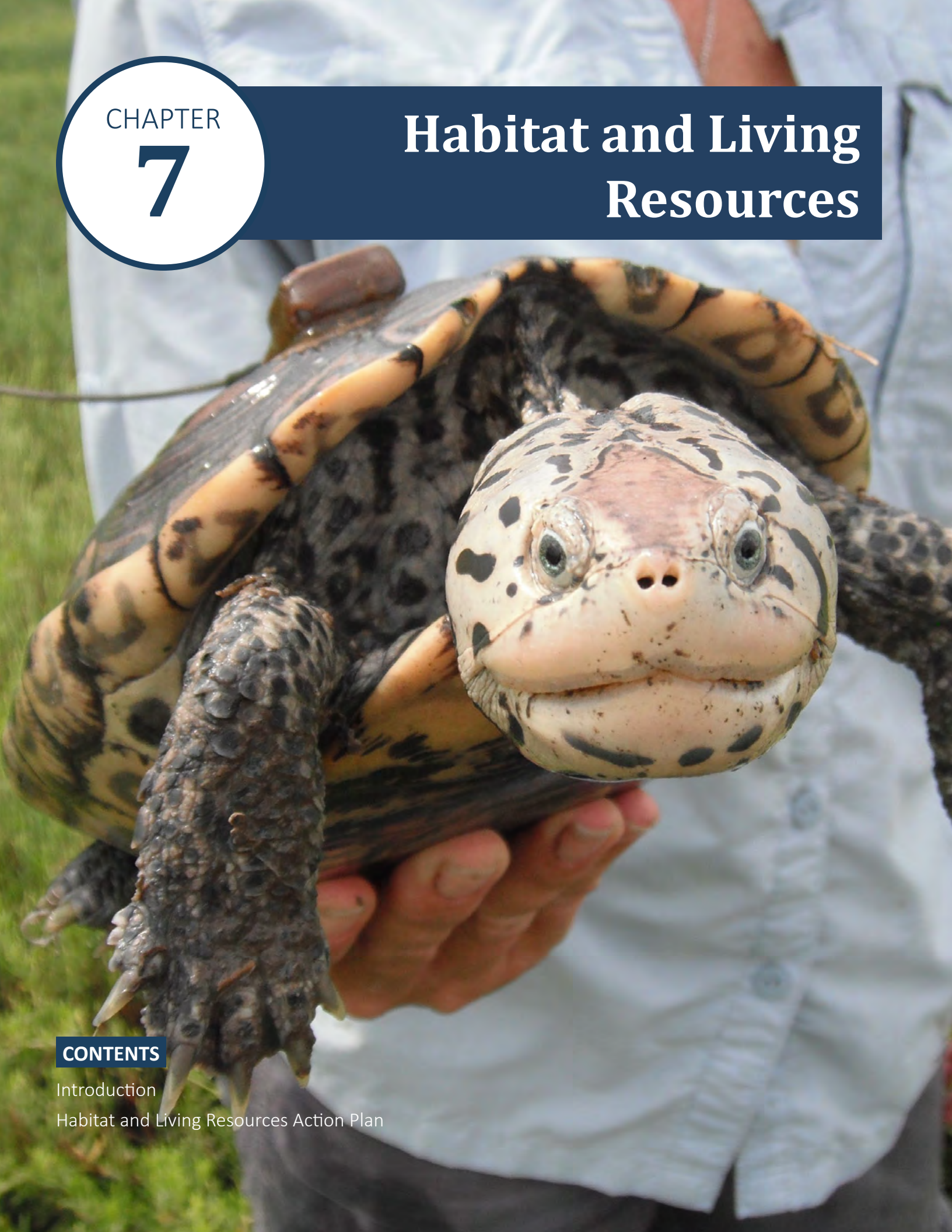
7

Habitat and Living Resources

CONTENTS

Introduction

Habitat and Living Resources Action Plan



Introduction

A diversity of tidally-influenced habitats is found within and adjacent to Coastal Bend bays and estuaries (Figure 14). These habitats and their populations of fauna and flora comprise ecosystems that are unique to South Texas. Recognizing that high quality, functional habitat is the foundation for a healthy bay system, *The Bays Plan, 2nd Ed.* adopts an 'ecosystems approach' to evaluate and implement the various conservation and management measures necessary to ensure long-term productivity of these resources.

High-Quality & Functional Habitats

The Coastal Bend is comprised of eight major tidally-influenced habitat types essential to native living resources and a productive estuarine ecosystem. These habitats are: (1) coastal marshes, (2) wind tidal flats, (3) seagrass meadows, (4) open bays, (5) oyster reefs, (6) serpulid worm reefs, (7) barrier islands, and (8) freshwater marshes. The CBBEP has worked to assess the status and trends of selected habitats and living resources and to evaluate strategies to ensure continued productivity for the three estuaries.

Although losses have been incurred by every type of habitat, offsetting gains have also taken place in some cases. For example, seagrass communities appear to be increasing in the Coastal Bend. Estuarine marshes are also increasing due to relative sea-level rise, where estuarine marshes spread into areas previously occupied by tidal flats. However, Coastal Bend palustrine (freshwater) marshes are decreasing due to barrier island development, agricultural practices on barrier islands, drier conditions and the landward movement of the salt/freshwater boundary. Wind tidal flats have suffered the most significant losses due to the expansion of seagrass beds and estuarine marshes as sea level rises.

Despite relatively small changes in the total acreage of most habitats, there is some evidence that stressors could affect the quality and functionality of certain habitat types. Changes in circulation patterns from freshwater inflow alteration, dredging and filling, shoreline alteration, sea level rise, and road construction have altered the hydrology of some areas. In addition, point and nonpoint source discharges can degrade habitat, as can activities associated with industrial activities and operations. For example, past (point source) brine discharges have

DIAMONDBACK TERRAPINS are a species of concern within Texas, and the CBBEP has funded several projects aimed at understanding the cause of their decline. (Photo by CBBEP)

degraded habitat at White's Point in Nueces Bay, and nonpoint source pollution from some urban stormwater outfalls has altered the chemistry of bay sediments and may have affected their biological communities. *The Bays Plan, 2nd Ed.* calls for efforts to identify habitat types that are most at risk and to work with landowners and local and state governments on ways to preserve sufficient, functional acreage of those habitats. Various tools can be employed to attain this goal, including the use of conservation easements, tax abatements, or land acquisition.

Habitat destruction, degradation, and fragmentation have been documented by various CBBEP-funded studies. Factors contributing to the loss of habitats include conversion to other land uses, dredge and fill activities, natural erosion, altered freshwater inflow, sea level rise, and degraded water quality. Declines in living resource populations relate to the loss, degradation, or fragmentation of essential habitats and, at times, over-exploitation. The development and implementation of site-specific plans for habitat enhancement, restoration, or creation will be pursued, again through cooperative efforts of landowners, local governments, and resource agencies with available technical and/or financial assistance. The following species of concern have been identified that would potentially benefit from the restoration, enhancement, creation, or better management of habitats: Whooping Cranes, neotropical migratory birds, colonial waterbirds, snowy and piping plovers, Texas diamondback terrapins, blue crabs, larval fish, and many others.

Survivability of Species

There are some cases where providing sufficient, high-quality habitat is not enough to ensure the survivability of a species. Other impacts, such as over-harvesting, invasion by non-native species, or decreased reproductive rates due to the persistence of a certain chemical in the environment, can be equally or more threatening to a given species. In such cases, a targeted species recovery or adaptive management plan is needed, and its actions put into full implementation throughout the species' range.

The Bays Plan, 2nd Ed. calls for a vigilant and continuing look at such species of concern (i.e., birds, aquatic species (including marine mammals and reptiles), and plants), and the development and implementation of adaptive management plans as necessary. Coupled with this action, stakeholders will work to improve the existing network of animal rescue and rehabilitation programs by supporting projects that maintain and improve existing programs in the Coastal Bend. Projects should focus on improving the survival of native animal species.

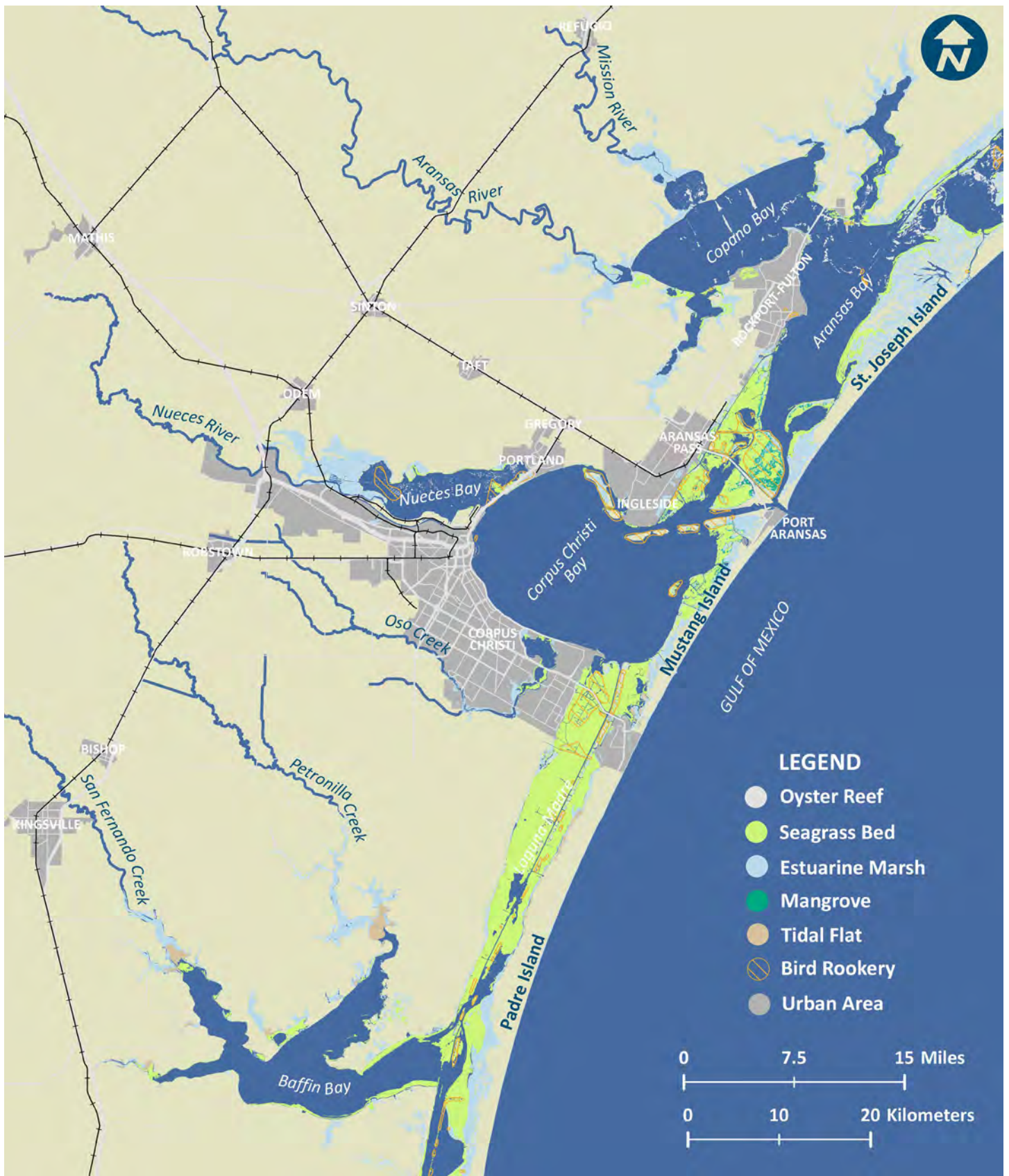


FIGURE 14. MAP OF ESTUARINE HABITATS AND BIRD ROOKERIES IN THE COASTAL BEND.



ACCOMPLISHMENT: Nueces Bay Marsh Restoration

The Nueces Bay Marsh was once a thriving bay ecosystem and essential habitat for juvenile fish, shrimp and crabs, as well as feeding grounds for bigger fish and birds. However, in the late 1940s, causeway construction and related dredging resulted in the loss of about 180 acres of marsh. Since then, studies show an additional 160 marsh acres have been lost due to erosion and subsidence. To restore the loss of marsh, the CBBEP began planning in 2005, and since that time, has been working to secure multiple funding partners for this major restoration effort. A project of this scale would not be possible without the support of multiple funding partners.

Constructing the marsh involved dredging bay sediment to form mounds, or terraces, at elevations suitable to grow smooth cordgrass. Smooth cordgrass marshes are typically inundated at high tide and remain partially wet at low tide.

Restoration was completed in four phases. The first phase created terraces and an outer berm. The second phase created additional marsh complex in the middle, and the third phase consisted of the outermost berm, placed with a rock revetment, to protect the project site and infrastructure. The fourth and final phase of the project involved putting the finishing touches on previous efforts, as well as building foundations in stewardship by inviting the public to get involved with volunteer plantings. An observation deck and educational signs will complete the project by providing public access and information about the marsh restoration project and restoring essential fish habitat, marsh communities, and the benefits to the surrounding infrastructure from the functions and values the marsh provides.

Other Management Issues & Needs

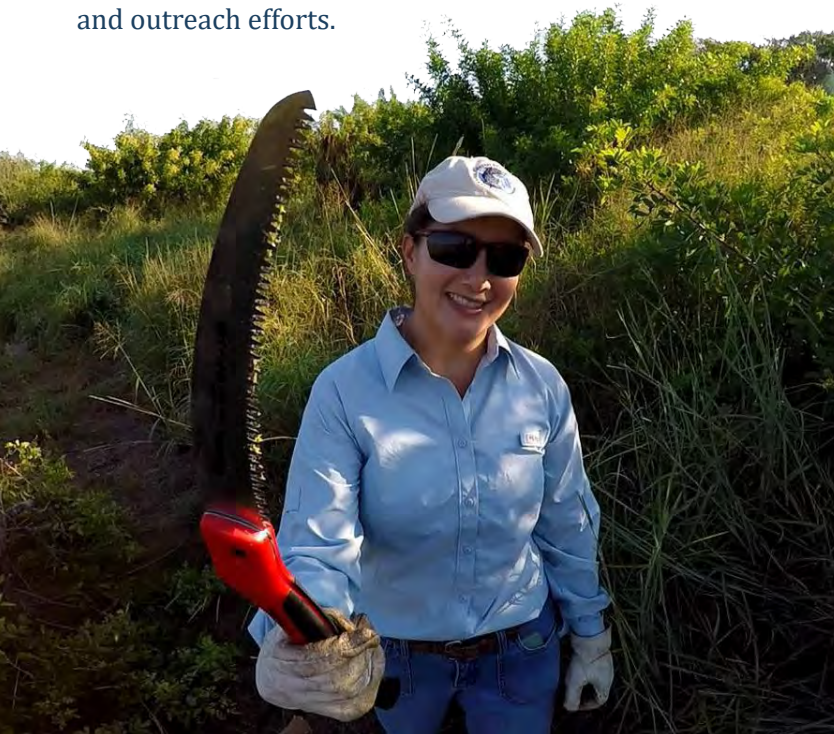
Catching and eating fish is fun and rewarding, but can also have a negative effect on fisheries resources. Fortunately, fish populations have a remarkable ability to replenish themselves, so that, within limits, they can be harvested on a continuing basis without being eliminated. However, as demands placed on our fisheries resources continue to increase, effective management strategies are needed to maintain their long-term stability and sustainability. Therefore, *The Bays Plan, 2nd Ed.* calls for the periodic evaluation of the major fisheries management issues within the Coastal Bend and the development of effective management strategies, such as acquisition of additional scientific research and monitoring data to evaluate population trends and development of appropriate fishing regulations.

There are numerous activities and operations that take place within the Coastal Bend bays and estuaries, generating major economic impacts both locally and outside the region. However, these activities and operations have the potential to affect coastal habitats adversely and the species they support, and they deserve at least some continued assessment and possible management action. In the Coastal Bend, seismic activity associated with oil and gas exploration, brine discharges linked to desalinization, wind farms, and expansion of liquid natural gas export and transportation have all prompted concern over their potential impacts to coastal resources. *The Bays Plan* calls for the CBBEP and its partners to evaluate and characterize the impacts of these activities and operations and to recommend appropriate Best Management Practices (BMPs) for avoiding, minimizing, and mitigating impacts to natural resources.

Algal blooms are considered harmful if they threaten human health, cause economic loss, or result in detrimental changes to an ecosystem. Unfortunately, scientists and resource managers have not yet solved all the mysteries of harmful algal blooms (HABs). Knowing with certainty their cause and reasons for perpetuation is a prerequisite to developing effective management strategies. Therefore, *The Bays Plan, 2nd Ed.* recognizes the need for continued experimental research to better understand the factors that trigger and sustain bloom development, and it also calls for additional research to determine the effects of toxins and secondary impacts on living coastal resources. Monitoring and public education programs also play a key role in managing public health and safety related to HABs, and Plan calls for continued efforts to monitor for the presence of HABs and to educate and inform the public.

Finally, the invasion of non-native species into native habitats can alter both habitat structure/function and disrupt or displace native species. Species that become invasive succeed due to favorable environmental conditions and a lack of natural predators, competitors, and diseases that normally regulate their populations. Invasive species are also costly, with major economic losses from damage to crops, fisheries, forests, and other resources being common. Numerous types of terrestrial and aquatic invasive species have been documented in the Coastal Bend, and there are several programs and organizations that are dedicated to preventing, monitoring, and controlling the spread of these species. *The Bays Plan, 2nd Ed.* calls for support of these existing programs and organizations and their efforts to document the distribution and ecological impacts of invasive species. It also recognizes the need to identify techniques and practices to control invasive species and implement demonstration projects as appropriate.

THE TEXAS GULF REGION COOPERATIVE WEED MANAGEMENT AREA was formed to address invasive Brazilian peppertree (*Schinus terebinthifolius*) from Port O'Connor to Packery Channel on the Texas Gulf Coast. The CBBEP has joined local, state, and federal partners in their efforts to prevent the spread and movement of the species by advocating for cooperative control amongst willing landowners and managers. Beyond removal efforts, the group is focused on establishing baseline distribution data, and raising awareness of Brazilian peppertree impacts to our landscapes through education and outreach efforts.

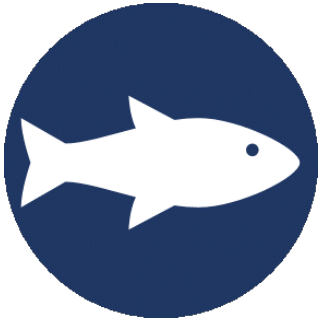


ACCOMPLISHMENT: Matagorda Island Restoration

In 2016, the CBBEP completed the Matagorda Island Restoration Project. The project was funded by the U.S. Fish and Wildlife Service through a General Land Office Coastal Impact Assistance Program grant and by the Coastal Conservation Association of Texas. This five-year project involved four levee removals, two culvert repairs, and one new culvert, and was designed to restore water flow and circulation, improving water quality and increasing wildlife abundance and diversity to 2,300 acres of emergent estuarine marsh.

In the 1950's, thousands of acres of estuarine marsh on Matagorda Island were negatively impacted when large portions of the marsh were sectioned off with constructed levees so they could be drained for cattle production. The area remained in this condition until the late 1970's, when several dozen culverts were installed to restore the natural hydrology. Many of these culverts have collapsed or become clogged, to the point where tidal exchange in the marsh was severely restricted or eliminated, impairing water quality and negatively impacting habitats.

Removal of the levees and culvert repairs began in 2011. Restoration projects in remote reaches like this one have many challenges, but thanks to the vigilant efforts of contractors and partners, 2,300 acres of marsh are benefiting from this five-year effort. Visits to the site have shown that it is now teeming with fish and wildlife, Whooping cranes use the area to feed, and the water was flowing freely.



HABITAT AND LIVING RESOURCES

Action Plan

GOAL

Increase and preserve the quantity, quality, and diversity of habitats and living resources.

OBJECTIVES

HLR 1: Preserve, restore, enhance, and create coastal habitats.

HLR 2: Ensure long-term sustainability of native living resources.

ACTIONS

HLR 1.1: Preserve functional, natural habitats of all major types.

HLR 1.2: Restore and enhance degraded habitats and create new habitats where feasible.

HLR 1.3: Support efforts to identify and minimize adverse impacts of activities and operations on coastal habitats.

HLR 2.1: Develop and implement adaptive management plans to ensure sustainability for species of concern.

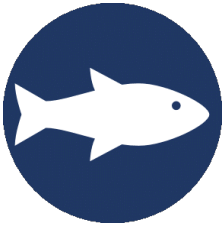
HLR 2.2: Support rescue and rehabilitation programs of native animal species.

HLR 2.3: Support effective commercial and recreational fisheries management.

HLR 2.4: Support efforts to identify and minimize adverse impacts of activities and operations on coastal living resources.

HLR 2.5: Improve understanding of harmful algal blooms and their impact on living resources.

HLR 2.6: Develop and support adaptive management plans to minimize introductions and impacts from invasive species.



Habitat and Living Resources 1.1

Preserve functional, natural habitats of all major types.

The Coastal Bend is comprised of eight major tidally-influenced habitat types essential to native living resources and a productive estuarine ecosystem. These habitats are coastal marshes, wind tidal flats, seagrass meadows, open bays, oyster reefs, serpulid worm reefs, barrier islands, and freshwater marshes. Estuaries and their associated habitats offer numerous and diverse benefits to society and natural systems. Some of these benefits include: storm buffers to protect from hurricanes and storms; nurseries and habitat for commercially important marine species; and stopover or wintering habitats for migratory species such as the endangered Whooping Crane. However, human growth and development has significantly eliminated or degraded the habitats that provide these important values. The continued preservation of these habitats is fundamental to the health and productivity of the native flora and fauna. CBBEP and its partners will work to identify habitat types and areas that are most at risk and work with landowners and local and state governments on ways to preserve sufficient, functional acreage of those habitats. Various tools can be employed to attain this goal, including the use of conservation easements, tax abatements, or land acquisition.

STEP 1:

Use publicly available mapping platforms to identify and inventory the current location and protection status of all natural habitat types within the project area.

STEP 2:

Prioritize habitat types and geographic areas based on needs, stressors, and threats, taking into account current and future impacts such as climate change and coastal development.

STEP 3:

Support efforts and activities to preserve priority habitats and areas through conservation easements, acquisition, or other preservation techniques.

STEP 4:

Conduct annual update of progress made towards preserving natural habitat and review prioritization based on current conditions.

STATUS



UNDERWAY: Land acquisition for protection is one of the most economical methods of conservation. Currently, the CBBEP owns approximately 13,000 acres (in fee title ownership and conservation easements) of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management in the Coastal Bend.

TIMEFRAME



Steps 1 and 2 will occur within the first five years of the planning time frame (2020-2025). Step 3 will be implemented as funding becomes available throughout the applicable life of this plan (2020-2040), and Step 4 will occur every year following the completion of Step 1.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic Funds (EPA 320 funds, TCEQ, Local funds); RESTORE Act; TGLO; TSSWCB; USFWS; NRCS; Private Foundations

PARTNERS



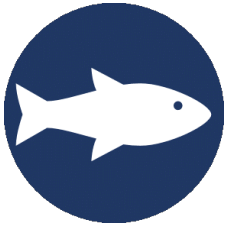
LEAD: CBBEP

PARTNERS: Audubon Texas; CBBF; DU; Landowners; Land trusts (e.g., CBLT, GBRT); Local governments; MANERR; NRCS; PCCA; SABP; SWCDs; TGLO; TNC; TPWD; TSSWCB; Universities (e.g., CCS, HRI, UTMSI); USGS; USFWS

**PERFORMANCE
METRICS**



1. Percentage of total acres protected by habitat in project area.
2. Number of inventories, prioritizations, and annual updates produced.



Habitat and Living Resources 1.2

Restore and enhance degraded habitats and create new habitats where feasible.

Estuarine habitat destruction, degradation, and fragmentation have been documented within the Coastal Bend. This habitat loss has resulted in the decline of several living resources. Factors contributing to the loss of habitats include conversion to other land uses, dredge and fill activities, natural erosion, altered freshwater inflow, degraded water quality, and sea level rise. Species of concern that would potentially benefit from the restoration, enhancement, creation, or better management of estuarine habitats include: Whooping Cranes, neotropical migratory birds, colonial waterbirds, shrimp, blue crabs, larval fish, and many others. By working cooperatively with landowners, local governments, and resource agencies, CBBEP and its partners can identify and pursue opportunities that will create additional habitat for these species of concern.

STEP 1:

Identify habitat types and geographic areas for potential restoration, enhancement, and creation projects.

STEP 2:

Prioritize habitat types and geographic areas based on needs, stressors, and threats, taking into account current and future impacts such as climate change and coastal development.

STEP 3:

Support efforts and activities to implement site-specific plans for restoration and enhancement of degraded habitats and/or creation of new habitats.

STEP 4:

Develop and implement monitoring plans for restored, enhanced or created habitats to assess habitat function improvements.

STEP 5:

Conduct annual update of progress made towards restoring, enhancing, and creating habitat and review prioritization based on current conditions.

STATUS



UNDERWAY: The CBBEP continues to restore and enhance habitat where feasible. The CBBEP has recently acquired funding to provide shoreline protection and preserve coastal habitat along the western shoreline of Nueces Bay, as well as the shoreline of Blackjack Peninsula in San Antonio Bay. The CBBEP is also currently working to protect and restore the Nueces Bay Rookery Islands, Causeway Island, Triangle Tree Island, Tern Island, and San Antonio Bay Island.

TIMEFRAME



Steps 1 and 2 will occur within the first five years of the planning time frame (2020-2025). Step 3 will be implemented as funding becomes available throughout the applicable life of this plan (2020-2040), and Step 4 will occur every year following the completion of Step 1.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic Funds (EPA 320 funds, TCEQ, Local funds); RESTORE Act; TGLO; USFWS

PARTNERS



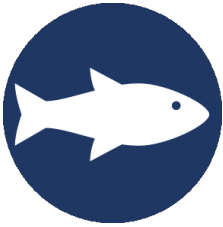
LEAD: CBBEP

PARTNERS: Audubon Texas; CBBF; CCA; DU; Landowners; Land trusts (e.g., CBLT, GBRT); Local governments; MANERR; NRCS; PCCA; SABP; SWCDs; TGLO; TNC; TPWD; TSSWCB; Universities (e.g., CCS, HRI, UTMSI); USGS; USFWS

PERFORMANCE METRICS



1. Percentage of total acres restored, enhanced, and created by habitat in project area.
2. Number of inventories, prioritizations, and annual updates produced.



Habitat and Living Resources 1.3

Support efforts to identify and minimize adverse impacts of activities and operations on coastal habitats.

Coastal Bend bays and estuaries directly support numerous activities and operations that generate economic impacts, including navigation, transportation, extraction, and recreation. These activities and operations have a major impact on the local economy as well as economic impacts outside the region. However, these activities and operations also have the potential to adversely affect coastal habitats and the species they support. In the Coastal Bend, seismic activity associated with oil and gas exploration, brine discharges linked to desalinization, wind farms, and expansion of liquid natural gas export and transportation have all prompted concern over potential impacts to coastal resources. To avoid, minimize, and mitigate impacts to natural resources from these and other activities/operations, resource agencies must be able to effectively evaluate/characterize impacts and recommend appropriate Best Management Practices (BMPs).

STEP 1:

Develop a working group to identify and prioritize adverse impacts on coastal habitats from proposed and existing activities and operations.

STEP 2:

Establish a baseline for determining habitat impacts from activities/operations by quantifying and characterizing the key components of coastal habitats.

STEP 3:

Identify stakeholders impacted by loss and/or degradation of habitat.

STEP 4:

Examine alternative strategies and mitigation options to reduce adverse impacts.

STEP 5:

Develop BMPs that can provide guidance for minimizing habitat impacts from activities and operations.

STEP 6:

Conduct outreach and education to stakeholders on BMPs, targeting groups that are potentially involved in impacts.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CMP; NRDA; RESTORE Act; USFWS

TIMEFRAME



Step 1 will occur within the first five years of the planning time frame (2020-2025). Steps 2-6 will be implemented sequentially as funding becomes available throughout the applicable life of this plan (2020-2040).

PARTNERS



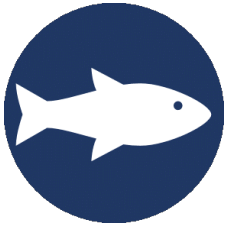
LEAD: Steps 1-3 = CBBEP; Steps 4-5 = TGLO; TPWD

PARTNERS: Audubon Texas; CCS; EPA; HRI; MANERR; NMFS; PCCA; PICC; TCEQ; TNC; USACE; USFWS; USGS; UTMSI

PERFORMANCE METRICS



1. Number of BMPs developed.
2. Number of BMPs implemented.
3. Number of groups/individuals reached in outreach efforts.



Habitat and Living Resources 2.1

Develop and implement adaptive management plans to ensure sustainability for species of concern.

A number of species within the Coastal Bend exhibit declining population trends. The cause for these declines varies by species, but may be due to such factors as habitat loss, human disturbance, predation, and over-harvesting. In such cases, a targeted recovery or management plan for each species of concern is needed, and whenever possible, its actions should be put into full implementation throughout the species' range.

STEP 1:

Establish working group to develop criteria for defining "species of concern."

STEP 2:

Develop management plans for species of concerns.

STEP 3:

Determine methods to support implementation of management plans developed for species of concern.

STATUS



UNDERWAY: The CBBEP seeks to maintain viable populations of native species. Effective species management is largely sustained through preserving and restoring habitat, protecting water quality, along with other actions. Yet, special attention should be given to declining species of concern. The CBBEP has recently funded studies to identify Texas diamondback terrapin (*Malaclemys terrapin littoralis*) nesting sites in the Nueces and Mission-Aransas estuaries. The Texas diamondback terrapin is listed as a Species of Greatest Conservation Need by TPWD. The results of these studies will be incorporated into a comprehensive management plan for the species in Texas. The CBBEP is also working with the American Bird Conservancy to determine breeding and nesting patterns for Wilson's and Snowy Plovers on Mustang Island, both species of concern. The CBBEP has also partnered with USFWS's Monarch Conservation Strategy to restore and enhance habitat in the eastern population's central flyway.

TIMEFRAME



Step 1 will be completed in 2020-2025 and will be re-implemented every five years. Steps 2 and 3 will be implemented following the completion of Step 1 and will continue to be implemented annually throughout the applicable life of this plan.

COST



ESTIMATED COST: Step 1 = \$; Step 2 = \$ - \$\$ (varies by project type); Step 3 = \$\$ - \$\$\$ (varies by project type)

POTENTIAL FUNDING: American Bird Conservancy; CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); Private industry; State and federal grants; Private industry

PARTNERS



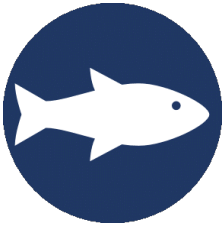
LEAD: Step 1 = CBBEP, TPWD, USFWS; Step 2 = CBBEP, Universities (e.g., CCS, HRI, UTMSI); Step 3 = CBBEP

PARTNERS: Conservation organizations (e.g., Audubon Texas, CCA, DU, ICF); MANERR; NMFS; NPS; TGLO; TNC

PERFORMANCE METRICS



1. Number of species management plans developed.
2. Number of management actions implemented from species management plans.



Habitat and Living Resources 2.2

Support rescue and rehabilitation programs of native animal species.

Animal rescue and rehabilitation programs decrease animal mortality, provide important information on species of concern, and increase public awareness about the estuarine and marine environment. However, these programs are often poorly funded and must rely on the use of volunteers and borrowed facilities. As a result, continued support for these programs and their facilities is needed.

STEP 1:

Support the implementation of projects that maintain and improve existing animal rescue and rehabilitation programs in the Coastal Bend. Projects should focus on improving the survival of native animal species.

STATUS



UNDERWAY: The CBBEP is currently working with the MANERR to create public access and educational trails and signage for portions of the Amos Rehabilitation Keep (ARK) located on the campus of the University of Texas Marine Science Institute in Port Aransas, Texas. The CBBEP will continue to support rehabilitation efforts.

TIMEFRAME



Projects will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040). Potential projects to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: TBD

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); NRDA; Private industry; RESTORE Act; State and federal grants

PARTNERS



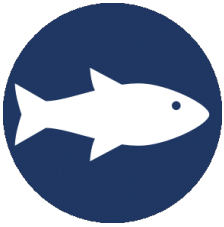
LEAD: CBBEP

PARTNERS: ARK; Conservation groups; MANERR; NMFS; NPS; PINS; STSSN; TMMSN; TPWD; TSA; USFWS; UTMSI

PERFORMANCE METRICS



1. Number of CBBEP-supported projects at animal rescue and rehabilitation programs.



Habitat and Living Resources 2.3

Support effective commercial and recreational fisheries management.

Many people once believed that fisheries resources were unlimited and could not be impacted by commercial or recreational harvest. As recreational fishing pressure and demands for commercial fisheries resources increased, it became increasingly clear that these resources could be affected. As demands placed on our fisheries resources continue to increase, effective management strategies are needed to maintain the long-term stability and sustainability of our fisheries. Coastal fisheries management strategies should strive (1) to maintain fisheries harvest at levels that are necessary to ensure replenishable stocks of commercially and recreationally important species and (2) to provide for balanced food webs within ecosystems. Management strategies should not remain static and must evolve as social and ecological conditions change. Development of effective management strategies requires scientific research and monitoring data to evaluate population trends and develop appropriate fishing regulations.

STEP 1:

Form a working group to periodically identify the major fisheries management issues in coastal bays (e.g., bycatch, overfishing, and habitat degradation).

STEP 2:

Examine TPWD fisheries monitoring data to better understand major management issues identified in previous step.

STEP 3:

Examine current TPWD and NMFS regulations to determine if there is a need to change regulations or gather additional data.

STEP 4:

Determine if additional research, outreach, strategic plan, or regulation changes are needed based on the management issue.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Once the Plan is approved, Step 1 will be completed every two years. Steps 2-4 will be implemented sequentially following the completion of Step 1.

COST



ESTIMATED COST: TBD

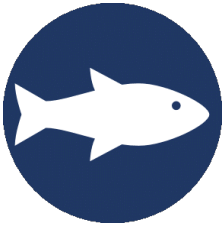
POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CCA; CMP; NMFS; TPWD; Texas Sea Grant; SEA

PARTNERS



LEAD: Steps 1 and 4 = CBBEP; Steps 2 and 3 = TPWD

PARTNERS: CCA; Commercial fishing industry (e.g., blue crab, oysters, black drum); NMFS; Recreational fishing guides; SEA; Texas Sea Grant; Universities (e.g., CCS, HRI, TAMUCC, UTMSI)



Habitat and Living Resources 2.4

Support efforts to identify and minimize adverse impacts of activities and operations on coastal living resources.

Coastal Bend bays and estuaries directly support numerous activities and operations that generate economic impacts, including navigation, transportation, extraction, and recreation. These activities and operations have a major impact on the local economy as well as economic impacts outside the region. However, these activities and operations also have the potential to adversely affect coastal species. In the Coastal Bend, seismic activity associated with oil and gas exploration, brine discharges linked to desalinization, wind farms, expansion of liquid natural gas export and transportation, and impingement/entrainment of organisms by cooling water intakes have all prompted concern over their potential impacts to coastal resources. To avoid, minimize, and mitigate impacts to natural resources from these and other activities and operations, resource agencies must be able to effectively evaluate and characterize impacts and recommend appropriate Best Management Practices (BMPs).

<p>STEP 1: Develop a working group to identify and prioritize adverse impacts on coastal living resources from proposed and existing activities and operations.</p>	<p>STEP 2: Establish a baseline for determining impacts by quantifying species abundance.</p>	<p>STEP 3: Identify stakeholders impacted by loss and/or degradation of species.</p>
<p>STEP 4: Examine alternative strategies and mitigation options to reduce adverse impacts.</p>	<p>STEP 5: Develop BMPs that can provide guidance for minimizing species impacts from activities and operations.</p>	<p>STEP 6: Conduct outreach and education to stakeholders on BMPs, targeting groups that are potentially involved in impacts.</p>

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

COST



ESTIMATED COST: \$
POTENTIAL FUNDING: CMP; NRDA; RESTORE Act; USFWS

TIMEFRAME



Step 1 will occur within the first five years of the planning time frame (2020-2025). Steps 2-6 will be implemented sequentially as funding becomes available throughout the applicable life of this plan (2020-2040).

PARTNERS

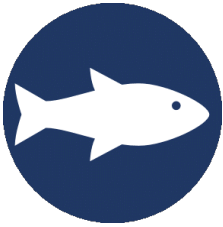


LEAD: Steps 1-3 = CBBEP; Steps 4-5 = TGLO, TPWD
PARTNERS: Audubon Texas; CCA; CCS; HRI; EPA; MANERR; NMFS; PCCA; PICC; TCEQ; TNC; SEA; USACE; USFWS; USGS; UTMSI

PERFORMANCE METRICS



1. Number of BMPs developed.
2. Number of BMPs implemented.
3. Number of groups/individuals reached in outreach efforts.



Habitat and Living Resources 2.5

Improve understanding of harmful algal blooms and their impact on living resources.

Harmful Algal Bloom (HAB) is a term that refers to the bloom phenomenon of a few microscopic algae that often produce potent toxins which can threaten human health, cause economic loss, and result in detrimental changes in an ecosystem. Although much scientific attention has been given to HABs, effective management measures are as yet unknown. Additional research is needed to develop a better understanding of the population dynamics and trophic impacts of harmful algal species, which can then be used as a basis for management strategies that help to minimize adverse effects on the economy, public health, and estuarine/marine ecosystems. Monitoring programs also play a key role in managing public health and safety related to HABs. These programs provide the information resource managers need to issue timely health advisories to the public and require continued support.

STEP 1:

Support the HAB Working Group's efforts to notify the public about the occurrence of HABs in a timely manner in order to minimize human health risks.

STEP 2:

Support efforts to monitor coastal waters to assess critical concentrations of HAB bloom activity.

STEP 3:

Conduct experimental research to better understand the factors that trigger and sustain HAB bloom development. In addition, determine the effects of toxins and secondary impacts on living coastal resources.

STEP 4:

Support efforts to inform and educate the public on HAB ecology and impacts to the coastal ecosystem/human health.

STATUS



UNDERWAY: The CBBEP participates with the HAB Working Group and receives information regarding current Harmful Algal Blooms from the TPWD Kills and Spills Team. CBBEP staff provides information to the public as needed.

TIMEFRAME



All steps are considered ongoing and will be implemented as funding becomes available throughout the applicable life of this plan (2020-2040). Potential new projects and programs to be implemented will be evaluated as part of the CBBEP's Annual Work Plan development process, which occurs every year.

PARTNERS



LEAD: Step 1 = TPWD; Step 2 = TAMU, UTMSI; Step 3 = Universities; Step 4 = MANERR, TPWD

PARTNERS: CBBEP; CBBF; CCS; HRI; TAMUCC; USFWS

COST



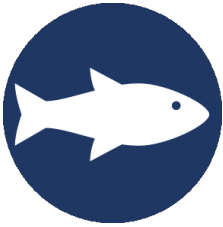
ESTIMATED COST: Steps 1, 2, and 4 = \$; Step 3 = \$\$ - \$\$\$ (varies by project)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CCA; CMP; NMFS; TPWD; Texas Sea Grant; SEA

PERFORMANCE METRICS



1. Number of studies focused on HAB dynamics, long-term associations with regional climate, and human health risks.
2. Number of brochures, pamphlets, presentations, etc. created that include information about HABs.



Habitat and Living Resources 2.6

Develop and support adaptive management plans to minimize introductions and impacts from invasive species.

An invasive species grows, reproduces, and spreads rapidly; establishes itself over large areas; and persists for long periods of time. Species that become invasive succeed due to favorable environmental conditions and a lack of natural predators, competitors, and diseases that normally regulate their populations. This includes a wide variety of plants, insects, and animals from exotic places. Invasion of non-native species can alter both habitat structure and function, resulting in the displacement of native flora and fauna. In addition to negatively impacting ecosystems, invasive species are also costly. It is very expensive to prevent, monitor, and control the spread of invasive species, and economic losses from damage to crops, fisheries, forests, and other resources are common. Invasive species are present in many of the terrestrial and aquatic habitats of the Texas Coastal Bend. Efforts by CBBEP and its partners to treat and control the spread of these invasive species are underway and continued support is needed.

STEP 1:

Identify the distribution and ecological impacts associated with existing invasive and nuisance species.

STEP 2:

Identify techniques for the treatment and control of current and potential invasive/nuisance species, and conduct demonstration projects to determine the effectiveness of these techniques.

STEP 3:

Implement treatment and control methods (including public education) through existing programs and organizations.

STATUS



UNDERWAY: The CBBEP and its partners seek to maintain viable populations of native species and to manage invasive species effectively. The CBBEP is an active member of the Texas Gulf Region Cooperative Weed Management Area and works with the CWMA stakeholders to prevent the spread and movement of Brazilian Peppertree by advocating for cooperative control amongst willing landowners and managers. The CBBEP Coastal Bird Program staff also manage invasive species on rookery islands in the bays and waterways along the Texas coast. Many of the colonial waterbird species in Texas have seen dramatic declines, partly because of the loss and degradation of vital nesting habitat.

TIMEFRAME



Steps 1 and 2 will be implemented sequentially once funding is available. Step 3 is considered on-going and will be implemented throughout the life of this plan (2020-2040).

COST



ESTIMATED COST: Steps 1 and 2 = \$\$; Step 3 = \$\$ - \$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; Local governments; NFWF; RESTORE Act; TFS; TPWD; USFWS

PARTNERS



LEAD: Step 1 = Lady Bird Johnson Wildflower Center; Step 2 = Land owners, Universities; Step 3 = Land owners, Local governments

PARTNERS: CBBEP; CCS; Conservation groups; MANERR; NMFS; TAES; TAMUCC; TFS; TGLO; TGR-CWMA; TPWD; USFWS; UTMSI

**PERFORMANCE
METRICS**



1. Number of control programs developed and implemented.
2. Number of acres treated.
3. Number and distribution of invasive and nuisance species.

CHAPTER

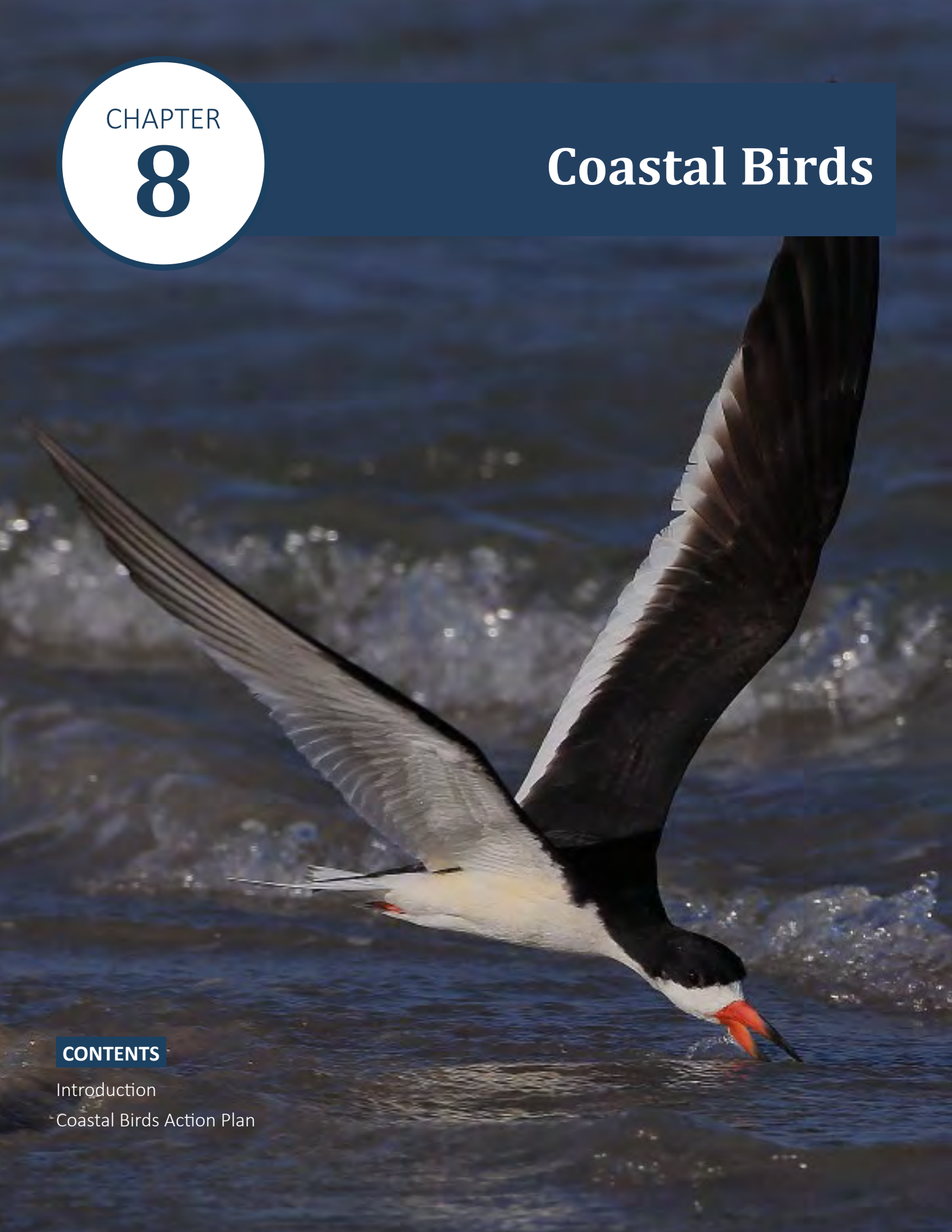
8

Coastal Birds

CONTENTS

Introduction

Coastal Birds Action Plan





ACCOMPLISHMENT: Migratory Connectivity Project

The CBBEP Coastal Bird Program participated in an initiative called the Migratory Connectivity Project, led by the Smithsonian Conservation Biology Institute's Migratory Bird Center. As a project partner, the CBBEP was involved in tagging and placing satellite transmitters on 10 Long-billed Curlews during Spring 2016 - nine birds were tagged in the Coastal Bend, and one very special bird in Georgia.

Long-billed curlews are a highly migratory bird species that spend winters on the warm shores of the Gulf Coast and southeastern United States, California, and Mexico, and migrate north to the grasslands of the Great Plains and Great Basin to breed. Conserving migratory birds poses unique challenges since they often depend on numerous sites spread over several continents. With advances in technology like the satellite transmitters, researchers can now gain a great amount of information from a relatively small number of birds. The transmitters allow the birds to be tracked in near real-time, and provide connectivity information, such as migratory pathways, locations of stop-over and wintering areas, and the similarity (or dissimilarity) among individuals.

Prior to leaving on their migration, the satellite transmitters were able to report the birds local movements here in the Coastal Bend, which revealed that some of the birds used CBBEP's Nueces Bay Marsh Restoration Site and the Nueces Delta Preserve. Once migration is complete, the information provided by the satellite transmitters will be analyzed and ultimately help focus conservation efforts where needed for this species. This project was funded in part by the ConocoPhillips Charitable Investment Global Signature Program.

Introduction

The South Texas coast is one of the most unique areas in North America and is renowned for its exceptional bird life. This is attributable to a suite of fortunate circumstances: (1) its prime position in the central flyway and a crossroads for many migrants that span two hemispheres, (2) the uniqueness and productivity of the barrier island, lagoon, and coastal prairie habitats, and (3) the protection afforded to these landscapes by federal and state entities as well as private landowners who maintain working landscapes that preserve critical ecological functions.

The Coastal Bend bays are home to an entire guild of birds that are known for their beauty and were once hunted near to the brink of extinction. These birds – pelicans, herons, spoonbills, terns, skimmers and many others – made easy targets during the breeding season, when they gather in dense colonies on small islets in the middle of the bays and lagoons to breed. After legal protections at the turn of the 20th century assisted the birds in a strong recovery, the birds began to decline again in the latter half of that century.

The CBBEP Coastal Bird Program originated in 2001 with the goal of reversing regional declines and restoring waterbird populations by addressing known threats and causes of decline, closely monitoring waterbird populations, and promoting waterbird conservation by engaging the public through education and outreach. Since then, the Coastal Bird Program has worked on hundreds of islands throughout the Texas coast, while focusing most of their management efforts in the central and lower part of the Texas coast. The Coastal Bird Program has worked to identify causes of declines, develop methods for addressing those causes, and engage the public by implementing successful outreach programs. *The Bays Plan, 2nd Ed.* calls for the Coastal Bird Program to continue implementing successful waterbird management strategies, such as rookery island habitat management, population monitoring, and education and outreach.

Conservation of highly migratory shorebird species has become an area of increased focus over the past five years. The CBBEP Coastal Bird Program has conducted numerous research projects on the abundance, distribution, nest success, habitat usage, migratory connectivity, and other aspects of this highly dynamic

◀ **BLACK SKIMMER** populations are declining along the Texas coast, and the Coastal Bird Program is conducting research to determine the causes of the declines.

group of birds. These projects have been conducted both with in-house staff as well as in conjunction with national and international partners in Canada, Mexico and beyond. This level of coordination and cooperation among researchers and biologists is essential to foster conservation through a better understanding of habitat requirements throughout the full annual cycle. *The Bays Plan, 2nd Ed.* calls for the Coastal Bird Program to serve as an anchor point for research projects focused on highly migratory shorebird species that utilize the Central Flyway and visit the Coastal Bend.

THE CBBEP COASTAL BIRD PROGRAM has been experimenting for over 15 years with a range of traditional and novel vegetation management methods to increase the available structure needed for successful nesting by wading birds. The Program has developed a full arsenal of equipment and knowledge to address the unique challenges of vegetation management on small islands with unique soils and highly variable rainfall. Staff collaborate with Texas Master Naturalists to grow the types of salt- and drought-tolerant shrub species that provide the structure necessary for wading birds.



ACCOMPLISHMENT: Expanding the Motus Network

Each spring, migratory birds fly from their wintering grounds in the south to their Arctic breeding grounds, sometimes travelling up to 14,000 thousand kilometers one-way. The productivity of our bays and estuaries makes the Coastal Bend a prime location for these travelers to stop and find nourishment during this long journey. As a result, many of the species we see on our beaches and tidal flats during the spring are not actually Coastal Bend residents - they are migratory birds like Sanderlings and Red Knots fueling up to travel to their breeding grounds.

On their journey these little birds face threats from both natural and human-caused sources including exhaustion, starvation, collisions, predators, disease, pollution, natural disasters and hunting to name a few. Declining populations have led to increased focus on conservation of these species in recent years. Their migratory nature, however, makes monitoring and understanding threats to populations more challenging.

To tackle this issue the CBBEP's Coastal Bird Program installed the first array of Motus telemetry stations in the Spring of 2015 along the Gulf Coast as part of a project to document shorebird migration along the Central Flyway through the Gulf of Mexico and the Prairie Pothole region. The CBBEP stations join a network of more than 300 other receiving stations that are a part of the Motus Wildlife Tracking System, a program of Bird Studies Canada in partnership with collaborating researchers and organizations. Each telemetry station can detect signals from active tags at distances of up to 15 km. When combined, this array can track animals across a diversity of landscapes covering thousands of kilometers.



COASTAL BIRDS

Action Plan

GOAL

Conserve coastal birds and the habitats they depend upon in the Coastal Bend of Texas.

OBJECTIVES

CB 1: Reverse population declines in colonial nesting waterbirds in the Coastal Bend.

CB 2: Advance the conservation of highly migratory shorebirds through research, monitoring, and stewardship.

ACTIONS

CB 1.1: Implement successful waterbird management actions to reverse declines in colonial nesting waterbirds in the Coastal Bend.

CB 2.1: Conduct conservation-oriented monitoring and management actions to benefit shorebird species that utilize the Central Flyway and visit the Coastal Bend.



Coastal Birds 1.1

Implement successful waterbird management actions to reverse declines in colonial nesting waterbirds in the Coastal Bend.

Colonial nesting waterbird species like herons, egrets, terns, skimmers, and pelicans nest in dense colonies on small, isolated islands along the Texas coast. While these islands offer colonies protection from predators, they are also threatened by erosion, heavy storms, exotic/invasive vegetation, sea level rise, coastal development, and chronic disturbance from an ever-growing human population. Legal protection allowed these populations to begin to recover after being hunted to near extinction at the turn of the 20th century, but more recent long-term data now suggest that many colonial waterbird populations in Texas have experienced declines of up to 75% since the early 1970's.

The CBBEP Coastal Bird Program originated in 2001 with the goal of reversing regional declines and restoring waterbird populations by addressing known threats and causes of decline, closely monitoring waterbird populations, and promoting waterbird conservation by engaging the public through education and outreach. The Coastal Bird Program has primarily focused its work in the Coastal Bend of Texas, within the CBBEP boundary, but has recently expanded to include the lower Laguna Madre, ensuring contiguous management and protection for rookery island habitat throughout the central and southern portions of the Texas coast. Working with a diverse set of partners, the Coastal Bird Program maintains an adaptive and innovative approach to waterbird conservation and continues to work towards its initial goal of restoring colonial waterbird populations.

STEP 1:

Manage and protect rookery island habitat throughout the program area. Management activities may include, but are not limited to: native vegetation propagation, treatment and removal of exotic vegetation, removal of harmful nest predators, and installation of protective signage.

STEP 2:

Monitor population trends of nesting colonial waterbirds. If necessary, identify potential causes of declines and develop management strategies to address those causes.

STEP 3:

Engage the public through dedicated education and outreach efforts to raise awareness of colonial waterbirds and the conservation actions citizens can take to support population recovery efforts.

STEP 4:

Support efforts to restore and enhance existing rookery islands and/or create new islands.

STEP 5:

Maintain an active role in the Texas Colonial Waterbird Society and participate annually in the Texas Colonial Waterbird Survey.

STEP 6:

Provide expertise and guidance to resource agencies, partners, and other stakeholders regarding colonial waterbirds and their habitats.

STATUS



UNDERWAY: The Coastal Bird Program continues its annual efforts to manage and protect rookery islands and colonial waterbirds while working to diversify and expand the program through partnerships and other initiatives.

CBBEP is also currently overseeing a project to protect and restore multiple rookery islands in Nueces Bay, and the organization has received funding to begin restoration efforts on several additional islands (Triangle Tree, Causeway). Additional funding is currently being sought to protect bird nesting islands in other bay systems (e.g., San Antonio Bay, Aransas Bay, and Lower Laguna Madre).

TIMEFRAME



All the steps listed above are considered on-going (e.g., performed annually) and will be implemented on a regular basis throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: Step 1 = \$\$; Steps 2-6 = \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds), Federal and State grants, RESTORE Act, Private industry, Private foundations

PARTNERS



LEAD: CBBEP - Coastal Bird Program

PARTNERS: American Bird Conservancy; Audubon Texas; Gulf Coast Joint Venture; TGLO; TPWD; USFWS; USGS

PERFORMANCE METRICS



1. Amount and quality of available rookery island habitat in the program area.



Coastal Birds 2.1

Conduct conservation-oriented monitoring and management actions to benefit shorebird species that utilize the Central Flyway and visit the Coastal Bend.

Migratory shorebirds comprise an astoundingly diverse group of birds, and a large proportion of them depend on coastal and upland habitats of the Texas Coastal Bend for significant parts of their annual cycles. Some nest here and winter elsewhere, some leave the area only briefly to breed in northerly latitudes and spend most of the year here, while yet others stop on their way north and/or south to refuel for the next leg of their migratory journey. Their challenges are legion – exhaustion, starvation, collisions, predators, disease, pollution, natural disasters, and hunting – to name a few. Their life histories emphasize the importance of this area as a vital link for their survival. As a group, they are among the most imperiled of birds. Protecting them means not only protecting the sites they use locally, but also gaining a better understanding of their full life histories so that appropriate efforts can be directed wherever they may be facing the greatest threats.

In recent years, the Coastal Bird Program has conducted numerous projects on the abundance, distribution, nest success, habitat usage, migratory connectivity, and other aspects of this highly dynamic group of birds. They also work with agencies and local landowners to ensure that habitats vital to these birds are protected, and provided guidance on management actions that can ameliorate threats. These projects have been conducted both with in-house staff as well as in conjunction with partners working at national and international levels such as the Smithsonian Migratory Bird Center, American Bird Conservancy, Conserve Wildlife Foundation of New Jersey, University of Saskatchewan, Canadian Wildlife Service, and Pronatura in Mexico, as well as US Fish & Wildlife Service, US Geological Survey, and Texas Parks & Wildlife Department. This level of coordination and cooperation among researchers and biologists is essential to foster conservation through a better understanding of habitat requirements throughout the full annual cycle, and leveraging range-wide interest and resources to support conservation efforts.

STEP 1:

Conduct monitoring of sites of local importance to shorebirds, assess their threats, and work with willing landowners/managers to develop and implement appropriate management actions.

STEP 2:

Conduct and facilitate projects that fill essential knowledge gaps related to migratory connectivity of species of conservation concern, through use of traditional methods, as well as innovative technologies.

STEP 3:

Communicate results of shorebird projects to the public in a way that emphasizes the connectiveness of bird populations and the importance of local protections in the larger scheme of their range-wide conservation.

STEP 4:

Serve as a primary point of contact and representative for shorebird issues in regional, national and international forums aimed at shorebird conservation, and work with regional partners to build capacity within coastal communities to assist with monitoring and conservation activities.

STATUS



UNDERWAY: The Coastal Bird Program currently has multiple projects underway associated with each of the four major steps. Many important relationships with collaborators have been developed and continue to grow.

TIMEFRAME



All the steps listed above are considered on-going (e.g., performed annually) and will be implemented on a regular basis throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: Steps 1-2 = \$\$; Steps 3-4 = \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds), Federal and State grants, RESTORE Act, Private industry

PARTNERS



LEAD: CBBEP - Coastal Bird Program

PARTNERS: American Bird Conservancy; Canadian Wildlife Service; Conserve Wildlife Foundation of New Jersey; Gulf Coast Bird Observatory; Gulf Coast Joint Venture; Local governments (e.g., city and county); Pronatura; Rio Grande Joint Venture; Smithsonian Migratory Bird Center; TGLO; USFWS; USGS; Universities

PERFORMANCE METRICS



1. Amount of area protected and managed for shorebirds.

CHAPTER

9

Land Conservation and Stewardship

CONTENTS

Introduction

Land Conservation and Stewardship Action Plan





ACCOMPLISHMENT: Conservation of the Nueces Delta

In 2016, the CBBEP closed on the purchase of 1,970 acres of land in the Nueces River Delta, the final piece in a multi-year effort to acquire the entire 4,737 acres of what once was the Dos Rios Division of Wyatt Ranches. The most recent acquisition nearly doubles the size of the Nueces Delta Preserve and creates more than 10,000 acres of contiguous conserved estuarine habitat for endangered and threatened wildlife species, protecting the fresh water flowing into Nueces and Corpus Christi Bays, and expanding environmental educational opportunities offered by the CBBEP.

Through the Natural Resource Damage Assessment (NRDA) process, the State of Texas Natural Resource Trustees (Texas Commission on Environmental Quality, Texas Parks and Wildlife Department and Texas General Land Office) provided \$2.435 million for the purchase of this last parcel from The Conservation Fund, who has been holding the ranch property since 2013 while the CBBEP secured monies for its permanent protection. The first two parcels of the ranch property were purchased with \$3 million from a separate NRDA award and private funds from M&G Chemicals. This last piece is significant in that it brings all the previous efforts together.

The newly protected land will nearly double the outdoor learning space provided to the CBBEP's environmental education program, Delta Discovery, which provides unique field-based, scientific experiences to students in grades K-12. The purchase will also allow the CBBEP and resource agency partners to manage and monitor the freshwater inflows to the Nueces and Corpus Christi Bays more efficiently, which improves water quality and preserves the essential and critical habitats of the Nueces River Delta.

Introduction

Despite their value, coastal habitats are stressed and at risk. Efforts are needed to conserve these at-risk habitats and help ensure the survivability of the species that depend on them. The CBBEP Land Conservation & Stewardship Program was established for purposes of using acquisition and stewardship to accomplish this goal.

The CBBEP identified land acquisition as a great first step towards conserving at risk lands. This can occur through the donation or purchase of land or conservation easements from willing sellers. Conservation easements are willing agreements between a landowner and an organization that limits, in perpetuity, the future uses of the land in order to protect its conservation value. The CBBEP identifies areas for land protection within the Coastal Bend and works with partners to acquire the funds necessary to conserve these valuable habitats. Since starting on land acquisition efforts in 2002, CBBEP has worked to acquire either fee simple title or conservation easements for close to 13,000 acres of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management. Locations of acquired properties have included the Nueces Delta (see below for a more detailed description of the Nueces Delta Preserve), Mustang Island, Lamar Peninsula, the Aransas River Delta, and the Mission River Delta (Figure 15). *The Bays Plan, 2nd Ed.* calls for the Land Acquisition and Stewardship Program to continue working with landowners, other conservation organizations, and local and state governments on ways to preserve sufficient, functional acreage of at-risk habitats.

Often described as the responsible management of natural resources, stewardship encourages protection through conservation and sustainable practices, and is key to forming ethical foundations in responsible planning and management for future generations. To achieve this, once acreage is set aside, management strategies are developed and implemented through the cooperative efforts of landowners and resource agencies. The Land Conservation and Stewardship Program strives to implement management projects that not only protect and restore habitats, but also provide opportunities for research and education. *The Bays Plan, 2nd Ed.* recognizes the importance of the CBBEP implementing responsible management practices at its own properties,

◀ **PRESCRIBED FIRE** is one method used to manage the landscape at the Nueces Delta Preserve. (Photo by the CBBEP)

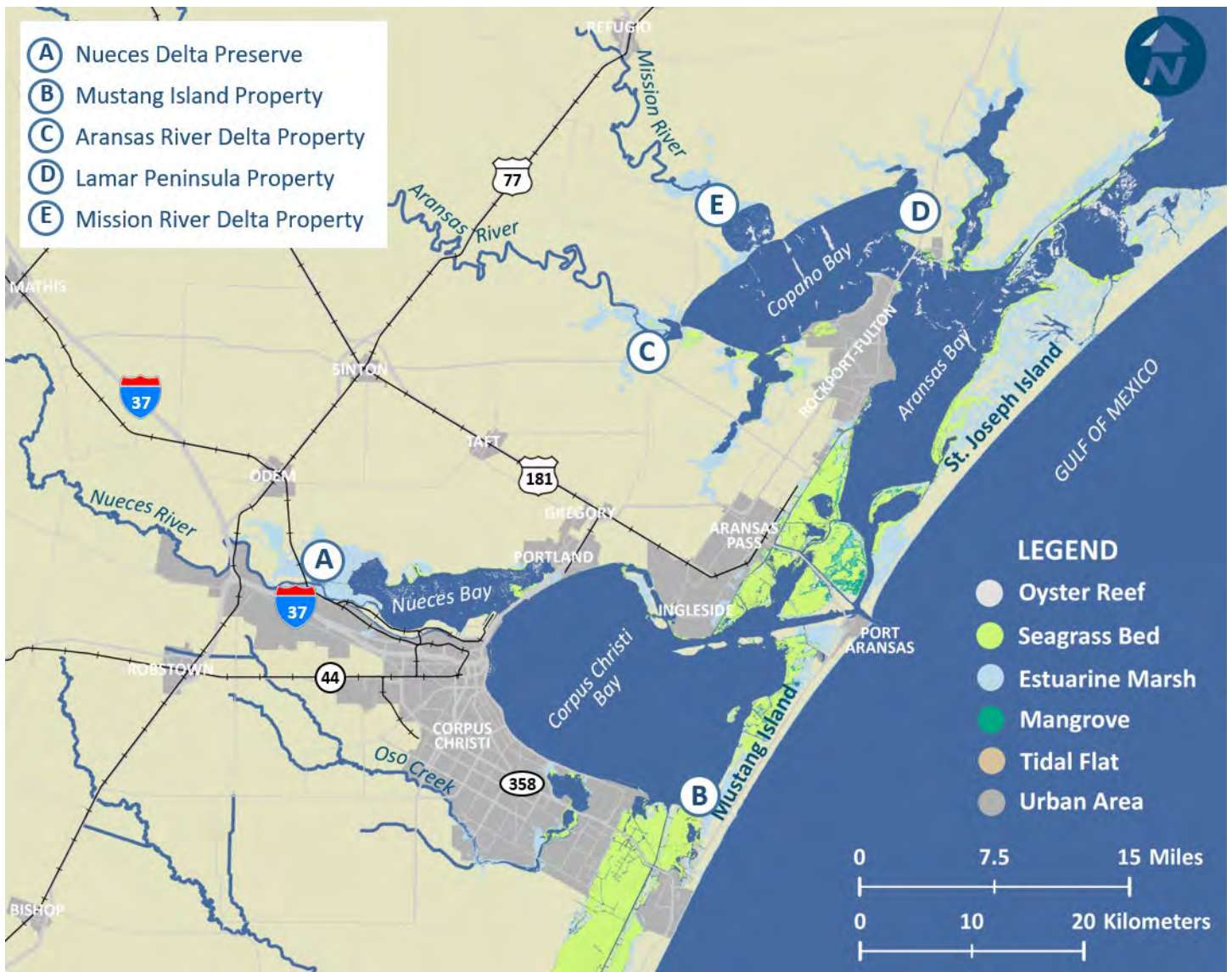


FIGURE 15. MAP OF PROPERTIES OWNED BY THE CBBEP.

and fostering stewardship by forming partnerships with willing landowners to either conserve or manage their property for priority species.

Nueces Delta Preserve

The highlight of CBBEP’s land conservation and management efforts is the Nueces Delta Preserve, a 10,500 acre property near Odem (Figure 16). The Nueces River Delta represents a unique mosaic of highly productive wetlands, open water, islands, prairie, and river and bay shorelines. Located on the former McGregor Ranch, the Preserve includes the Rincon Bayou, a vital link in the riparian habitat, and a significant freshwater inflow route from Nueces River into Nueces Bay. With a goal of preserving and protecting this unique land, the Coastal

Bend Bays & Estuaries Program began in 2000 plans to acquire land in the Nueces Delta. The first parcel was purchased in 2003 and the CBBEP has now purchase several tracts totaling about 10,500 acres.

By conserving these habitats, the CBBEP has reduced threats of land fragmentation, preserved open space, and provided habitat for wildlife, including migratory and threatened/endangered species. The CBBEP works to manage the Nueces Delta Preserve responsibly and sustainability for the long-term benefit of both wildlife and people.

The Nueces Delta Preserve also serves as a home for the CBBEP educational program (known as Delta Discovery), and is the site for various monitoring and freshwater



FIGURE 16. MAP SHOWING THE LOCATION OF THE CBBEP'S NUECES DELTA PRESERVE.

inflow projects, as well as wildlife and habitat restoration projects. An outdoor pavilion was built in 2007, a screened-in classroom in 2009, and restroom facilities in 2015.

The CBBEP vision for the Nueces Delta Preserve includes improvements that will enhance the opportunities for education, research, exploration and management. This vision includes an Estuary Learning Center and a Visitors Center to be built on the Rincon Unit's highest ground. The center would have informational exhibits, touch and interactive elements, a lecture hall, a laboratory, offices and adequate restrooms for busloads of students. An observation tower and hillside amphitheater are also part

of the future vision. Hiking trails with improved rest areas and interpretive signage will allow visitors to venture deep into the varied delta habitats. A conceptual master plan was developed in 2010 and funding opportunities are being explored to make this plan and vision a reality.

The Bays Plan, 2nd Ed. calls for continued stewardship efforts at the Nueces Delta Preserve, including the development of a comprehensive management plan and performance of routine management practices, such as prescribed fire, brush management, native vegetation plantings, hydrologic restoration, fencing, installation of signage.



LAND CONSERVATION AND STEWARDSHIP Action Plan

GOAL

Ensure the survivability of species that depend on coastal habitats in the Coastal Bend.

OBJECTIVES

LCS 1: Use land acquisition and stewardship techniques to conserve and protect coastal habitats in the Coastal Bend.

ACTIONS

- LCS 1.1: Promote the stewardship of coastal resources through the implementation of responsible and sustainable adaptive management techniques on both CBBEP properties and those of willing landowners.
- LCS 1.2: Collaborate with partners to identify and protect properties with high conservation value through donation, acquisition, or conservation easements.



Land Conservation and Stewardship 1.1

Promote the stewardship of coastal resources through the implementation of responsible and sustainable adaptive management techniques on both CBBEP properties and those of willing landowners.

The CBBEP promotes stewardship through the implementation of responsible and sustainable adaptive management techniques at all its properties. The CBBEP Land Conservation and Stewardship Program is responsible for managing several properties, including over 8,500 acres along the Nueces River and Nueces River Delta, 35 acres along Nueces Bay (HWY 181), 160 acres on Mustang Island, 180 acres on the Lamar Peninsula, XXX acres in the Aransas River Delta, and 981 acres along the Mission River Delta. The CBBEP must perform necessary management and routine maintenance of these, including but not limited to road maintenance, fencing maintenance, gates, brush control, equipment purchases, habitat and predator management (as appropriate and necessary), and property taxes.

Past project accomplishments include dike repair to a 50-acre created wetland, management equipment purchases, nest box construction, building maintenance, volunteer projects, aerial application of herbicide to invasive huisache, road repairs, preparation for prescribed fire, construction of a parking area for school buses, creation of a wildlife observation area and water sampling station, establishing routine mowing of common areas, trash collection service and (when needed) portable toilet services.

In addition to implementing responsible management practices at its own properties, the CBBEP Land Conservation and Stewardship Program also fosters stewardship by forming partnerships with willing landowners to either conserve or manage their property for priority species.

STEP 1:

Develop a comprehensive management plan for the Nueces Delta Preserve.

STEP 2:

Perform routine management practices at CBBEP-owned properties (e.g., prescribed fire, brush management, native vegetation plantings, hydrologic restoration, fencing, installation of signage).

STEP 3:

Work with willing landowners to develop and implement adaptive management projects that promote stewardship of coastal resources.

STATUS



UNDERWAY: Currently, the CBBEP owns approximately 13,000 acres (in fee title ownership and conservation easements) of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management in the Coastal Bend. The Land Conservation and Stewardship Program performs routine management and maintenance of all these properties as needs are identified.

TIMEFRAME



Step 1 will be completed in the first five years of Plan implementation (2020-2025). Steps 2-3 are considered on-going and are typically implemented on annual basis.

COST



ESTIMATED COST: Step 1 = \$\$; Steps 2-3 = \$\$ - \$\$\$ (varies by project)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds or Local funds), CMP, NRCS, RESTORE Act, TPWD, TSSWCB, USFWS, Private foundations, Private industry

PARTNERS



LEAD: CBBEP - Land Conservation and Stewardship Program

PARTNERS: Private landowners; CBLT; NRCS; TNC; TPWD; USFWS

PERFORMANCE METRICS



1. Acres of CBBEP property undergoing brush management, prescribed fire, native vegetation planting, hydrologic restoration, etc.
2. Acres of private property undergoing brush management, prescribed fire, native vegetation planting, hydrologic restoration, etc.



Land Conservation and Stewardship 1.2

Collaborate with partners to identify and protect properties with high conservation value through donation, acquisition, or conservation easements.

The CBBEP identified land acquisition as a great first step towards conserving at risk lands. This can occur through the donation or purchase of land or conservation easements from willing sellers. Conservation easements are willing agreements between a landowner and an organization that limits, in perpetuity, the future uses of the land in order to protect its conservation value. The CBBEP Land Conservation and Stewardship Program identifies areas for land protection within the Coastal Bend and works with partners to acquire the funds necessary to conserve these valuable habitats. Since starting on land acquisition efforts in 2002, CBBEP has worked to acquire either fee simple title or conservation easements for more than 12,000 acres of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management.

STEP 1:

Work with partners to identify lands with high conservation value that should be targeted for protection through donation, acquisition, or conservation easements.

STEP 2:

Identify and secure funding sources to secure fee-simple title or conservation easements from willing landowners.

STATUS



UNDERWAY: Land acquisition for protection is one of the most economical methods of conservation. Currently, the CBBEP owns approximately 13,000 acres (in fee title ownership and conservation easements) of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management in the Coastal Bend. The Land Conservation and Stewardship Program routinely works with partners and private landowners to identify and pursue additional land acquisition targets.

TIMEFRAME



Steps are considered on-going and will be implemented throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: Step 1 = \$; Step 2 = \$\$\$ - \$\$\$\$ (varies by project)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds or Local funds), CMP, NFWF, NOAA, NRCS, NRDA, RESTORE Act, TPWD, TSSWCB, USFWS, Private industry, Private foundations

PARTNERS



LEAD: CBBEP - Land Conservation and Stewardship Program

PARTNERS: Private landowners; CBLT; Conservation Fund; NRCS; TPWD; TNC; Trust for Public Lands; USFWS

PERFORMANCE METRICS

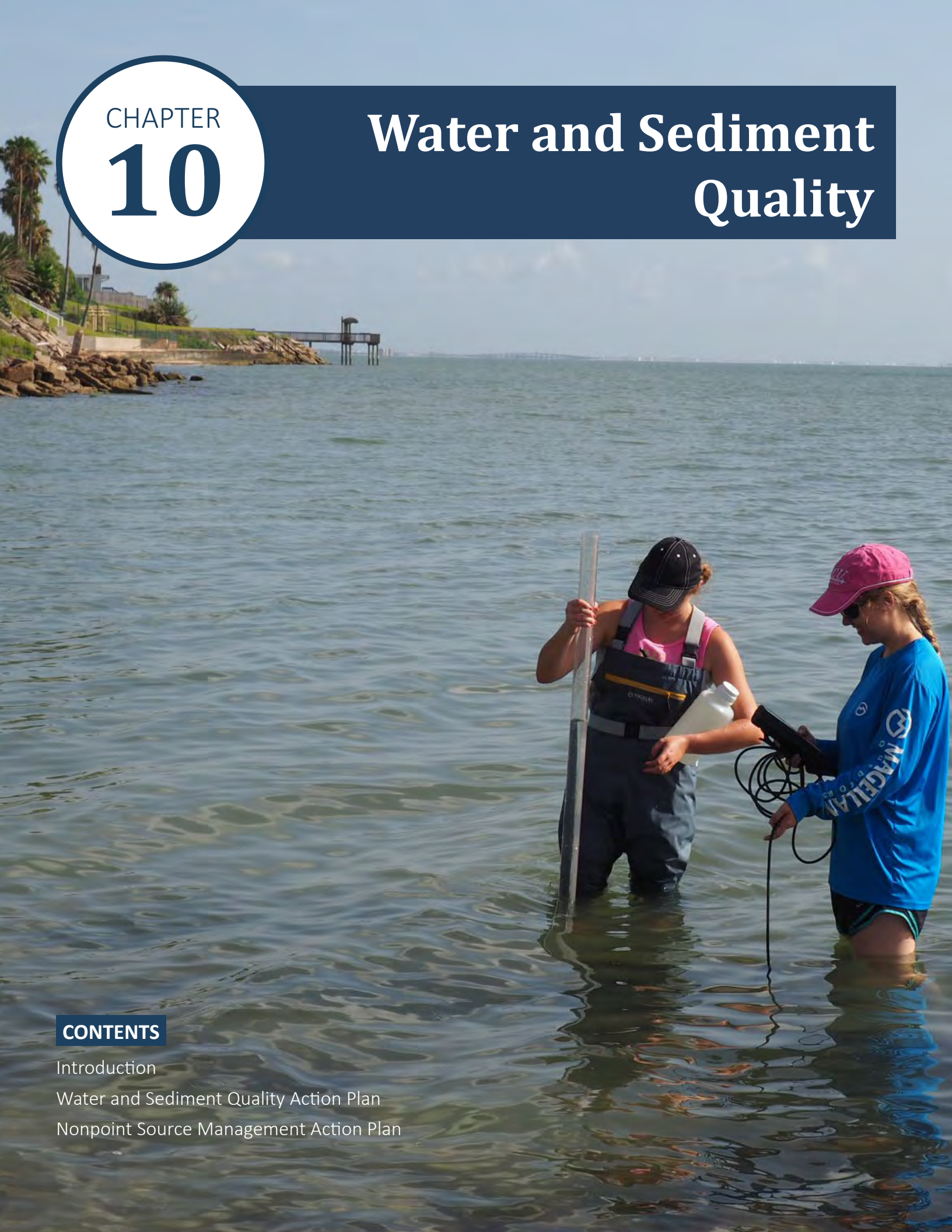


1. Acres of habitat donated, acquired, or placed under conservation easement.

CHAPTER

10

Water and Sediment Quality



CONTENTS

Introduction

Water and Sediment Quality Action Plan

Nonpoint Source Management Action Plan

Introduction

Maintaining the quality of water and sediment in the face of expanding population and growing industry is important to human health, aquatic life, and the economic vitality of the Coastal Bend. Fortunately, overall bay water quality has significantly improved during the past 45 years. The advent of the Clean Water Act in 1972, and the subsequent control of point source discharges, has brought steady improvement to several conventional water quality parameters in certain, previously impaired segments. Industries and municipalities have invested and worked hard to do their part to achieve coastal water quality standards. Today, point source discharges are frequently utilized to offset freshwater supply demands, including beneficial return flows to the estuaries. In addition to discharges from municipal and industrial wastewater treatment plants (point sources, Figure 17), we must also consider the diffuse runoff from urban and rural areas (nonpoint sources).

The most productive estuarine ecosystems thrive in areas with clean water and an optimal level of suspended solids. Many factors contribute to water and sediment quality. Increasing the amount of contaminants or turbidity in the water can decrease productivity, or even human health. Human activities, such as agriculture, dredging, and trawling can increase water turbidity, which limits photosynthesis. Limiting the flow of water in an estuary or limiting freshwater inflow can inhibit the natural properties that wetlands have to filter contaminants from water. Many human activities have the potential to contaminate water, from oil spills to runoff from streets following a storm.

Sediment quality is important because sediments are a 'sink' or repository for pollutants such as metals and pesticides. Sediments accumulate and concentrate pollutants over a long period of time. When activities such as dredging disturb contaminated sediments the result can be a reintroduction of pollutants into the water column.

Water and sediment quality are important to estuarine productivity, wildlife habitats, and the aesthetic appeal of bays and shorelines. Maintaining the water quality improvements made during the past 45 years will be a challenge in the years ahead as the regional population increases, industrial growth continues, and the climate

changes. However, it is possible to enhance water and sediment quality through pollution prevention and other Best Management Practices.

Water and Sediment Quality

The federal Clean Water Act gives states the primary responsibility for implementing programs to protect and restore water quality, including monitoring/assessing and reporting on their quality. In Texas, the Texas Commission on Environmental Quality is the agency with primary responsibility for implementing the monitoring, assessment, and reporting requirements of the Clean Water Act. The TCEQ Surface Water Quality Monitoring (SWQM) program provides for an integrated evaluation of physical, chemical, and biological characteristics of aquatic systems in relation to human health concerns, ecological condition, and designated uses. SWQM data provide the basis for establishing effective TCEQ water quality management policies that promote the protection, restoration, and responsible use of Texas surface-water resources.

Under section 303(d) of the Clean Water Act, the TCEQ is required to submit lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet water quality standards. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDL) for these waters. A TMDL is a pollution budget and includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and allocates the necessary reductions to one or more pollutant sources. A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the ultimate goal of attaining or maintaining water quality standards.

The Bays Plan, 2nd Ed. calls for the CBBEP to support the development and implementation of plans designed to maintain and improve water and sediment quality in segments that do not meet standards. It also calls for the development of TMDL allocations for priority 303(d) listed segments, evaluation of new data, and collaboration on revisions (additions or deletions) to the 303(d) list. In addition, *The Bays Plan* recognizes that problematic areas may exist that are not included on the 303(d) list. Therefore, closer investigation of the sources of water and sediment quality problems (e.g., elevated levels of heavy metals, low dissolved oxygen concentrations, bio-markers of fecal pollution, etc.) in specific portions of the project area may be needed in the future.

Understanding the contribution of 'total loadings' to the bay system is a fundamental goal of the Water and

RESEARCHERS FROM TEXAS A&M UNIVERSITY
- **CORPUS CHRISTI** collect water quality data near Ropes Park as part of a study to identify sources of bacteria. (Photo by CBBEP)

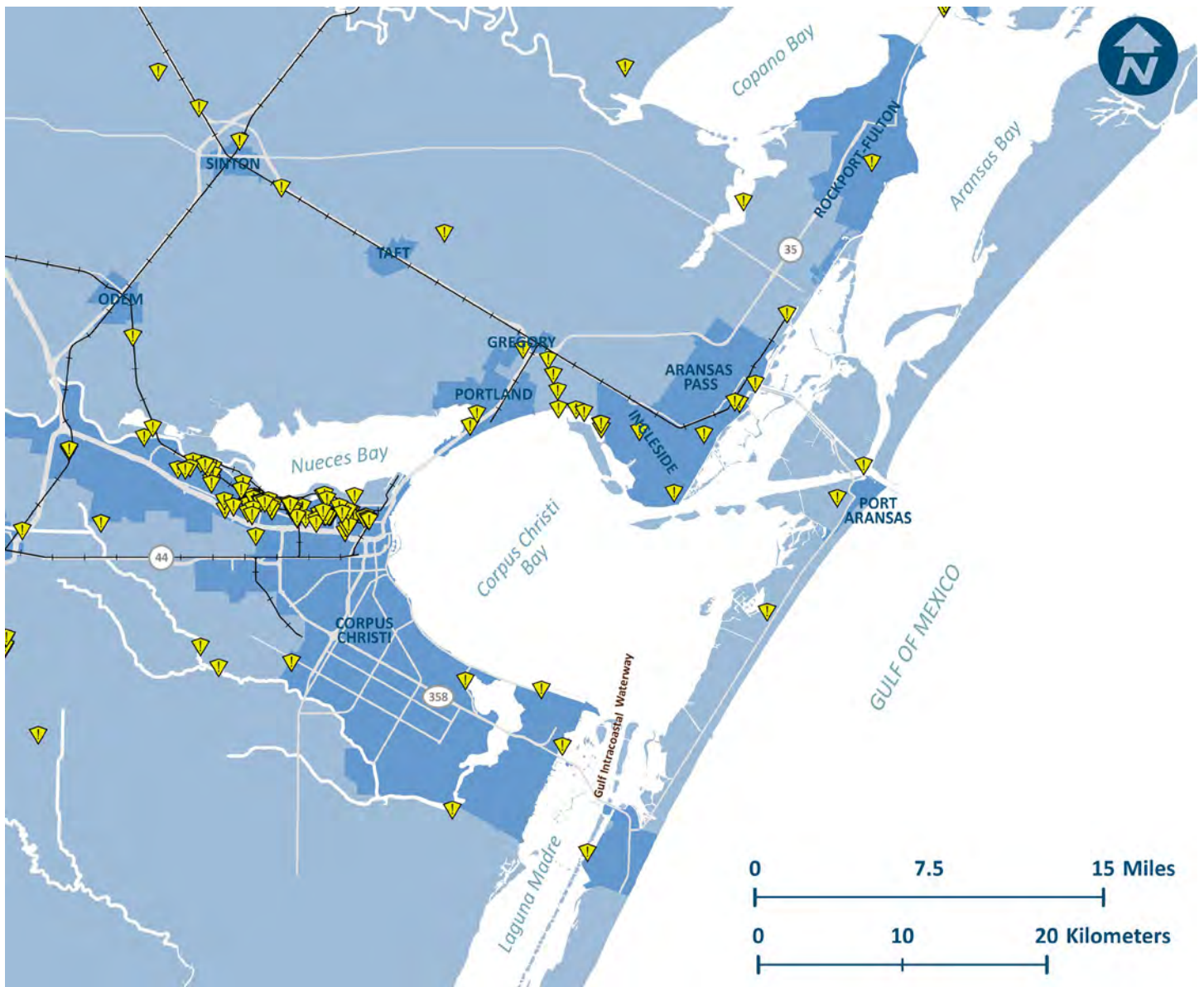


FIGURE 17. MAP OF TCEQ-PERMITTED WASTEWATER OUTFALLS.

Sediment Quality Action Plan. To accomplish this, the CBBEP will support efforts to identify data needs and coordinate additional data acquisitions that will help determine the relative contributions and loadings of point and nonpoint sources. Efforts will also focus on identifying transport pathways, sources, and fates of constituents. New data acquisitions will support the refinement of existing models and/or the development of new models that enhance our understanding of total constituent loadings.

The approach of *The Bays Plan* is to develop ways to get ahead and stay ahead of water and sediment quality problems before they pose risk to people or the environment. Knowing more about the quality, volume,

and biological effects of loadings will allow stakeholders to provide educated input during the State’s review of water quality standards. Such knowledge may also drive the development of sediment quality and/or biological criteria guidelines as additional tools to assess ecosystem health. It will also allow stakeholders to participate in a variety of important water quality management programs, including the development of basin watershed management plans, identification of priority water bodies, and the development and implementation of TMDL allocations for impaired water segments.

Although aquaculture and mariculture are not yet major industries in the Coastal Bend, they are showing signs of growth. Discharges from these operations have



ACCOMPLISHMENT: Baffin Bay Study Group

The Baffin Bay Study Group (BBSG) was formed by the local community to bring together scientists, natural resource managers, fishing guides, and other bay users to support interests in resolving Baffin Bay's water quality and biological productivity concerns. The first meeting of the group was held on August 2, 2012, in response to fish kills that occurred around the mouth of Baffin Bay where it meets the Upper Laguna Madre. The CBBEP, TPWD, Texas A&M University – Corpus Christi, and the Harte Research Institute for Gulf of Mexico Studies met to discuss the fish kills, water quality problems, and food web changes in the bay.

The BBSG has grown to include not only researchers and state agencies, but commercial fisherman, recreational fisherman, hotel owners, citizens living on Baffin Bay, ranchers, business owners, federal and local agencies, and other interested stakeholders. The BBSG's charge is to identify the issues in Baffin Bay, characterize the problems, and develop solutions. The group focuses on collaboration and keeping everyone on the same page as research and management decisions are made.

The BBSG also established the Baffin Bay Community-based Water Quality Monitoring Program. Since 2013, volunteers and scientists have been collecting monthly water samples from nine sites within the bay and analyzing them for concentrations of chlorophyll a, inorganic nutrients, dissolved organic carbon, and total dissolved nitrogen. The group has made what they believe to be a critical finding when it comes to potential causes of brown tide - concentrations of dissolved organic nitrogen in Baffin Bay are three-fold higher, on average, than in other bay systems of the Texas coast. An important next step will be to determine the main sources of the organic nitrogen.

the potential to generate water and sediment quality concerns and could lead to possible introductions of non-native species or disease to the bay system. Various permitting and licensing programs are in place to control for impacts from aquaculture and mariculture operations. *The Bays Plan, 2nd Ed.* supports the implementation of the existing aquaculture regulations and also calls for additional research on water quality and invasive species issues associated with aquaculture and mariculture techniques and procedures.

Nonpoint Source Management

When chemicals in rainwater runoff exceed certain concentrations they become pollutants and result in reduced water and sediment quality. Stormwater runoff picks up and carries not only pollutants (e.g., oil and grease from vehicles, lawn and garden chemicals, animal wastes, and street litter), but also ecologically important nutrients, sediments, and freshwater. Excessive nutrients or other chemicals not fully utilized by the ecosystem become pollutants. Unless prudent management actions are taken, these pollutant loadings will increase in the Coastal Bend as populations grow and urban areas expand.

Urban runoff is an important factor in bay water and sediment quality. In addition to the populated areas within city limits, urban runoff is generated by rural subdivisions, highways, industrial and military activities, and construction sites throughout the region. Urbanized areas have impervious surfaces and drainage systems that increase the volume of runoff and deliver loads faster to the bays. In some cases, stormwater drainage ditches can create linear freshwater wetlands, vegetated with marsh plants that can function to help slow water movement, trapping sediment and contaminants, and filtering some of the constituents before they reach the estuaries, while providing habitat for some wildlife species.

The City of Corpus Christi operates under a Texas Pollutant Discharge Elimination System (TPDES) permit. Under the permit, the City implements programs to monitor discharges, identify sources of contamination, establish and enforce ordinances aimed at reducing pollution, and educate residents, construction site managers, and others on how to improve stormwater quality. Additional programs - such as street sweeping, maintenance of marsh vegetation and erosion control in drainage ditches, cleaning of catch basins and storm sewers, litter abatement, household hazardous waste collection, and curbside recycling - assist in the management of urban runoff.

Water and sediment quality issues may also result from On-site Sewage Facilities (OSSF), or septic systems as they are more commonly known. OSSFs can contribute to fecal coliform contamination and nutrient enrichment of receiving waters. Many septic systems are improperly installed or maintained and the clay and sand soils in a large part of the project area are not well-suited to efficient septic system operation.

The Bays Plan, 2nd Ed. calls for the CBBEP and its partners to support efforts to distribute existing information and resources about nonpoint source BMPs (e.g., City of Corpus Christi Stormwater Master Plan; Guidance for Sustainable Stormwater Drainage on the Texas Coast) to local communities, businesses, and industries through workshops and brochures and to provide a central repository for this information. In response to the recent growth in the Corpus Christi Metropolitan area, the Plan specifically highlights the need to focus on projects that lead to the implementation of urban stormwater BMPs and improved understanding of the quality of urban stormwater runoff. In addition, the CBBEP will support TCEQ's efforts to provide compliance assistance to small businesses and industries on ways to help achieve urban runoff objectives through the 'TexasEnviroHelp' program. Finally, the CBBEP will assist local communities and organizations with their efforts to seek funding for OSSF programs and projects and will utilize existing education and outreach sources to educate local landowners about proper OSSF installation and maintenance.

Agricultural lands can be another major source of nonpoint source runoff. Agricultural uses, ranging from cattle grazing to row-crop farming, are the leading landcover in most of the watersheds draining into the Coastal Bend bays and estuaries. Nutrients, pesticides, organic matter, and animal wastes can be carried to the bays by agricultural runoff. However, a combination of flat terrain and the use of improved chemicals and application techniques are already at work to minimize the amount of material carried away. Management programs implemented for many years in the region include erosion control and integrated crop management. These and other programs have helped to reduce agricultural runoff and improve water quality. While many of these practices were developed for economic reasons, they have had the effect of reducing the amount of sediment, organic material, and chemicals that are washed into the bay system.

The Bays Plan, 2nd Ed. calls for the continued and expanded implementation of agricultural conservation assistance programs as authorized and funded by



ACCOMPLISHMENT: **Cole and Ropes Park Coordination Committee**

In 2010, Cole and Ropes Parks beaches, located along Ocean Drive in Corpus Christi, Texas, were listed on the TCEQ 303(d) List of Impaired Waters for bacteria. Data from the Texas Beach Watch Program showed that bacteria concentrations were higher than the criteria for protecting contact recreation activities, such as swimming or windsurfing. To address these concerns, the TCEQ developed a total maximum daily load (TMDL) for Cole and Ropes Parks beaches. The goal of a TMDL is to determine the amount (or load) of a pollutant that a body of water can receive and still support its assigned uses.

Following the establishment of the TMDL, the local community and stakeholders worked together to develop a voluntary action plan for reducing bacteria loadings to these beaches - the plan is known as the Cole and Ropes Parks Bacteria Reduction Implementation Plan (I-Plan). The ultimate goal of the I-Plan is to reduce bacteria levels at the beaches in order to protect people who use these areas for contact recreation. The Plan details voluntary management measures and control actions that government and citizens can take to reduce bacteria entering the bay at these sites, such as placing additional pet waste centers around town and educating the public.

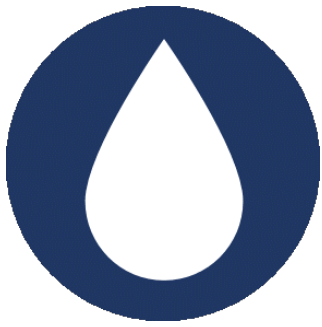
The Coal and Ropes Park Coordination Committee (or CARP for short), was formed in 2012 to lead the development of the I-Plan. The CARP is a community elected group that consists of 12 members representing various stakeholder groups. The CBBEP has been an active member of the CARP since it was established, serving in the Environmental Stakeholder position and chairing the Science and Technology Workgroup. After four years, numerous meetings, and countless volunteer hours, the CARP released the I-Plan in 2016.

state and federal law. Specifically, the CBBEP will work with partners to identify landowners within the project area that could be potential participants in agricultural conservation programs and will seek funding for projects demonstrating agricultural BMPs that are practicable, economically achievable, and enhance water quality. Finally, *The Bays Plan, 2nd Ed.* recognizes the need for implementing partners to continue to assist Soil and Water

Conservation Districts and other conservation partners in their efforts to provide educational workshops on BMPs and other data pertaining to water quality management and agricultural runoff.

BACTERIAL SOURCE TRACKING is a method used to identify potential sources of fecal pollution. The CBBEP is currently working with researchers at Texas A&M University - Corpus Christi to identify fecal pollution sources at Cole and Ropes Parks in Corpus Christi Bay. Impairment of water quality in these areas is thought to stem from unknown point and nonpoint sources of fecal pollution. Researchers will quantify the abundance of human, gull and dog fecal pollution. The results will help determine if any of these groups are a significant source of fecal pollution, which will help local officials develop better, targeted management strategies to reduce bacteria inputs to the bay.





WATER AND SEDIMENT QUALITY Action Plan

GOALS

Maintain and/or enhance water and sediment quality.

Understand total loadings, transport pathways, and biological and ecological effects of loadings to the bay system.

OBJECTIVES

WSQ 1: Improve the quality of ambient water and sediment in impaired or stressed segments to attain standards and criteria.

WSQ 2: Assess total loadings, transport pathways, sources, and fates of constituents.

WSQ 3: Evaluate and assess segment-specific water and sediment quality standards.

ACTIONS

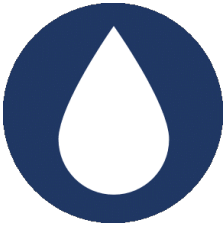
WSQ 1.1: Support the implementation of plans and projects to improve water and sediment quality in identified segments.

WSQ 1.2: Continue to support permitting rules for mariculture and aquaculture.

WSQ 2.1: Support efforts to quantify total constituent loadings and identify possible transport pathways, sources, and fates.

WSQ 2.2: Support analyses of the biological and ecological effects of constituents.

WSQ 3.1: Ensure that water and sediment quality standards and criteria are adequate and appropriate.



Water and Sediment Quality 1.1

Support the implementation of plans and projects to improve water and sediment quality in identified segments.

Program reports and the state 303(d) list have identified water segments that exceed state water quality standards and do not support designated uses. Identifying the cause of the problems and restricting migration of pollutants are critical. Of equal importance is understanding the environmental and human health effects of contaminants. In each case, steps need to be taken to reduce pollutant levels through a watershed management approach that coordinates with Watershed Protection Plans and Implementation Plans developed for Total Maximum Daily Loads (TMDLs) under Section 303(d) of the Clean Water Act, Municipal Water Pollution Control and Abatement Programs developed under Section 26.177 of the Texas Water Code, the state’s Coastal Nonpoint Source Program developed under Section 6217 of the Coastal Management Act, and the state’s Nonpoint Source Management Program developed under Section 319 of the Clean Water Act.

STEP 1:

Support the development and implementation of plans (i.e., Watershed Protection Plans, Implementation Plans) and projects to maintain and improve water and sediment quality in segments that do not meet TCEQ or EPA standards (e.g., the state 303(d) list). Support the development of TMDL allocations for priority 303(d) listed segments, evaluation of new data, and collaboration on revisions (additions or deletions) to the 303(d) list.

STEP 2:

Support assessments and planning that address problematic levels of heavy metals, dissolved oxygen, bio-markers of fecal pollution, and other water quality issues identified by stakeholders for specific portions of the project area that are of concern (e.g., low dissolved oxygen in Corpus Christi Bay).

STATUS



UNDERWAY: CBBEP participates in the Cole and Ropes Park Coordination Committee (CARP) for the bacteria impairment at Corpus Christi Bay recreational beaches. The Implementation Plan (I-Plan) is completed and is in the process of reaching approval. CBBEP also participates in the Oso Creek and Bay Coordination Committee. The Committee has submitted a draft I-Plan to the TCEQ for approval.

TIMEFRAME



Steps will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan. Potential new plans, projects and assessments will be evaluated for implementation as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$\$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, and Local partners); EPA; TCEQ; TSSWCB

PARTNERS



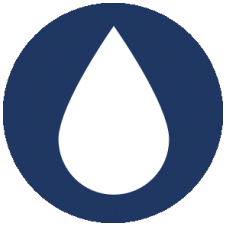
LEAD: CBBEP; TCEQ; TSSWCB

PARTNERS: Conservation organizations (e.g., CBBF; Sierra Club); EPA; Local governments; MANERR; Private industry; TPWD; Universities (e.g., CCS, HRI, UTMSI); USFWS; USGS

PERFORMANCE METRICS



1. Number of TMDLs.
2. Number of Watershed Protection Plans developed.
3. Number of Implementation Plans developed.
4. Number of assessments complete.



Water and Sediment Quality 1.2

Continue to support permitting rules for mariculture and aquaculture.

Aquaculture and mariculture are growing industries in Texas. However, potential discharges from aquaculture/ mariculture operations may generate water and sediment quality problems and could lead to the introduction of invasive species and disease. Such introductions could have catastrophic consequences on native species. Various aquaculture management activities require permits or licenses from state agencies, such as the Texas Parks and Wildlife Department (TPWD), Texas Department of Agriculture (TDA), and Texas Commission on Environmental Quality (TCEQ). Examples of permits and licenses required include: TDA Aquaculture Facility License, TCEQ Wastewater Discharge Permit, and TPWD Exotic Species Permit.

STEP 1:

Review and comment, as needed, on regulations and permitting/licensing issues related to mariculture and aquaculture.

STEP 2:

Support research on water quality and invasive species issues associated with aquaculture and mariculture techniques and procedures.

STATUS



UNDERWAY: CBBEP maintains active partnerships with licensing and permitting agencies, and staff will work with these partners to review and provide comments on aquaculture/mariculture issues as they arise.

TIMEFRAME



Step 1 will be implemented as new regulations and/or permitting/licensing issues arise throughout the applicable life of this plan (2020-2040). The State of Texas recently passed new regulations allowing for oyster aquaculture in Texas bays. Research related to this new and emerging field of aquaculture makes Step 2 a high priority for the first 5-10 years of Plan implementation. Research related to other forms of aquaculture/mariculture will be conducted as needed throughout implementation of the Plan. Potential research projects will be evaluated for implementation as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: Step 1 = \$; Step 2 = \$\$ - \$\$\$ (varies by project type)

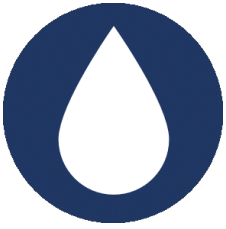
POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; NMFS

PARTNERS



LEAD: CBBEP

PARTNERS: Step 1 = EPA; NMFS; TCEQ; TDA; TGLO; TPWD; USACE; USCG; USFWS; Step 2 = MANERR; Texas Sea Grant; Universities (e.g., CCS, HRI, UTMSI)



Water and Sediment Quality 2.1

Support efforts to quantify total constituent loadings and identify possible transport pathways, sources, and fates.

An understanding of the relative contributions, total loadings, transport pathways, sources, and fates of constituents entering the bay system allows for continued refinement of resource management strategies. Management actions should be based on studies that include data collection during different environmental conditions (e.g., winter, summer, dry, wet), and examination of changes associated with land use/land cover and land management practices are critical for understanding future changes. In 1996, the CBBEP completed an investigation of nonpoint source pollution and loading into the study area. This study provided a broad overview of the study area and includes recommendations for additional data needs and more detailed studies. Since that report was completed, the CBBEP has completed studies in the Mission-Aransas Estuary, Oso Creek, and at the Corpus Christi Bay recreational beaches to understand the sources of bacteria loading, but as technology improves, future studies will be able to refine the sources with greater accuracy.

STEP 1:

Support efforts to identify needs and coordinate additional data acquisition, including citizen science programs, to determine relative contributions and loadings from point and nonpoint sources.

STEP 2:

Support efforts to identify needs and coordinate additional data acquisition to determine transport pathways, sources, and fates of constituents.

STEP 3:

Support the refinement of existing models and the development of new models related to constituent loadings, transport pathways, sources, and fates.

STATUS



UNDERWAY: The CBBEP has recently funded studies related to constituent loadings (e.g., Oso Creek, Mission-Aransas Estuary, and Corpus Christi recreational beaches) and continues to work with partners to identify opportunities for implementation of additional studies that would improve our understanding of loadings. Projects are often related to impaired water bodies listed on the 303(d) list, but they can also occur in water bodies of concern that are not considered impaired.

TIMEFRAME



Steps will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan. Potential new plans, projects and assessments will be evaluated for implementation as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$\$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; EPA; NOAA; TCEQ; Texas Sea Grant; TSSWCB

PARTNERS



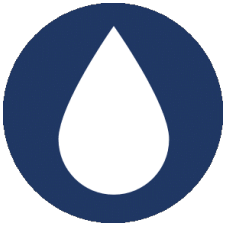
LEAD: CBBEP

PARTNERS: EPA; MANERR; TCEQ; Texas Stream Teams; TPWD; TSSWCB; TMN; Universities (e.g., CCS, HRI, UTMSI)

PERFORMANCE METRICS



1. Number of segments studied using CBBEP resources.
2. Number of reports and models developed using CBBEP resources.



Water and Sediment Quality 2.2

Support analyses of the biological and ecological effects of constituents.

Information is limited regarding the biological and ecological effects of the thousands of constituents that enter the bay system. An understanding of the effects of constituent loadings is necessary for the continued refinement of water and sediment quality standards. There is also very little information about how constituents interact within one another and how constituents are affected by environmental parameters like temperature, dissolved oxygen, and salinity. A better understanding of the biological and ecological effects of constituents will assist in the development of management strategies that improve the quality of Coastal Bend estuaries.

STEP 1:

Support studies and projects that determine the responses of flora/fauna (i.e., biological, chemical, and physiological changes) and ecological effects to varying levels of constituents entering the bays.

STEP 2:

Support studies and projects that examine the potential interactions among constituents, as well as the interaction between constituents and environmental parameters (e.g., temperature, dissolved oxygen, salinity).

STATUS



UNDERWAY: As issues arise within the program area, the CBBEP works with partners to understand the biological and ecological effects of constituent loadings. For example, the CBBEP recently funded studies to examine the ecological impacts (e.g., benthic macrofaunal, fisheries) of loadings and water quality changes in Baffin Bay. This research was in response to fish kills, water quality problems, and food web changes in the bay. Several projects are ongoing, as researchers attempt to understand the long-term responses.

TIMEFRAME



Steps will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan. Potential new studies and projects will be evaluated for implementation as part of the CBBEP's Annual Work Plan development process, which occurs every year.

COST



ESTIMATED COST: \$\$ - \$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; EPA Gulf of Mexico Program; NMFS

PARTNERS



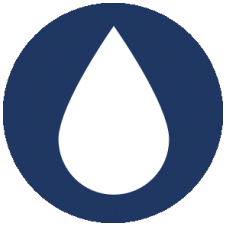
LEAD: CBBEP

PARTNERS: EPA; MANERR; TCEQ; TPWD; TSSWCB; Universities (e.g., CCS, HRI, UTMSI)

PERFORMANCE METRICS



1. Number of studies and projects developed/funded with CBBEP resources.



Water and Sediment Quality 3.1

Ensure that water and sediment quality standards and criteria are adequate and appropriate.

Established water quality and sediment standards and criteria do not in all cases account for natural variability with measured parameters (e.g., dissolved oxygen levels are naturally low in some segments during the summer months). In some cases, this may result in overly strict wastewater discharge limits, or misidentification of segments as being impaired. A look at the health of biological communities - through the use of biological criteria - is another useful analytical tool to assess if water and sediment quality standards and criteria are effective in the long-term.

STEP 1:

Support studies that examine water and sediment quality standards and criteria, as well as biological criteria, for various portions of the project area to coincide with the State’s review process or as needed.

STEP 2:

Review and develop recommended changes to water, sediment, and biological criteria and standards as needed.

STATUS



UNDERWAY: The TCEQ sets and implements water quality standards and sediment benchmarks. These standards are reviewed at least every three years, and revisions address new information about pollutants, additional data about water quality conditions in specific segments, and new state and federal regulatory requirements. Stakeholders in the review and revision process include the TCEQ, EPA, the general public, other governmental agencies, industries, municipalities, environmental groups, and others. CBBEP works with its partners to ensure that standards used in the Coastal Bend region are appropriate and that proposed revisions are based on quality research results (e.g., proposed lowering of dissolved oxygen criteria for Oso Bay and Laguna Madre).

TIMEFRAME



Steps will be implemented as TCEQ undergoes the review process for water and sediment standards. Revised water quality standards were approved by TCEQ in 2018, so the next anticipated revision is 2021.

COST



ESTIMATED COST: Step 1 = \$\$ - \$\$\$ (varies by project type); Step 2 = \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; EPA; TCEQ; TSSWCB

PARTNERS



LEAD: CBBEP; TSSWCB; TCEQ

PARTNERS: GBRA; MANERR; NRA; SARA; TPWD; USGS; Local governments; Universities (e.g., CCS, HRI, UTMSI)

PERFORMANCE METRICS



1. Number of studies and projects developed/funded with CBBEP resources.
2. Number of CBBEP-recommended changes to water quality standards and sediment benchmarks.



NONPOINT SOURCE MANAGEMENT Action Plan

GOAL

Improve management of all loadings to the bay system.

OBJECTIVE

NPS 1: Assess and improve nonpoint source management throughout the region.

ACTIONS

- NPS 1.1: Assist local governments, small businesses, industries, and organizations in their efforts to reduce loadings.
- NPS 1.2: Provide assistance to small businesses and industries in the region that are subject to the TPDES permit program or have point or nonpoint source control needs.
- NPS 1.3: Assist local governments and organizations to implement On-Site Sewage Facility (OSSF) programs and projects.
- NPS 1.4: Support agricultural water quality management plans, programs, and projects.
- NPS 1.5: Support efforts to improve the quality of urban stormwater runoff.



Nonpoint-Source Management 1.1

Assist local governments, small businesses, industries, and organizations in their efforts to reduce loadings.

Urban nonpoint source runoff can have detrimental effects on rivers, lakes, bays, and estuaries. Urban nonpoint source pollutants may include oil and grease, pathogenic microorganisms, pesticides, nutrients, trash, and heavy metals. Unless prudent management actions are taken, these pollutant loadings will increase in the Coastal Bend as populations grow and urban areas expand. The voluntary implementation of prudent, low cost nonpoint source Best Management Practices (BMPs) by coastal communities will help protect bay resources and could help business/industries avoid future costly remediation. CBBEP and its partners support the efforts of local communities to implement nonpoint source BMPs, which are outlined in several existing local planning documents (e.g., City of Corpus Christi Stormwater Master Plan; Guidance for Sustainable Stormwater Drainage on the Texas Coast).

STEP 1:

Support efforts to distribute information and resources related to nonpoint source BMPs to local communities (e.g., workshops, brochures).

STEP 2:

Identify a central repository for nonpoint source BMP information and resources (e.g., plans, brochures, presentations) and update as needed.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Step 1 will be implemented, as needed and as funding becomes available, throughout the applicable life of this plan (2020-2040). Step 2 will be implemented over the course of the next five years (2020-2025), and once the central repository is developed, updates will occur as needed, most likely every 2-3 years.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); CMP; EPA; Local governments

PARTNERS



LEAD: CBBEP

PARTNERS: City of Corpus Christi; Local governments; MANERR; NRA; TSSWCB

PERFORMANCE METRICS



1. Number of nonpoint source BMP workshops that were supported by CBBEP resources.
2. Number of nonpoint source brochures and other educational materials distributed to local communities.
3. Number of organizations assisted with information regarding nonpoint source BMPs.
4. Number of segments where nonpoint source BMP information is distributed.



Nonpoint-Source Management 1.2

Provide assistance to small businesses and industries in the region that are subject to the TPDES permit program or have point or nonpoint source control needs.

The state of Texas assumed the authority to administer the National Pollutant Discharge Elimination System (NPDES) program in Texas on Sept. 14, 1998. NPDES is a federal regulatory program to control discharges of pollutants to surface waters of the United States. The Texas Commission on Environmental Quality (TCEQ) Texas Pollutant Discharge Elimination System (TPDES) program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. Many small businesses and industries in the Coastal Bend are subject to TPDES regulation and may require assistance with compliance in order to avoid enforcement action. TCEQ administers the “TexasEnviroHelp” program which provides resources specifically tailored to help small businesses and local governments comply with environmental regulations.

STEP 1:

Support TCEQ’s efforts to assist local businesses/industries through the “TexasEnviroHelp” program.

STATUS



UNDERWAY: The CBBEP frequently provides assistance to partners, including local businesses and industries, by recommending various programs and grant opportunities that would help reduce nonpoint source pollution.

TIMEFRAME



CBBEP and partners will encourage use of the TexasEnviroHelp program, as needed, throughout the applicable life of the Plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); Private industry

PARTNERS



LEAD: CBBEP; TCEQ

PARTNERS: CBBF; Local businesses/industries

PERFORMANCE METRICS



1. Number of businesses/industries within the Coastal Bend that are assisted with compliance.



Nonpoint-Source Management 1.3

Assist local governments and organizations to implement On-Site Sewage Facility (OSSF) programs and projects.

Rural and outlying urban areas rely primarily on “on-site sewage facilities” (OSSFs) for waste treatment, and septic tank systems are the most common OSSFs in the project area. Problems associated with septic tank systems include the following: soils that are unsuited for conventional septic systems; lot sizes that are too small, resulting in soil saturation; and sites that are located in floodplain areas where the water table is too shallow to allow for proper drainage. As populations increase in the Coastal Bend region, there is a greater demand for programs and projects that ensure the proper installation, maintenance, and regulation of approved septic systems. Examples of OSSF programs and projects include: (1) identify and inspect existing OSSFs; (2) promote the availability of technical and financial assistance to homeowners; (3) provide technical and financial assistance to homeowners for the repair, replacement, or removal of OSSFs; (4) educate the homeowners on proper OSSF maintenance; (5) educate inspectors, installers, and maintenance providers on proper installation, inspection, operation, and maintenance of OSSFs.

STEP 1:

Provide grant application assistance to local communities and organizations wishing to implement OSSF programs and projects.

STEP 2:

Utilize existing education and outreach resources to educate local communities and landowners about proper OSSF installation and maintenance.

STATUS



UNDERWAY: The Texas AgriLife Extension is currently working on a pilot project in the Oso Creek Watershed to provide information on leaky septic tanks, free inspections of septic systems, and free pumping of septic tanks for eligible homes. The CBBEP will work with Texas AgriLife Extension and other partners to ensure that OSSF improvement projects are implemented as needed. The CBBEP is also currently partnering with the Center for Coastal Studies at Texas A&M University - Corpus Christi to provide education and outreach materials to "colonias" communities in the Oso Creek/Oso Bay Watershed. Education and outreach efforts are focused on helping underserved communities understand water quality issues and threats related to urban and agricultural runoff in the Oso Creek/Oso Bay Watershed. Funds are being sought to expand these outreach efforts.

TIMEFRAME



Step 1 will be implemented as relevant projects and programs are identified by CBBEP and its partners. Potential new projects and programs will be evaluated for implementation as part of the CBBEP's Annual Work Plan development process, which occurs every year. Step 2 is considered ongoing and will be implemented throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$
POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); TCEQ 319 funds; County governments; EPA; TCEQ; RESTORE Act

PARTNERS



LEAD: CBBEP; TCEQ
PARTNERS: CBBF; Coastal Bend COG; County governments; MANERR; SWCDs; TAES; TSSWCB, South Texas Colonias Initiative, Inc.

PERFORMANCE METRICS



1. Number of OSSF projects and programs implemented.
2. Number of OSSF workshops hosted with CBBEP resources.
3. Number of local communities and landowners that received OSSF education and outreach materials (e.g., brochures, workshops) and assistance.



Nonpoint-Source Management 1.4

Support agricultural water quality management plans, programs, and projects.

Agricultural production significantly influences the economy and environment of the project area. Rangeland, pastureland, and row crop agriculture comprise a large percent of total land area within the Coastal Bend. For many years, ranchers and farmers in the region have utilized Best Management Practices (BMPs) for erosion control and integrated crop management. These and other BMPs have helped to improve agricultural runoff water quality. While many of these practices were developed for economic reasons, they have had the effect of reducing the amount of sediment, organic material, and chemicals that are washed into the bay system. Continued support for the implementation of agricultural conservation assistance programs, projects, and plans as authorized and funded by state and federal law is needed.

STEP 1:

Identify landowners within the project area that could be potential participants in agricultural conservation programs provided by partners like TSSWCB, SWCDs, and NRCS.

STEP 2:

Assist SWCDs and other conservation partners with educational workshops on BMPs and other data pertaining to water quality management and agricultural runoff.

STEP 3:

Support efforts to seek Section 319 funds and other funds for demonstration projects, or other water quality implementation projects, on agricultural BMPs that are practicable, economically achievable, and enhance water quality.

STATUS



UNDERWAY: The CBBEP is collaborating with local partners to secure funding to work with private landowners to restore and/or secure conservation easements in riparian areas. In addition, the CBBEP frequently provides assistance to partners, including local landowners, by recommending various programs and grant opportunities that provide assistance to landowners interested in implementing agricultural BMPs. Finally, CBBEP is working with Texas Sea Grant to provide workshops on BMPs related to riparian management and soil health for stakeholders in the Baffin Bay Watershed.

TIMEFRAME



Water quality issues in the Baffin Bay System are currently a high priority for CBBEP and numerous partners. Therefore, implementation of the steps listed above will likely take place in the Baffin Bay Watershed within the next five years (2020-2025). In other watersheds, steps will be implemented, as needs/opportunities are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$
POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); NRDA; TSSWCB

PARTNERS



LEAD: Steps 1 and 3 = CBBEP; Step 2 = CBBEP, Texas Sea Grant, and TSSWCB

PARTNERS: GBRA; MANERR; NRA; NRCS; SARA; SWCDs; TAES; TNC; TPWD; TAMU - Texas Water Resources Institute; TWDB

PERFORMANCE METRICS



1. Number of landowners voluntarily participating in agricultural water quality management programs.
2. Number of agriculture BMP workshops hosted in project area.



Nonpoint-Source Management 1.5

Support efforts to improve the quality of urban stormwater runoff.

Urban stormwater runoff is generated from rain events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops. The runoff that does not soak into the ground picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm our rivers, streams, lakes, and coastal waters. As populations grow and urban areas continue to expand in the Coastal Bend, there will be an increase in the amount of pollutants in the runoff as well as the volume and rate of runoff from impervious surfaces. This can cause changes in hydrology and water quality that result in habitat modification and loss, increased flooding, decreased biological diversity, and increased sedimentation and erosion. To protect our coastal resources, communities, construction companies, industries, and others use stormwater controls known as Best Management Practices (BMPs). These BMPs are designed to filter out pollutants and/or prevent pollution by controlling it at its source. The benefits of stormwater BMPs can include: protection of wetlands and aquatic ecosystems, improved quality of receiving waterbodies, conservation of water resources, protection of public health, and flood control.

STEP 1:

Support the implementation of existing plans, programs, and projects that promote the use of urban stormwater BMPs (e.g., Low-Impact Development; City of Corpus Christi Stormwater Master Plan; Guidance for Sustainable Stormwater Drainage on the Texas Coast, Slow the Flow; TPDES Permit Program).

STEP 2:

Support the development of new plans, programs, and projects that promote the use of urban stormwater BMPs.

STEP 3:

Support studies and assessments that improve the quality of urban stormwater runoff.

STEP 4:

Develop a central repository for Coastal Bend urban stormwater information and resources (e.g., brochures, plans, and presentations).

STATUS



UNDERWAY: The CBBEP is currently working with the City of Corpus Christi on a pilot study to purchase and install catch basins to capture floating trash in stormwater. In addition, funding was recently provided to TAMUCC to quantify the amount of plastic pollution entering Corpus Christi Bay, primarily from stormwater. The results of these projects will help guide future projects related to trash in stormwater.

TIMEFRAME



Step 4 will occur during the first five years of implementation (2020-2025). Steps 1-3 will be implemented, as needs/opportunities are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$ - \$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, or Local funds); Coastal Bend COG; EPA; Local government; NOAA; TCEQ

PARTNERS



LEAD: CBBEP

PARTNERS: City of Corpus Christi; Conservation organizations (e.g., CBBF, Surfrider Foundation, Sierra Club); Local governments; EPA; MANERR; NOAA; TCEQ; TGLO; Universities (e.g., CCS, HRI, UTMSI)

PERFORMANCE METRICS



1. Number of stormwater BMPs developed.
2. Number of stormwater BMPs implemented.
3. Number of stormwater reports and publications supported by CBBEP resources.

An aerial photograph of a wide, dark river winding through a lush green landscape. The river is the central focus, with smaller channels and tributaries branching off. The surrounding land is a mix of vibrant green grass and some brownish patches, suggesting a wetland or marsh environment. The sky is overcast with soft, grey clouds.

CHAPTER

11

Freshwater Resources

CONTENTS

Introduction

Freshwater Resources Action Plan

Introduction

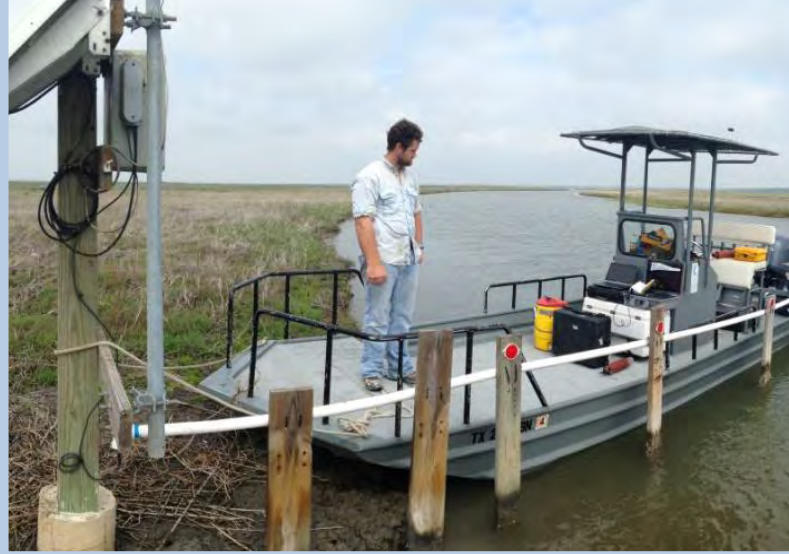
Freshwater was in short supply in South Texas even before people established ranches, towns, railroads, and industries in the semiarid region. In the face of increasing population and industrial growth, this scarcity of locally available freshwater means there will always be competing demands on this limited resource. Freshwater that flows into Coastal Bend bays comes from rivers, creeks, drainage structures, and wastewater treatment plants. These inflows create a salinity gradient that is important to the productivity of the bay system. Adding to this beneficial effect, they also contribute nutrients and sediments.

Coastal Bend estuaries are unique in that freshwater inflows vary greatly from year to year. In addition, the construction of two reservoirs and other smaller impoundments have altered the volume and timing of freshwater inflows and diminished nutrient and sediment supplies to the bay system. The combined effect of increasing human demand and naturally occurring droughts, which are expected to become more frequent with climate change, has the potential to severely impact the health and productivity of our estuaries.

Several significant processes have been at work in recent years that have increased demand for water from the Nueces River and decreased the amount flowing to the Nueces Estuary. First among these has been the shift from an economy based on agriculture to one based on oil and gas related activity, manufacturing, transportation, and government services. Development of the petroleum and chemical process industries in Nueces and San Patricio Counties would not have been possible without adequate high quality water. This has helped to encourage population growth both internally and from other areas. The percentage of the region's population depending on the Nueces River has also increased as towns have converted from the use of groundwater to surface water.

Municipal and industrial water demand in the region will continue to grow. Competing needs for finite water resources have prompted stakeholders to develop management strategies to balance the human and environmental needs for freshwater. Regional water planning groups were established to provide a water planning process based on a "bottom-up" consensus-

◀ **THE ARANSAS RIVER** supplies freshwater to the Mission-Aransas Estuary, one of three major estuaries in the Coastal Bend. (Photo by the Mission-Aransas NERR)



ACCOMPLISHMENT: Nueces Delta Salinity Monitoring

The Nueces River enters into Nueces Bay near the City of Corpus Christi. For many years, the Nueces Delta continued to receive regular flooding of freshwater when the Nueces River would overflow its banks, but upstream damming, riverbank modifications, and increased urbanization along the River have reduced the number of flood events that provide freshwater to the Delta. Hypersaline conditions (i.e., salinity is greater than the salinity of ocean waters) have resulted due to the lack of freshwater input, which has placed the marsh plants under greater stress and also increased erosion rates due a lack of sediment supply.

In response to deteriorating conditions, the TCEQ developed an inflow criterion that requires the City of Corpus Christi to provide freshwater to the Nueces Estuary. Each month the City is required to "pass through" inflows up to a target amount - the amount varies by month and is based on the inflows to and the combined storage volume of the Reservoir System.

Since 2009, the CBBEP has contracted with the Conrad Blucher Institute to monitor salinity at three stations within the Nueces Delta and Bay. This project's principal objective was to monitor the releases of freshwater into the Nueces Delta system and measure the salinity downstream and in adjacent areas to the main channel. The results of the study will be used in the development of a Rincon Bayou Pipeline Management Plan that will help water managers make decisions on quantity, timing, and duration of pipeline inflow events that are most productive and significant to the ecology of the Nueces Delta.

driven approach. The CBBEP will continue to support regional water planning efforts by participating in the Coastal Bend Regional Water Planning Group, ensuring that environmental needs are represented in the planning process. The CBBEP will also support other regional water planning efforts, such as the Nueces River and Corpus Christi and Baffin Bays Bay and Basin Area Stakeholder Committee and the Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas and San Antonio Bays Bay and Basin Area Stakeholder Committee.

If future water planning and management efforts are to be effective, additional information and understanding of environmental flows in the Coastal Bend is needed. The CBBEP has either lead or participated in a number of studies aimed at better understanding how freshwater inflows contribute to the dynamics of the Coastal Bend bays and estuaries. However, continued work is still needed and *The Bays Plan, 2nd Ed.* calls for efforts by CBBEP and its partners to enhance our ability to monitor and assess the impacts of freshwater inflow alterations.

The Bays Plan also calls for continued and expanded efforts to conserve the region's valuable freshwater supply and optimize environmental flows to the bays and estuaries. The Plan encourages the assessment of what the future freshwater inflow needs will be and to seek ways to meet those needs, including the reuse of treated wastewater, water conservation practices, and innovative rate programs, building codes, and incentive programs.

Finally, many citizens do not understand environmental flow needs and that continued demand for freshwater for human use makes such a balance an expensive challenge. This makes it difficult for elected decision-makers and regulators to develop acceptable strategies that meet household and business needs while maintaining the vitality of the bay system during periods of drought. Therefore, *The Bays Plan, 2nd Ed.* calls for continued efforts to increase understanding of the purpose and process for development of various freshwater related plans and programs, including the environmental needs of freshwater inflow.

THE CBBEP IS WORKING WITH PARTNERS to install new water wells and to refurbish existing water wells with solar panels at strategic locations throughout the Coastal Bend. The goal of these projects is to provide reliable freshwater resources that can be used by wildlife during times of drought. Much of this effort has focused on providing additional wells within the wintering range of the Whooping Cranes. While Whooping Cranes are predominantly linked to marsh and tidal flat habitats along the shorelines of San Antonio and Aransas bays, dietary freshwater is necessary when bay salinities rise. By providing reliable freshwater resources through the placement of energy-efficient water wells, managers may be able to help reduce the stress the cranes experience when looking for sources of freshwater.





FRESHWATER RESOURCES Action Plan

GOAL

Optimize regional freshwater inflows to meet long-term human and environmental needs.

OBJECTIVE

FW 1: Support the development and implementation of regional and local water management strategies.

ACTIONS

- FW 1.1: Improve scientific understanding of the freshwater, nutrient, and sediment supply needs of the estuaries.
- FW 1.2: Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate environmental needs in comprehensive planning.
- FW 1.3: Support efforts that optimize environmental flows to the bays and estuaries of the Coastal Bend.
- FW 1.4: Effectively communicate the purpose and results of environmental flow efforts.



Freshwater Resources 1.1

Improve scientific understanding of the freshwater, nutrient, and sediment supply needs of the estuaries.

Freshwater inflows are critical to the health and productivity of estuaries. Freshwater inflows perform three major functions that are essential for sustaining a productive estuary: (1) they blend with the Gulf’s seawater to provide a range of salt concentrations that support various stages of life of many estuarine species, such as fish and shellfish; (2) they bring nutrients essential to the total productivity of estuarine ecosystems; and (3) they bring in sediments that form muddy deltas and sandy barrier islands that help create and maintain back bays and coastal marshes. Coastal Bend estuaries are unique in that freshwater inflows vary greatly from year to year. The combined effect of naturally occurring droughts and increasing human demand has the potential to severely impact the health and productivity of our estuaries. A better understanding of freshwater inflow needs is critical for future water planning.

STEP 1:

Continue use of current methods and assess new methods of monitoring salinity; productivity of bays; inflow quantity and quality; direct bay rainfall; and climate trends and forecasting.

STEP 2:

Continue to develop and assess methods for linking environmental flows to the ecological health and productivity of Coastal Bend bays and estuaries.

STEP 3:

Continue to refine the reservoir system operating plan based on best available information.

STEP 4:

Continue to coordinate and assess new data collection needs, identify new locations, and deploy new streamflow and rainfall gauges (e.g., tidal river flow index-velocity gauges) throughout the project area as needed.

STEP 5:

Support efforts to maintain existing data and information repositories and make them available to the public and governmental organizations.

STATUS



UNDERWAY: The CBBEP continues to support salinity gages located within the Nueces River Delta and the Rincon Bayou. The data gained from these gages are used to determine the effectiveness of the Rincon Bayou Pipeline and to support numerous research projects. The CBBEP staff serve on the NEAC and have worked with NEAC members to prioritize BBASC Adaptive Management Workplan projects for future funding opportunities. The CBBEP also serves as reviewers for the final reports of TWDB funded projects for the NEAC. For the FY16/17 biennium, the TWDB has funded six new projects for the Nueces Estuary. Three of the projects - identifying vegetation changes in the Nueces Delta, a nutrient budget for Nueces Bay, and Nueces Bay circulation assessment - will further our understanding of the needs of nutrients, sediment, and freshwater inflows to the Nueces Estuary.

TIMEFRAME



Steps will be implemented, as needs/opportunities are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$ - \$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); EPA; NOAA; RESTORE Act; TWDB

PARTNERS



LEAD: Steps 1 = TWDB; Step 2 = TCEQ, TPWD, TWDB; Step 3 = City of Corpus Christi, TCEQ; Step 4 = USGS; Step 5 = CBBEP

PARTNERS: BBASC; BBEST; City of Corpus Christi; CBI; GBRA; MANERR; NEAC; NRA; SABF; SABP; SARA; Universities (e.g., CCS, HRI; UTMSI)

PERFORMANCE METRICS



1. Number of new streamflow and rainfall gauges in project area.
2. Number of CBBEP-supported environmental flows studies.
3. Reservoir system operating plan is revised.



Freshwater Resources 1.2

Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate environmental needs in comprehensive planning.

In 1997, the Texas Legislature established a new water planning process based on a “bottom-up” consensus-driven approach. Coordinating this water planning process are 16 planning groups, one for each regional water planning area. The planning groups, each made up of about 20 members, represent a variety of interests, including agriculture, industry, environment, public, municipalities, business, water districts, river authorities, water utilities, counties, groundwater management areas, and power generation. The Coastal Bend Regional Water Planning Area (Region N) includes 11 counties, portions of the Nueces River Basin, and its adjoining coastal basins, including the Nueces Estuary. The ongoing work of the regional water planning process consists of 13 tasks: (1) describing the regional water planning area; (2) quantifying current and projected population and water demand over a 50-year planning horizon; (3) evaluating and quantifying current water supplies; (4) identifying surpluses and needs; (5) evaluating water management strategies and preparing plans to meet the needs; (6) evaluating impacts of water management strategies on water quality, agricultural and natural resources, as well as water resources of the state; (7) describing how the plan is consistent with long-term protection of the state’s water, agricultural, and natural resources; (8) developing drought response information and recommendations; (9) recommending regulatory, administrative, and legislative changes; (10) describing how sponsors of water management strategies will finance projects; (11) describing the state of project implementation in the regional planning area; (12) prioritizing the recommended projects in the regional water plan; and (13) adopting the plan, including the required level of public participation.

STEP 1:

Support efforts by the Coastal Bend Regional Water Planning Group to develop the Region N Water Plan.

STEP 2:

Support other regional water planning efforts and groups, such as the ‘Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area Stakeholder’ and the ‘Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas and San Antonio Bays Basin and Bay Area Stakeholder Committee.’

STATUS



UNDERWAY: The CBBEP staff are active members of the Coastal Bend Regional Water Planning Group and the Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area Stakeholder.

TIMEFRAME



The Coastal Bend Regional Water Planning Group and the Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area Stakeholder meet on a regular basis. The CBBEP anticipates continued participation in these groups throughout the applicable life of this plan (2020-2040). CBBEP will look for opportunities to become involved in other water planning efforts as they are developed during the course of this Plan.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds)

PARTNERS



LEAD: CBBEP

PARTNERS: BBASC; Coastal Bend Regional Water Planning Group; TCEQ; TWDB

PERFORMANCE METRICS



1. Number of Region N water planning meetings attended by CBBEP staff.
2. Region N Water Plan is developed.
3. Number of BBASC meetings attended by CBBEP staff.
4. Number of projects from BBASC Adaptive Management Plans implemented in program area.



Freshwater Resources 1.3

Support efforts that optimize environmental flows to the bays and estuaries of the Coastal Bend.

Freshwater that flows into Coastal Bend bays and estuaries comes from rivers, creeks, drainage structures, and wastewater treatment plants. These inflows create a salinity gradient that is important to the productivity of the bay system. Adding to this beneficial effect, they also contribute nutrients and sediments. However, construction of reservoirs and other smaller impoundments have altered the volume and timing of freshwater inflows and diminished nutrient and sediment supplies. Municipal and industrial water demands are growing in the region, creating competition for our finite water resources. This has prompted stakeholders to develop management strategies to balance the human and environmental needs for freshwater.

STEP 1:

Support efforts to implement projects identified in the “Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays Basin and Bay Area Stakeholders Committee Work Plan for Adaptive Management” and the “Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area Stakeholders Committee Work Plan for Adaptive Management.”

STEP 2:

Continue to implement projects and assess the ecology and economics of beneficial reuses of wastewater. Possibilities include recycling effluent back into industrial processes, municipal uses, freshwater inflow enhancement, habitat creation/enhancement, and other non-potable uses. Support the effort to divert treated wastewater to the Nueces Delta.

STEP 3:

Encourage water conservation measures and investigate the feasibility and environmental impacts of alternative freshwater supply sources such as desalinization and aquifer storage and recovery.

STEP 4:

Identify new innovative rates, programs, building codes, and incentives to encourage water conservation.

STATUS



UNDERWAY: For the FY16/17 biennium, the TWDB funded six new projects for the Nueces Estuary that were listed in the BBASC Adaptive Management Workplan. Three of the projects - exploring alternative freshwater sources for the Nueces Delta, feasibility assessment of landform modifications in the Nueces Delta, and a re-examination of the 2001 Agreed Order monthly targets: Phase 2 - were designed to further our understanding on how to optimize environmental flows to the Nueces Estuary.

TIMEFRAME



Recent urban growth and industrial development in the Coastal Bend region is placing increased demands on freshwater inflows. Therefore, the need to optimize environmental flows to the bays and estuaries and complete the steps identified above is a high priority during the first 5-10 years of Plan implementation (2020-2030).

COST



ESTIMATED COST: \$\$ - \$\$\$ (varies by project type)

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); EPA; NFWF; RESTORE Act; TCEQ; TWDB

PARTNERS



LEAD: City of Corpus Christi; TWDB

PARTNERS: BBASC; BBEST; CBBEP; CBI; GBRA; Local industry; MANERR; NEAC; NRA; NWF; PICC; SABF; SABP; SARA; TCEQ; TGLO; TPWD; Universities (e.g., CCS, HRI; UTMSI); USFWS

PERFORMANCE METRICS



1. Volume of water diverted into the Nueces Delta.
2. Number of water conservation programs and projects implemented using CBBEP resources.



Freshwater Resources 1.4

Effectively communicate the purpose and results of environmental flow efforts.

The issue of freshwater is very important to Coastal Bend residents, but many citizens do not understand the environmental needs. This makes it difficult for elected decision-makers and regulators to develop acceptable strategies that meet household and business needs while maintaining the vitality of the bay system during periods of drought. Therefore, it is important to increase the public’s understanding of the purpose and process for development of various freshwater related plans and programs, including the environmental needs of freshwater inflow. This includes keeping residents informed of developing information and changes to reservoir system operating agreements. Educating the public about their individual role in water conservation is equally as important.

STEP 1:

Continue efforts to convey information to the public regarding freshwater supply issues. Focus should be on the scientific need for freshwater inflows to the estuaries and the justification for any changes to the reservoir system operating plan.

STEP 2:

Support efforts to communicate water conservation strategies to the public.

STATUS



UNDERWAY: The CBBEP works with partners to communicate information related to freshwater inflows to estuaries as needed. For example, the CBBEP currently has funding to develop a “whiteboard animation” that includes a history of our reservoirs and facts about where our water comes from and how it is divided up. The animation will also include strategies that residents can undertake to help conserve water, and it will be created in English and Spanish to ensure that language is not a barrier in reaching individuals.

TIMEFRAME



Steps will be implemented, as needs/opportunities are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); EPA; TCEQ; TSSWCB; TWDB

PARTNERS



LEAD: CBBEP; City of Corpus Christi

PARTNERS: GBRA; MANERR; NRA; NWF; SARA; TCEQ; TPWD; TSSWCB; TWDB

PERFORMANCE METRICS



1. Number of freshwater inflow/water conservation education and outreach materials distributed (e.g., brochures, flyers, presentations).

CHAPTER

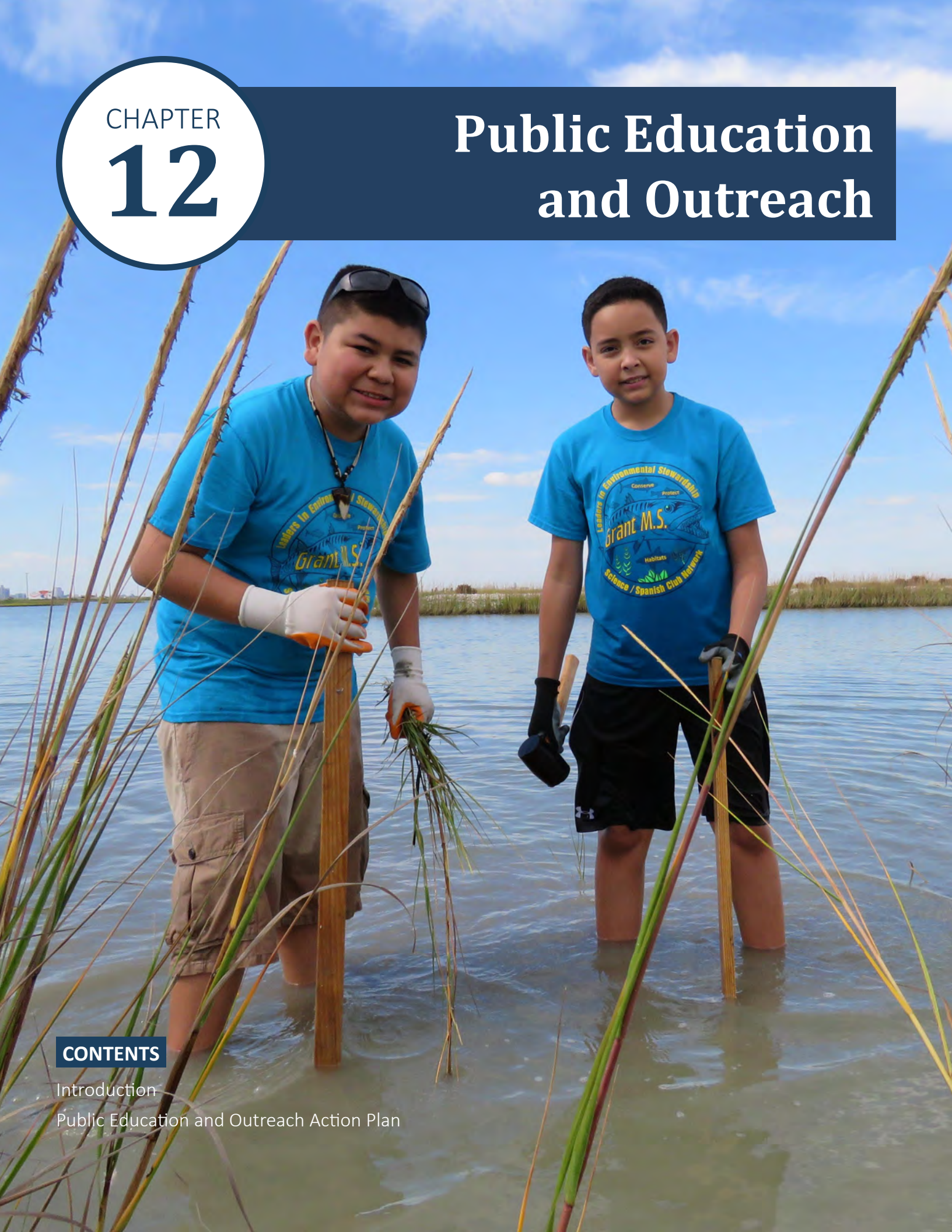
12

Public Education and Outreach

CONTENTS

Introduction

Public Education and Outreach Action Plan





ACCOMPLISHMENT: Coastal Issue Forums

The Coastal Bend Bays Foundation (CBBF) is a public interest organization dedicated to the conservation of freshwater and coastal natural resources for current and future generations through consensus, facilitation, communication, advocacy, research and education. The CBBF strives to bring together diverse interests to achieve the Coastal Bend's environmental and economic objectives.

Every month, the CBBF hosts a public forum on regional resource management issues. The forums began in 1991 and have proven to be very popular with local citizens. They are designed to bring together diverse community interests to identify problems and seek solutions.

Guest speakers are natural resource experts, government officials, and industry representatives who present information on a range of issues. Past forums have focused on topics like healthy fisheries, heavy metals in drinking water, endangered species protection, climate change, wind farms, land use planning, freshwater inflows, local industry, and bay debris. The presentations allow visitors to interact with and learn from experts, and most importantly, they provide an opportunity for dialogue between competing user groups.

INVOLVING THE PUBLIC IN RESTORATION

activities is an important component of the CBBEP Public Education and Outreach Program. (Photo by the CBBEP)

Introduction

One of the most important goals of *The Bays Plan, 2nd Ed.* is to educate citizens about the ecology of the bay system, its many environmental and economic values, and how an individual can make a positive difference to ensure its long-term health. Helping residents and visitors to understand the complex issues concerning bay resource management will be a priority. In addition to understanding how the bay system functions, it is important that citizens develop a sound appreciation for the significant value and economic impact derived from the bay resources.

The Environmental Education and Outreach component of *The Bays Plan, 2nd Ed.* is designed to: (1) raise the public's environmental awareness; (2) foster community stewardship of bay resources; and (3) increase individual involvement in bay resource management issues. To accomplish this, the CBBEP conducts outreach activities that target culturally diverse audiences of environmental professionals, resource users, and the general public. Education and outreach incorporates science-based content into a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues. Programs have a strong emphasis on the science, research, and monitoring activities supported by the CBBEP and its partners and utilize a locally focused approach to foster stewardship.

The CBBEP implements a comprehensive regional public outreach strategy to reach people of all ages. The strategy focuses on effective use of media (particularly social media), development of user-friendly educational materials (in languages other than English when necessary), and establishment of an electronic clearinghouse on bay-related information. These and other tools are developed and refined with strong emphasis given to the science which supports the actions of *The Bays Plan*. Target audiences for the education and outreach strategies listed above include the general public, recreational users, government officials, and commerce/industry.

The Coastal Bend is fortunate to have a number of recurring events and festivals that focus on educating the public about the value of coastal resources and how to be better stewards of these resources. Implementation of these festivals and events requires the continued support of numerous partners and volunteers. The cornerstone of these events is the 'Earth Day – Bay Day' celebration hosted annually in Corpus Christi, Texas by the Coastal Bend Bays Foundation (CBBF), a local nonprofit organization dedicated to the health and productivity of the local bays and estuaries. The event educates thousands of residents and visitors to the Coastal Bend on the importance of

environmental stewardship and appreciation for our coastal natural resources - all while having fun. Dozens of local, regional, and state organizations, businesses, and government agencies join CBBF to provide free education, entertainment, and resources to the public to promote awareness and inspire conservation for our coastal wildlife and environments. The CBBEP is a proud supporter of Earth Day – Bay Day, as well as several other local events and educational festivals, such as the Hummerbird Festival (Rockport, Texas) and the Whooping Crane Festival (Port Aransas, Texas).

Other actions of *The Bays Plan, 2nd Ed.* focus on how best to achieve stewardship through individual involvement and responsibility for sound environmental practices. The CBBEP and its local partners provide opportunities for the general public, including youth, to volunteer for stewardship-oriented activities like clean-up events and marsh grass planting days. Personal involvement with nature in the form of stewardship projects will not only benefit the environment but the individual as well. Coupled with this is the CBBEP's support for environmental recognition programs, with awards and public recognition given to those individuals and groups who have demonstrated environmental leadership in the Coastal Bend.

By working to promote public/private partnerships in this fashion, *The Bays Plan* can achieve its educational goals more quickly and with more lasting success. However, there will always be the need for continued dialogue between competing user groups, as well as continued opportunities for the public to learn about current management issues. A relaxed, public forum allows for individual input into the public policy debate, and the CBBF has served such a function for many years by hosting monthly 'Public Issue Forums.' *The Bays Plan, 2nd Ed.* calls for continued support for the CBBF's efforts to host Forums that provide information about resource management issues to the public. *The Bays Plan, 2nd Ed.* also calls for support of other types of meetings that are designed to provide an opportunity for citizens to gain knowledge about and participate in the public policy debate (e.g., scientific meetings, regulatory meetings, civic organization meetings). This is increasingly important as the Coastal Bend prepares itself for ever-increasing numbers of people wanting to make use of the bays and estuaries. Minimizing conflict through informed discussion will help achieve the overall objective of ensuring the public's safety, health, and enjoyment of our bays and estuaries.



ACCOMPLISHMENT: Earth Day - Bay Day

Presented by local nonprofit, the Coastal Bend Bays Foundation (CBBF), Earth Day - Bay Day has become one of the City of Corpus Christi's best attended and most enjoyably educational family events. This free event provides education, entertainment, and resources to the public to promote awareness and inspire conservation for our coastal wildlife and environments.

Each year, the day-long festival offers an array of family-friendly activities that focus on connecting people to nature, such as native animal exhibits, a petting zoo, birds of prey exhibitions, and a catch-and-release fish pond. The CBBF has hosted Earth Day – Bay Day annually since 1999. Nearly 10,000 visitors attend annually to see nearly 100 exhibitors, presenters, and vendors at the event.



EARTH DAY - BAY DAY posters feature works by a different local artist each year.



PUBLIC EDUCATION AND OUTREACH

Action Plan

GOAL

Increase public understanding and stewardship of bay resources.

OBJECTIVE

PEO 1: Implement an innovative public education and outreach strategy to improve understanding and stewardship of bay resources.

ACTIONS

- PEO 1.1: Develop and distribute information and outreach materials for targeted audiences.
- PEO 1.2: Support events that focus attention on bay resources and uses.
- PEO 1.3: Promote public participation in stewardship activities.
- PEO 1.4: Support public meetings that improve understanding and stewardship of bay resources.
- PEO 1.5: Promote recognition of individuals and programs that protect our bays and estuaries.



Public Education and Outreach 1.1

Develop and distribute information and outreach materials for targeted audiences.

The future of the Coastal Bend relies on a well-educated public to be wise stewards of the environment that sustains us, our families and communities, and future generations. CBBEP implements a comprehensive regional outreach strategy to reach people of all ages. Target audiences for education and outreach materials include the general public, recreational users, government officials, and commerce/industry. The regional outreach strategy employed by CBBEP includes effective use of the media, development of user-friendly educational materials, and maintenance of an electronic clearinghouse on bay-related resource information. These and other tools will be developed and refined with strong emphasis given to the science which supports the actions of the Bays Plan.

STEP 1:

Implement a variety of innovative outreach techniques to provide information to targeted audiences. Techniques may include, but are not limited to, the use of social media (i.e., Facebook, Instagram), videos (YouTube), newsletters, project updates, public service announcements, website, press releases, project signage, and collateral (e.g., brochures, fact sheets, stickers). Languages other than English will be used when appropriate.

STEP 2:

Organize and maintain electronic clearinghouse on bay-related resources.

STEP 3:

Organize and maintain contact list for distribution of education and outreach materials.

STEP 4:

Support the implementation of the "Port Industries of Corpus Christi's Community Survey." Use survey results to identify needs and opportunities for environmental education and outreach in the Coastal Bend.

STATUS



UNDERWAY: The CBBEP maintains current social media accounts and websites, utilizes email marketing services for maintaining a contact list and distribution of information, produces educational project signage at public access locations where appropriate, and maintains a current collection of collateral for distribution by the CBBEP as well as other stakeholders. The CBBEP organizes and maintains a database on our website of all final reports for projects funded by the CBBEP, as well as other documents relevant to current issues or topics of concern in our bays and estuaries. The CBBEP continues to support the Port Industries of Corpus Christi's Community Survey conducted biennially.

TIMEFRAME



Step 4 will be implemented every other year throughout the applicable life of the plan, as long as funding is available. Steps 1-3 will be implemented throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); PICC; Private industry; Foundations; RESTORE Act; NRDA; NFWF

PARTNERS



LEAD: Steps 1-3 = CBBEP; Step 4 = CBBEP, PICC

PARTNERS: CBBF; HRI; Local governments (i.e., cities and counties); Local media outlets (e.g., television, newspapers, radio); MANERR; TAMUCC; Texas Sea Grant; TPWD; TSA; USFWS; UTMSI

PERFORMANCE METRICS



1. Social media statistics (e.g., number of “Likes,” “Reach” statistic for individual posts, number of subscribers/followers).
2. Number of visitors to CBBEP website.
3. Amount of collateral distributed.
4. Number of public surveys completed.



Public Education and Outreach 1.2

Support events that focus attention on bay resources and uses.

One of the most important goals of the Bays Plan is to educate citizens about the ecology of the bay system, its many environmental and economic values, and how an individual can make a positive difference to ensure its long-term health. The Coastal Bend is fortunate to have a number of recurring events and festivals that focus on educating the public about the value of coastal resources and how to be better stewards of these resources. Implementation of these festivals and events requires the continued support of numerous partners and volunteers.

STEP 1:

Assist with the planning, organization, and implementation of Earth Day – Bay Day, an annual festival hosted by CBBF that focuses attention on coastal resources by providing the appropriate mix of education, entertainment, and bay-related, hands-on fun.

STEP 2:

Support partner efforts to host various community events and educational festivals that enhance awareness of the value of coastal resources (e.g., Hummerbird Festival, Whooping Crane Festival).

STATUS



UNDERWAY: The CBBEP annually assists with the planning, organization, and implementation of Earth Day-Bay Day, as well as supports other annual events such as CCA, DU, and SEA banquets, National Estuaries Day celebrations, and Hummerbird and Whooping Crane festivals.

TIMEFRAME



Steps will be implemented as events and festivals occur, which is often on an annual basis.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (TCEQ, Local funds); Local governments (e.g., City of Corpus Christi); Foundations (e.g., The Trull Foundation); Private industry (e.g., PICC)

PARTNERS



LEAD: CBBEP; CBBF

PARTNERS: City of Corpus Christi; Local governments; Chambers of Commerce; Conservation organizations (e.g., CCA; DU; SEA); MANERR; Resource agencies (e.g., TGLO, TPWD, USFWS); Universities (e.g., HRI, TAMUCC, UTMSI)

PERFORMANCE METRICS



1. Number of partner festivals/celebrations supported by CBBEP.
2. Number of attendees at festivals/celebrations supported by CBBEP.
3. Number of volunteers involved in festivals/celebrations supported by CBBEP.
4. Number of attendees at Earth Day – Bay Day.
5. Number of volunteers participating in Earth Day – Bay Day.



Public Education and Outreach 1.3

Promote public participation in stewardship activities.

CBBEP and its local partners promote enhanced conservation of coastal resources by providing opportunities for the general public to participate personally in stewardship-oriented projects. Previous opportunities have included volunteer involvement in marsh and oyster restoration activities and participation in clean-up events at beaches and bay shorelines. Personal involvement with nature will in the form of stewardship projects benefits the individual as well as aiding in species and ecosystem survival.

STEP 1:

Support efforts to involve volunteers in clean-up events of beaches and bay shorelines.

STEP 2:

Support efforts to involve volunteers in restoration activities, such as planting marsh grass and bagging oyster shells.

STATUS



UNDERWAY: The CBBEP plans, organizes and implements an annual Rookery Island Clean Up, and supports the CBBF in implementation of the fall and spring Adopt a Beach Clean Ups, as well as marsh planting events. The CBBEP also hosts industry and other volunteer groups at the Nueces Delta Preserve for volunteer work and stewardship building activities.

TIMEFRAME



Steps will be implemented as clean-up events and restoration activities occur. Clean-up events typically occur on at least an annual basis, while the schedule for restoration activities is less predictable due to the dependency on available funds.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); CMP; Private industry (e.g., Citgo); Foundations; NRDA; NFWF; RESTORE Act

PARTNERS



LEAD: CBBEP

PARTNERS: CBBF; CCA; MANERR; TAMUCC; TGLO; TNC; TPWD; Conservation organizations (e.g., Sierra Club, Surfrider Foundation); Industry (e.g., Citgo)

PERFORMANCE METRICS



1. Number of volunteers participating in clean-up events.
2. Pounds of trash collected during clean-up events.
3. Number of volunteers participating in restoration projects.
4. Acres planted with marsh grass by volunteers.
5. Acres of oyster reef restored through volunteer assistance.



Public Education and Outreach 1.4

Support public meetings that improve understanding and stewardship of bay resources.

As the population in the Texas Coastal Bend region continues to grow, there will be greater utilization and demand for natural resources. In order to achieve effective management and to minimize conflicts between user groups, public participation in the decision-making process is necessary. There must be opportunities for the public to learn about current management issues, as well as a chance for dialogue between competing user groups. Public forums and meetings allow citizens to learn information about coastal resource management issues, while also providing the opportunity to provide input into the public policy debate.

STEP 1:

Coordinate and implement “Coastal Issue Forums” and other forums as needed on regional resource management issues.

STEP 2:

Support efforts to host scientific meetings (e.g., Texas Bays and Estuaries Meeting) that promote the sharing of scientific findings related to Texas coastal resources.

STEP 3:

Promote participation in other public meetings designed to promote citizen involvement in the management and policy debates (i.e., regulatory meetings).

STEP 4:

Enhance public understanding of resource management and policy issues by providing presentations to local civic organizations (e.g., Rotary Club).

STATUS



UNDERWAY: The CBBEP will continue to support the CBBF and monthly Coastal Issue Forums, scientific meetings, and workshops that promote the sharing of scientific findings related to Texas coastal resources (e.g., Texas Bays & Estuaries Meeting). CBBEP will also continue to promote participation in public meetings such as the Nueces Estuary Advisory Committee, City Councils, and TMDL-related implementation planning or watershed protection planning (e.g., Oso Creek and Bay Coordination Committee; Cole and Ropes Park Coordination Committee, and Lower Nueces River Watershed Protection Plan). Finally, CBBEP provides presentations on current issues and topics of concern, as well as success stories and general environmental stewardship to local organizations such as Rotary and World Affairs Council.

TIMEFRAME



Forums and meetings will take place repeatedly throughout the applicable life of this plan (2020-2040) – some will be repeated on a monthly or annual basis, while others will be implemented irregularly.

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds, TCEQ, Local funds); NFWF; NRDA; RESTORE Act

PARTNERS



LEAD: Step 1 = CBBF, CBBEP; Steps 2-4 = CBBEP

PARTNERS: Civic organizations (e.g., Rotary Club, Kiwanis); MANERR; Resource agencies (e.g., TCEQ, TPWD, TSSWCB, USFWS); Universities (e.g., HRI, TAMUCC, UTMSI)

PERFORMANCE METRICS



1. Number of public forums and meetings supported by CBBEP resources.
2. Number of attendees at public forums and meetings supported by CBBEP resources.
3. Number of presentations provided by CBBEP staff to local civic organizations.



Public Education and Outreach 1.5

Promote recognition of individuals and programs that protect our bays and estuaries.

Recognition programs, with appropriate awards and public recognition given to those individuals and groups who have demonstrated environmental leadership, will help promote enhanced stewardship of our coastal resources.

STEP 1:

Support recognition programs that acknowledge and award individuals and programs that demonstrate environmental leadership in the Coastal Bend region (e.g., CBBF Annual Conservation & Environmental Awards Banquet; CCA Banquet; DU Banquet).

STATUS



UNDERWAY: The CBBEP annually assists with the planning, organization, and implementation of the CBBF Conservation & Environmental Awards Banquet, as well as supports other annual events such as CCA, DU, and SEA banquets where individuals and programs are awarded.

TIMEFRAME



Support for recognition events will be provided annually throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBF; CCA; DU; SEA

PARTNERS



LEAD: CBBEP

PARTNERS: CBBF; CCA; MANERR; TAMUCC; TGLO; TNC; TPWD; Conservation organizations (e.g., Sierra Club, Surfrider Foundation); Industry (e.g., Citgo)

CHAPTER

13

Delta Discovery

CONTENTS

Introduction

Delta Discovery Action Plan



ACCOMPLISHMENT: Record Year for Delta Discovery

The 2015-2016 school year was record-breaking for the Delta Discovery Program. The Program saw almost 10,000 PK-12 students, 600 teachers, and over 1,000 others through various outreach events. The Program is based at the Nueces Delta Preserve and introduces students and teachers in the Coastal Bend to issues affecting the bays and estuaries, as well as the local ecology. Engaging field experiences for all grade levels aligned with Texas Essential Knowledge and Skills (TEKS) are available, allowing students and teachers to get 'mud between their toes' and connect with nature through discovery-based learning.

During the 2015-2016 school year, Delta Discovery was able to reach more students than ever before, but the most notable increase in attendance was at teacher workshops. Almost 600 teachers earned Continued Professional Education Credits and Texas Environmental Education Advisory Committee Credits. At the heart of it all is connecting classrooms to nature, and teacher workshops are key to providing teachers the tools they need to bring the outdoors and environmental education into their classrooms.

In addition to formal K-12 educational opportunities, Delta Discovery offers programs called Nature Story Time and Delta Discovery Picnic Days. Picnic Days allow students who have visited the Delta through a field trip to bring their families, share what they've learned, and explore a little more. Nature Story Time targets children ages 2-5 and allows families to enjoy days at the Delta with nature-themed stories and other activities including nature walks, crafts, and/or live animals. Both of these programs are open to the public and will continue into the future.

◀ **STUDENTS EXPLORE** and record their observations in a field journal. (Photo by CBBEP)

Introduction

The CBBEP is committed to preparing tomorrow's future leaders to be responsible stewards by providing them with knowledge and understanding of our bays and estuaries. To fulfill this commitment, the CBBEP has created the Delta Discovery Program to increase the estuary literacy of students and teachers within the Coastal Bend. It is important that local teachers and students understand the ecology of the bay system, its many environmental and economic values, and how an individual can make a positive difference to ensure its long-term health. In addition to understanding how the bay system functions, it is important that young people develop a sound appreciation for the significant value and economic impact derived from the bay resources. Local students are likely to become the next generation of local decision-makers and their teachers are in a position to help them understand the importance of coastal resources.

The Delta Discovery Program implements hands-on, discovery-based programs that help students learn about essential coastal and estuarine concepts and strengthen their critical thinking, team building, and problem solving skills. The main audience for Delta Discovery programs are PK-12 students and teachers, but target audiences range from toddlers to senior adults. Curriculum is discovery-based and aligned with state/national standards, providing students a connection between classroom instruction and practical application through outdoor experiences. Field trips are primarily conducted at the CBBEP Nueces Delta Preserve, but other CBBEP properties and partner sites are utilized on occasion. The 10,500 acre Nueces Delta Preserve is located at the north end of Nueces Bay near Odem, Texas. The property protects a variety of habitats (coastal marshlands, wetlands, open water, islands, upland prairie, and bay shorelines) and is known for the quality of its conservation and land management practices. *The Bays Plan, 2nd Ed.* calls for the Delta Discovery Program to continue offering discovery-based, hands-on experiences to students of the Coastal Bend at the Nueces Delta Preserve and other sites, as needed.

The Bays Plan also calls for the Delta Discovery to offer workshops that provide educators the tools needed to incorporate outdoor experiences more readily into formal classroom instruction and programming. By providing teacher workshops that complement student field trips, Delta Discovery ensures that teachers can successfully connect instruction in the classroom with real world application. In addition to curriculum, workshop participants also receive supplies and equipment necessary to implement programs in the classroom, as well as staff

support if necessary.

The Bays Plan, 2nd Ed. recognizes that outdoor community programs can help foster behavioral change and promote resource conservation by working with audiences whose choices directly impact the integrity of our estuaries and their watersheds. At the Nueces Delta Preserve, community programs provide opportunities for the public to experience our local bays and estuaries first-hand. For example, Delta Discovery currently provides a program called “Nature Story Time,” and families are also able to participate in outdoor activities at the Nueces Delta Preserve during “Delta Discovery Picnic Days.” These special events allow families to explore the wonders of the Nueces Delta Preserve with staff scattered throughout the Preserve to answer questions and give background information on plants, animals, and history.

Enhancing public awareness and understanding of estuarine systems and providing suitable opportunities for public education and interpretation would be very difficult goals to fulfill without partners. Partnerships are key to helping the Delta Discovery Program create broader reaching programs that may be of interest to a larger audience. Delta Discovery focuses on bringing together people and organizations with varied expertise that can help provide educational programs and trainings focused on a wider breadth of topics. Partnership programs may involve the utilization of partner staff and/or facilities.

THE NUECES DELTA PRESERVE

serves as home for the Delta Discovery Program. Facilities at the site include an outdoor pavilion, screened-in classroom, and restroom facilities.



ACCOMPLISHMENT: Youth Odyssey Visit Nueces Delta Preserve

In 2010, Delta Discovery and Youth Odyssey teamed up to host overnight camping trips for 150 kids from the Youth Odyssey program. With the help of a \$36,000 grant from the Texas Parks and Wildlife Department, Youth Odyssey leaders and participants were able to visit the Nueces Delta Preserve for overnight camping trips. These are true camping trips, with the youth pitching tents, cooking, and cleaning the site themselves. There is also hiking and kayaking activities.

Combining life skills and outdoor experiences, Youth Odyssey provides a special perspective to kids struggling with school and life. Nature is used to help participants realize they have talents that will help them be a successful community member. Youth Odyssey participants are selected by schools and recreation centers throughout the area. The children, ages 10-17, attend team-building sessions that focus on basic life skills - communication, goals setting, problem solving, leadership, and trust - before going kayaking, hiking, rock climbing, and camping.

By partnering with Youth Odyssey, the Delta Discovery Program was able to expand its mission of reaching children who might not otherwise get the chance to go outdoors. Kids are given time away from distractions - television, video games, school bullies, and complicated home lives - in a place where they can focus on bettering themselves. Programs like Delta Discovery and Youth Odyssey are also critical for getting the next generation into the outdoors so they in turn will work to protect and preserve that natural world. For children who haven't spent much time outdoors, this can be a life-changing experience.



DELTA DISCOVERY

Action Plan

GOAL

Increase environmental literacy and stewardship of coastal watersheds through formal and informal education utilizing the Nueces Delta Preserve, other CBBEP properties, and partner sites.

OBJECTIVES

- DD 1: Enhance the capacity of students to think critically about the environment and their role in watershed stewardship by connecting them to nature through guided discovery.
- DD 2: Expand opportunities for children, adults, and families to participate in experiential outdoor learning programs.

ACTIONS

- DD 1.1: Provide authentic discovery-based experiences for PK-12 students and beyond that are aligned to cross-curricular state/national standards.
- DD 1.2: Provide professional development and resources for educators that allow them to connect classroom instruction with real-world application.
- DD 1.3: Identify and promote partnership opportunities with like-minded organizations to develop and/or deliver programs that support the Delta Discovery mission of environmental education and coastal watershed protection.
- DD 2.1: Provide outdoor learning opportunities that facilitate hands-on investigations of and experiences in the natural environment.



Delta Discovery 1.1

Provide authentic discovery-based experiences for PK-12 students and beyond that are aligned to cross-curricular state/national standards.

The CBBEP is focused on educating the next generation of local decision-makers about the ecology of the bay system, its many environmental and economic values, and how an individual can make a positive difference to ensure its long-term health. The CBBEP offers hands-on field experiences for PK-12 students through its “Delta Discovery Program.” Curriculum is discovery-based and aligned with state/national standards, providing students a connection between classroom instruction and practical application through outdoor experiences. Environmental education not only connects classroom learning to the real world, it builds critical thinking, fosters leadership and relationship skills, and when integrated into the core curricula has a measurable positive impact not only on student achievement in science, but also in reading, math, and social studies. Field trips are primarily conducted at the CBBEP’s Nueces Delta Preserve, but other CBBEP properties and partner sites are utilized on occasion. Delta Discovery provides field trip opportunities for over 8,000 students annually at the Nueces Delta Preserve.

STEP 1:

Seek continued funding to support personnel and supplies needed to implement field-based experiences.

STEP 2:

Continue to develop productive relationships with teachers and administrators from Coastal Bend schools and home school programs in order to promote high levels of participation in field-based experiences.

STEP 3:

Develop and implement topic and grade specific field trip programs. This includes creation of pre- and post-materials, implementation of field trip activities, and completion of student assessments.

STATUS



UNDERWAY: The Delta Discovery Program routinely provides hands-on field experiences for thousands of PK-12 students annually, and the program will continue to do so throughout the applicable life of this plan.

TIMEFRAME



Steps are considered on-going and will be implemented annually throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$\$\$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds); Private industry (e.g., Green Mountain, Union Pacific, Citgo); Foundations (e.g., CBBF, Ed Rochelle Foundation); State and Federal grants (e.g., TPWD, EPA)

PARTNERS



LEAD: CBBEP

PARTNERS: Step 1 = Foundations; Private industry; Programmatic Partners (e.g., TPWD, WIF, TSA); Step 2 = ESC Region 2 & 3; Home schools (e.g., HSST, HUT); Private schools; Public school districts; TEA; TEEAC; Step 3 = Delta Discovery Advisory Committee; Programmatic partners (e.g., TPWD, WIF, TSA); Teachers, administrators, and volunteers; TMN; TPWD; Universities

PERFORMANCE METRICS



1. Number of students, teachers, schools, and school districts participating in field-based experiences.
2. Number of returning teachers, schools, and school districts.
3. Demonstration of learning objectives in student assessments.
4. Teacher/workshop evaluations.



Delta Discovery 1.2

Provide professional development and resources for educators that allow them to connect classroom instruction with real-world application.

Teaching individuals and communities about the environment enhances public understanding of the values and functions of the natural resources in the Coastal Bend and provides motivation for solving environmental problems. Delta Discovery offers workshops that give educators the tools they need to more readily incorporate outdoor experiences into formal classroom instruction/programming. By providing teacher workshops that complement student field trips, Delta Discovery is ensuring teachers can successfully connect instruction in the classroom with real world application. Workshop participants also receive supplies and equipment necessary to implement programs in the classroom, as well as staff support if necessary. In the past, Delta Discovery has provided workshops to as many as 600 teachers.

STEP 1:

Update existing and create new content and curricula for professional development trainings.

STEP 2:

Identify, develop, and obtain resources (e.g., teaching supplies, curricula, staff support) for educators that promote concepts covered in professional development trainings and enhance classroom teaching.

STEP 3:

Implement and host professional development trainings. This includes scheduling, providing “ask an expert” visits, hosting interpretive workshops, and conducting assessments of training events.

STEP 4:

Continue to develop productive relationships with teachers and administrators from Coastal Bend schools and home school programs in order to promote high levels of participation in field-based experiences.

STATUS



UNDERWAY: The Delta Discovery Program routinely provides training workshops for teachers, reaching as many as 600 teachers in previous years. Delta Discovery will continue to provide training events throughout the applicable life of this plan.

TIMEFRAME



Steps are considered on-going and will be implemented annually throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$\$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds); Private industry (e.g., Green Mountain, Union Pacific, Citgo); Foundations (CBBF, Ed Rochelle Foundation); State and Federal agencies (e.g., TPWD, EPA)

PARTNERS



LEAD: CBBEP

PARTNERS: Step 1 = ESC Region 2 & 3, National organizations (e.g., NAI), Programmatic partners (e.g., TPWD, WIF, CCMSH), TEA, TEAC, Universities; Step 2 = Non-profit organizations (e.g., Leopold Education Foundation, Berkley Center, Cornell Lab of Ornithology), State and Federal agencies (e.g., TPWD), Universities; Step 3 = NAI, State and Federal agencies, Universities; Step 4 = ESC Region 2 & 3; Home schools (e.g., HSST, HUT); Private schools; Public school districts; TEA; TEEAC; TPWD

PERFORMANCE METRICS



1. Teacher assessments show an increase following trainings.
2. End-of-year surveys show that content from professional development trainings is implemented in classrooms.



Delta Discovery 1.3

Identify and promote partnership opportunities with like-minded organizations to develop and/or deliver programs that support the Delta Discovery mission of environmental education and coastal watershed protection.

Collaborating with partners allows the Delta Discovery Program to provide educational programs and trainings focused on a wider breadth of topics by bringing together people and organizations with varied expertise (e.g., International Crane Foundation, TPWD Interpretation Staff, etc.). Additionally, these partnerships allow the Delta Discovery Program the opportunity to create broader reaching programs that may be of interest to a larger audience by utilizing the staff, and sometimes the facilities, of other organizations.

STEP 1:

Research and vet potential partners for formal education programs (e.g., TCIN, ISEA of Texas).

STEP 2:

Develop program (e.g., trainings, field trips) with identified partner. Steps for program development include: creating curriculum, agendas, and assessments; identifying roles and responsibilities; coordinating logistics (e.g., facilities and supplies); and identifying funding, if needed.

STEP 3:

Once programs are developed, schedule, promote, and implement programs.

STEP 4:

Survey partners to evaluate and assess programmatic successes and failures and determine likelihood for repeating programs in the future.

STATUS



UNDERWAY: The Delta Discovery Program routinely works with the partners listed below to implement its formal education programs.

TIMEFRAME



Steps will be implemented sequentially as partners are identified throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$\$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds); Foundations (e.g., CBBF, Ed Rochelle Foundation); Private industry (e.g., Green Mountain, Union Pacific, Citgo); School Districts; State and Federal agencies (e.g., TPWD, EPA)

PARTNERS



LEAD: CBBEP

PARTNERS: ANWR; CBCiN; CCS; CCMSh; City of Corpus Christi; ICF; MANERR; NRA; TCiN; TMN; TPWD; TSA; WIF

PERFORMANCE METRICS



1. Number of programs requested by partners.
2. Number of programs completed with partners.
3. Number of programs repeated with the same partners.
4. Teacher/student evaluations.



Delta Discovery 2.1

Provide outdoor learning opportunities that facilitate hands-on investigations of and experiences in the natural environment.

One of the most effective methods of enhancing public awareness and understanding of natural resources involves getting people out into nature. Outdoor community programs can help foster behavioral change and promote resource conservation by working with audiences whose choices directly impact the integrity of our estuaries and their watersheds. At the Nueces Delta Preserve, community programs provide opportunities for the public to experience our local bays and estuaries first-hand. For example, Delta Discovery currently provides a summer program called “Nature Story Time.” Each session focuses on a theme and allows children, accompanied by a parent or caregiver, to enjoy days at the Delta with nature-themed stories and other activities, such as nature walks, crafts, and/or live animals. “Nature Story Time” activities are targeted for ages 2 -5, but all are welcome to come and enjoy. Families are also able to participate in outdoor activities at the Nueces Delta Preserve during “Delta Discovery Picnic Days.” These special events allow families to explore the wonders of the Nueces Delta Preserve with staff scattered around the Preserve to answer questions and give background information on plants, animals, and history. Delta Discovery is working to expand its community programs based on gaps that have been recognized in the local area and identifying potential partnerships.

STEP 1:

Identify gaps and needs for community outdoor programs in the Texas Coastal Bend.

STEP 2:

Identify organizations with existing programs that could be partnered with in order to fill identified gaps (e.g., Youth Odyssey, Boy Scouts of America, Wildlife In Focus).

STEP 3:

Develop programs to fill identified gaps/needs.

STEP 4:

Once programs are developed, schedule, promote, and implement programs.

STEP 5:

Evaluate and assess program effectiveness by utilizing measures such as satisfaction surveys and social media posts.

STATUS



UNDERWAY: Implementation of existing outdoor community education programs at the Nueces Delta Preserve, called “Nature Story Time” and “Delta Discovery Picnic Days,” is on-going.

TIMEFRAME



Step 1 will occur approximately every two-three years. Following the completion of Step 1, the remaining steps will be implemented, as needs/opportunities are identified and as funding becomes available, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic funds (EPA 320 funds); Donations; Foundations (e.g., CBBF, Ed Rochelle Foundation); Private industry (e.g., Green Mountain, Union Pacific, Citgo); State and Federal agencies (e.g., TPWD, EPA)

PARTNERS



LEAD: CBBEP

PARTNERS: Boy Scouts of America; Girl Scouts; Libraries/Publishing Companies; TMN; WIF; Youth Odyssey

PERFORMANCE METRICS



1. Number of visitors participating in outdoor community education programs.
2. Contact hours (i.e., time in nature) for outdoor community education program participants.

CHAPTER

14

Coastal Resilience

CONTENTS

Introduction

Coastal Resilience Action Plan



Introduction

Changing climatic and environmental conditions pose major threats to our nation's estuaries, and as part of a network of coastal, place-based programs, the CBBEP and the communities it serves are significantly affected by these changes. Changes to sea level, storm intensity and surge, rainfall and hydrology, and acidification are impacting our coastal zones. As a result, efforts to make the Coastal Bend area more resilient to changing conditions is more crucial than ever. The failure in designing and implementing effective avoidance, mitigation, minimization, and adaptation strategies will result in large costs to the citizens of the Coastal Bend for addressing problems associated with climate and environmental change (Murdock and Brenner, 2016).

In 2016, with funding from the EPA Climate Ready Estuaries Program, the CBBEP collaborated with The Nature Conservancy to complete the Texas Coastal Bend Regional Climate Change Vulnerability Assessment (CCVA). The CCVA identified changes caused by a changing climate and environment in the Coastal Bend area and assessed how current changes in climate stability could have future effects on sea level, storms, hydrology, geomorphology, natural habitats and species, land use, economy, human health, infrastructure, and cultural resources. It also used future scenarios of climate to identify impacts and vulnerabilities of different sectors that represent relevant coastal environments and communities in the study area. Stakeholders of the Coastal Bend area provided input at a workshop regarding aspects that they considered relevant about their vulnerabilities and opportunities for building resiliency. Coastal resiliency is defined as a community's ability to "bounce back" after hazardous events such as hurricanes, coastal storms, droughts, and flooding, rather than simply reacting to impacts.

The study concluded with a series of recommendations for reducing vulnerabilities and promoting natural and community resiliency:

- Facilitate and support studies to better understand local biological, chemical, and physical effects of a changing climate. Bridge the gap between the climate science and the planning, management and decision-making communities by identifying the key information needed to build resiliency. For example, the translation of key science-based vulnerabilities into easy to understand components of people's well-being and express them in monetary terms.

- Increase community resilience to most drastic hazards, such as storms, by building in redundancies (alternative or primary) in power generation that are based on natural gas, a more reliable energy source after storm rebuilding. Communities should adopt an early flood warning system and coordinate other adaptation measures through their planning and emergency departments to maximize public response to adaptation needs through education. Communities should look into creating incentives for the acquisition of repetitive loss properties. When possible retrofit infrastructure with energy efficient facilities.
- Build coastal resiliency by restoring coastal habitats that protect communities and infrastructure. Coastal vegetation habitats, such as salt and freshwater marshes, should be allowed to migrate landwards together with sea level rise to minimize losses and maintain resiliency. Invest in a combination of grey and green infrastructure that builds resilient communities and take into account the social benefits and costs.
- Assist local governments in developing and implementing adaptive management plans that conserve and protect the Coastal Bend area's ecological services. Address climate adaptation, and the threats of sea level rise and storm surge in the Comprehensive Plans of the communities in the Coastal Bend area. For example - adjust plans and policies to require that new construction occur outside the flood areas and include these changes in local facilities plan. Involve all supporting industries such as utility providers in the planning process.
- Develop and implement educational programs and distribute literature about the effects of a changing climate. Education programs should cover a diverse group of topics from human health to storm preparedness to protection of natural infrastructure, among others.

These recommendations, along with guidance from stakeholders, were used to develop objectives and actions for a Coastal Resiliency Action Plan that will increase the resiliency of the estuaries and communities in the Coastal Bend. The primary focus of the Coastal Resiliency Action Plan is on (1) contributing to the scientific understanding of local climate and its impacts on estuarine systems and coastal communities, (2) increasing the capacity of local communities to adapt and mitigate for impacts from a changing climate, and (3) providing educational opportunities related to local effects of a changing climate on human and estuarine systems to increase public awareness and foster behavior change.

◀ **BLACK MANGROVES** have expanded their range within the Coastal Bend in recent decades.
(Photo by Mission-Aransas NERR)



INCREASING COASTAL RESILIENCE

Hurricane Harvey made landfall on the Texas coast on August 25, 2017, resulting in devastating impacts to the communities of the Texas Coastal Bend. In addition to the impacts this major storm had on people, it also had a significant affect on our natural resources. This disaster increased local awareness of the need for resilience in the natural and built environments, particularly the need to consider resilience in and around the Coastal Bend. Resiliency planning should be focused on the capacity of community and natural infrastructure to withstand the effects of anthropogenic and natural perturbations. The following list provides examples of CBBEP's current efforts to increase resiliency in the Coastal Bend region:

1. Improving our understanding of local changes in key data parameters related to climate variability (e.g., pH, salinity) and strengthening our knowledge of climate impacts on ecosystem structure and function (e.g., effects of mangrove expansion).
2. Collaborating with partners to protect and/or adapt important natural and man-made infrastructure and habitats that were identified in the Texas Coastal Bend Regional Climate Change Vulnerability Assessment as being vulnerable to impacts from natural hazards or infrastructure failures due to climate change.
3. Consideration of sea level rise in the planning and design of habitat and hydrological restoration projects.
4. Expanding the connectivity of conserved landscapes to allow for habitat migration due to sea level rise.
5. Promoting the understanding of potential local impacts to both natural habitat and man-made infrastructure due to changing climatic conditions and encourage incorporation of findings into resiliency and adaptation planning.
6. Incorporating natural infrastructure/habitat based solutions into resiliency and adaptation planning activities. Where appropriate, encouraging the beneficial use of dredged material in these solutions.
7. Collaborating with local partners to re-design, upgrade and/or retrofit wastewater treatment facilities, stormwater infrastructure, and drinking water facilities to be resilient in a changing climate. Where appropriate, encouraging consideration of sea level rise in the planning and design of wastewater treatment facility construction and upgrades.
8. Assisting with resiliency planning for water dependent uses and sustainable land use practices.



COASTAL RESILIENCE

Action Plan

GOAL

Understand, project, mitigate, and adapt to impacts from changing climatic conditions to increase resiliency of estuaries and coastal communities in the Coastal Bend.

OBJECTIVES

- CR 1: Integrate climate science into strategic planning and adaptive management.
- CR 2: Improve climate literacy in order to build capacity for adapting and mitigating impacts from changing climatic conditions.

ACTIONS

- CR 1.1: Facilitate and support studies to better project and understand the local biological, chemical, physical, and ecological effects of changing climatic conditions.
- CR 1.2: Assist in developing and implementing adaptive management plans that conserve and protect coastal resources and their ecosystem services by incorporating changing climatic conditions.
- CR 2.1: Develop or use formal and informal education materials that are locally relevant to enhance climate literacy.



Coastal Resilience 1.1

Facilitate and support studies to better project and understand the local biological, chemical, physical, and ecological effects of changing climatic conditions.

Changing climatic and environmental conditions pose major threats to our nation’s estuaries. Changes in sea level, shifts in salinity and pH, changes in air and water temperature, and alterations in precipitation result in the potential loss of habitats and associated species, as well as adverse impacts to local economies, development, and infrastructure. In order to improve the resiliency of these important ecosystems and the communities that rely on them, we must increase our understanding of local changes in key data parameters relating to climate variability, strengthen our knowledge of climate impacts on ecosystem structure and function, and use new data and information in modeling efforts to better predict future impacts of climate on local resources. This data and information is essential for helping local communities and resource managers conduct assessments that determine which resources (i.e., people, infrastructure, and natural resources) are most vulnerable to climate variability and which climate phenomena and associated impacts could cause the greatest losses.

STEP 1:	STEP 2:	STEP 3:	STEP 4:
Facilitate research and monitoring of key abiotic parameters related to climate variability (e.g., temperature, precipitation, salinity, dissolved oxygen, pH, carbon dioxide, water level).	Support assessments of climate impacts on ecosystem structure and function, including studies of the interaction between climate and existing stressors (e.g., invasive species, urban development).	Use the results from Steps 1 and 2 to enhance modeling efforts (e.g., SLAMM) to better project future climate impacts on local resources.	Use new data and models to build upon the Texas Coastal Bend Regional Climate Change Vulnerability Assessment and other climate vulnerability assessments performed by partners.

STATUS



UNDERWAY: CBBEP is partnering with TAMUCC to monitor coastal acidification in the Aransas Pass Ship Channel at the UTMSI research pier. The highly precise equipment, which will measure pH and pCO₂, was funded by the EPA. CBBEP will also continue to support salinity gages located within the Nueces River Delta and the Rincon Bayou. These gages provide a source for long-term salinity records that can be used to evaluate changes over time.

TIMEFRAME



Steps are considered on-going and will be implemented on a regular basis throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$-\$

POTENTIAL FUNDING: CBBEP Programmatic Funds (EPA 320 funds, TCEQ, Local funds); CMP; EPA Gulf of Mexico Program; NOAA; NSF

PARTNERS



LEAD: CBBEP

PARTNERS: EPA; MANERR; NOAA; TCEQ; TNC; TPWD; TWDB; Universities (e.g., CCS, HRI, TAMUCC, UTMSI); USFWS, USGS

PERFORMANCE METRICS



1. Number of CBBEP-supported research and monitoring projects that address climate variability.
2. Number of models utilizing local data to enhance climate predictions.



Coastal Resilience 1.2

Assist in developing and implementing adaptive management plans that conserve and protect coastal resources and their ecosystem services by incorporating changing climatic conditions.

The effects of changing climatic conditions are increasingly apparent in the Texas Coastal Bend. These changes will greatly affect our ability to conserve coastal resources and protect the communities that depend on their ecosystem services. Communities and resource managers must strive to increase coastal resiliency by developing adaptation strategies and plans that address the impacts of changing climatic conditions that cannot be avoided. Adaptation planning requires the identification and assessment of impacts that are likely to affect the planning area, development of goals and actions to best minimize these impacts, and establishment of a process to implement those actions. Planning for future climate impacts will help reduce risks to people and infrastructure and will improve natural resource management and conservation strategies.

Many of the impacts and consequences of a changing climate are not new – they are simply exacerbated or accelerated. In many cases, the adaptation strategies needed to reduce impacts already exist and are often being implemented outside the context of a changing climate. Therefore, familiar actions can be used to support climate adaptation, but some of these actions are likely insufficient for addressing the scale of potential changes. It will take a combination of existing, reconfigured, and new actions to meet the challenge of adapting to a changing climate. Most importantly, the potential impacts of climate on coastal resources should be considered in all related planning activities.

STEP 1:	STEP 2:	STEP 3:	STEP 4:
Support efforts by local communities and resource managers to address resiliency through the development of climate adaptation plans.	Support efforts to incorporate changing climatic conditions in on-going local and regional planning efforts that address coastal resource management issues.	Ensure that climate impacts are considered in all CBBEP conservation and management efforts, such as identification of land acquisition targets, species management planning, and restoration design and implementation.	Coordinate regional efforts to make Coastal Bend communities more resilient to storm events by helping them enroll in the Community Rating System.

STATUS



UNDERWAY: The CBBEP partnered with TNC to complete the Coastal Bend Climate Change Vulnerability Assessment (CCVA) with funding from the EPA. The CCVA was completed in 2016 and included stakeholder recommendations for building local resiliency to changing climatic conditions. The CBBEP will continue to engage its partners in conversations regarding coastal resiliency and will work on implementing the CCVA strategies in the coming years.

TIMEFRAME



Step 4 will occur during the first five years of plan implementation (2020-2025). Steps 1-3 are considered on-going and will be implemented on a regular basis, as needs/opportunities and funding are identified, throughout the applicable life of this plan (2020-2040).

COST



ESTIMATED COST: \$

POTENTIAL FUNDING: CBBEP Programmatic Funds (EPA 320 funds, TCEQ, Local funds); EPA; EPA Gulf of Mexico Program; NOAA

PARTNERS



LEAD: Steps 1-3: CBBEP; Step 4: CBBEP, MANERR, TGLO

PARTNERS: EPA; HRI; Local governments; TCEQ; Texas Sea Grant; TNC; TPWD; TWDB

PERFORMANCE METRICS



1. Number of climate adaptation plans developed by local communities within the program area.
2. Number of local and regional planning documents that incorporate strategies for adapting to changing climatic conditions.
3. Number of communities within the program area enrolled in the Community Rating System.



Coastal Resilience 2.1

Develop or use formal and informal education materials that are locally relevant to enhance climate literacy.

A climate-literate individual understands their influence on climate and climate’s influence on their life and society. Climate literacy requires an understanding of the essential principles of Earth’s climate system, knowledge of how to assess scientifically credible information about climate, the capacity to communicate about climate and changing conditions in a meaningful way, and the ability to make informed and responsible decisions with regard to actions that may affect climate.

In the coming decades, scientists expect changing climatic conditions to have an increasing impact on human and natural systems. Reducing our vulnerability to these impacts depends not only upon our ability to understand climate science and the implications of a changing climate, but also upon our ability to integrate and use that knowledge effectively. The formal and informal education and outreach programs offered by CBBEP and its partners play a key role in educating the general public and students about climate impacts on coastal resources and providing information about potential mitigation and adaptation options. Framing issues locally can be especially persuasive in climate literacy efforts. Education materials that focus on local climate conditions in the Coastal Bend will be the most effective at reaching people who are generally dismissive of climate science.

STEP 1:

Support efforts to develop interpretive exhibits and displays that can be used at community events, festivals, and forums to educate Coastal Bend residents about local climate and the actions they can take to mitigate and adapt to climate impacts.

STEP 2:

Develop a regional climate education and outreach toolkit that serves as a repository of information on climate for local educators, teachers, and the general public. The toolkit could include maps of projected sea-level change, brochures and handouts that describe ways to limit carbon emissions and increase community resiliency, climate curriculum for K-12 teachers, relevant climate literature, regionally focused presentations on impacts and actions, and information on green building resources and networks.

STATUS



NEW: Implementation of new actions will take place following the adoption of the revised plan during the time period identified.

TIMEFRAME



Steps will be take place during the first 10 years of Plan implementation (2020-2030).

COST



ESTIMATED COST: \$
POTENTIAL FUNDING: CBBEP Programmatic Funds (EPA 320 funds, TCEQ, Local funds); EPA; NOAA

PARTNERS



LEAD: CBBEP

PARTNERS: CBBF; CCMSh; EPA; MANERR; NOAA; TCEQ; Texas Sea Grant; TGLO; TPWD; TSA; TWDB; Universities (e.g., CCS, HRI, UTMSI); USFWS

PERFORMANCE METRICS



1. Number of climate education and outreach toolkits and interactive exhibits developed with CBBEP resources.
2. Number of events utilizing climate education and outreach toolkits and exhibits.
3. Number of stakeholders reached by climate education and outreach toolkits and exhibits at events, workshops, and forums.

CHAPTER

15

Monitoring Strategy



CONTENTS

Environmental Monitoring
Programmatic Monitoring
Informational Products

Evaluating the success of *The Bays Plan, 2nd Ed.* requires the CBBEP to track both the extent to which the actions laid out in the Plan are being implemented and the environmental response to those implemented actions. The combination of these monitoring approaches support evaluations of whether management actions are being implemented as planned and have resulted in progress toward environmental goals. Monitoring also establishes baselines from which to evaluate the environmental response to potential future perturbations, such as hurricanes, oil spills, and climate change.

The CBBEP developed a regional monitoring plan for the Coastal Bend in support of *The Bays Plan, 2nd Ed.* proposes to continue using a similar monitoring approach, with the primary goals of the monitoring program being: (1) to measure the effectiveness of the management actions and programs implemented under the Bays Plan, and (2) to provide essential information that can be used to redirect and refocus *The Bays Plan, 2nd Ed.* during implementation (Hunt et al., 2001).

Environmental Monitoring

The goal of the environmental monitoring program is to provide environmental data that can be compared to the goals, objectives, and actions outlined in the Bays Plan and used to evaluate progress towards achieving environmental goals. Two complementary approaches are used by the CBBEP to conduct environmental monitoring. The first approach involves an assessment of the overall health of the bays. This allows for the systematic measurement of the net effectiveness of all actions implemented. This approach incorporates environmental monitoring of the major areas of concern, including habitat, sediment quality, water quality, freshwater resources, commercial and recreational fisheries, species of concern, and shoreline management. The second approach provides for more tailored monitoring programs and plans that may be required for individual projects or programs that have specific environmental evaluation criteria (Hunt et al., 2001).

There are numerous ongoing environmental data collection and monitoring activities in progress within the CBBEP program area, most of which are carried out by federal, state and local agencies, academic institutions, and volunteers and community organizations (Table 4). Data are collected at thousands of stations throughout the Coastal Bend, some of which have been in operation for decades, and the frequency of data collection ranges from

continuous to annual sampling (Hunt et al., 2001). The CBBEP's role in these monitoring programs and activities has focused primarily on financial support, coordination, synthesis, and communication to varying degrees.

CBBEP utilizes the monitoring data from its partners to track environmental indicators and determine status and trends of important indicators on a periodic basis (e.g., CBBEP Environmental Indicators Report, State of the Bay). These types of reports bring together data collected by researchers from the academic and agency communities as it applies to understanding the environmental dynamics of the Coastal Bend bays and estuaries.

Several of the major environmental monitoring programs and activities within the Coastal Bend are described in Table 4. These data sources are considered useful for measuring the effectiveness of management actions/programs and for tracking progress towards environmental goals. However, this is not a comprehensive listing and other programs and activities may be used as needed to determine the health of the bay and estuary system.

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 CBBEP 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 (Hunt et al., 2001). Results of environmental evaluations from individual projects will be summarized in project reports and research publications and will be included in CBBEP summary reports when relevant.

A number of actions in *The Bays Plan, 2nd Ed.* identify the need to implement new monitoring activities or enhance existing monitoring efforts. A summary of *The Bays Plans* actions related to monitoring is provided in Table 5, including a prioritization, timeframe, and cost estimate.

It is important to note that the environmental monitoring programs are not static, and data collection techniques must evolve and adapt with changes in technology, management needs, ecosystem responses, and funding. The Action Plans of *The Bays Plan, 2nd Ed.* include a number of recommendations for ongoing enhancements to monitoring. The CBBEP will make efforts to ensure that the Annual Work Plans and Quality Assurance Plans of individual monitoring components will be regularly updated as these changes are incorporated.

CBBEP STAFF WORK WITH PARTNERS to install water quality monitoring equipment in Egery Flats. (Photo by the CBBEP)

TABLE 4. DESCRIPTIONS OF THE MAJOR ENVIRONMENTAL MONITORING PROGRAMS AND ACTIVITIES WITHIN THE CBBEP PROGRAM AREA. THESE PROGRAMS AND ACTIVITIES REPRESENT POTENTIAL DATA SOURCES FOR EVALUATION OF BAY AND ESTUARY HEALTH.

Program/Activity Name (Lead Agency)	Program/Activity Description	Location	Relevant Action Plans
Surface Water Quality Monitoring Program (TCEQ)	Surface water quality monitoring involves collection of physical, chemical, and biological samples (i.e., dissolved oxygen, pH, temperature, conductivity, salinity, fecal coliform, nutrients, chlorophyll, dissolved and suspended solids, metals in water, metals in sediment, organics in water, and fish tissue) from numerous surface water sites throughout the Coastal Bend. Data may be used to determine compliance with the Texas Surface Water Quality Standards through the Texas Integrated Report.	Gulf of Mexico, bays, lakes, rivers, and creeks throughout the CBBEP area	WSQ, NPS, PH, SM, FR, CR
Clean Rivers Program (NRA, SARA)	The Clean Rivers Program monitors bacteria (<i>E.coli</i> , <i>Enterococcus</i>) and water quality parameters (dissolved oxygen, temperature, pH, ammonia, chlorophyll, nutrients, chloride, sulfate, and total dissolved solids) in bay/tidal and river/lake sites within the Coastal Bend on a quarterly basis.	Rivers and bays within the CBBEP area	WSQ, NPS, PH, SM, FR, CR
Texas Coastal Ocean Observation Network	TCOON is tasked with the collection of accurate water level data along the Texas Coast. Many TCOON stations also measure wind data, atmospheric pressure, and air and water temperature.	Bays throughout the CBBEP area	WSQ, FR, CR
System-Wide Monitoring Program (MANERR)	The System Wide Monitoring Program measures water quality parameters (i.e., pH, salinity, temperature, dissolved oxygen, turbidity, and water level), weather conditions (i.e., air temperature, wind direction, wind speed, barometric pressure, and relative humidity), and nutrient concentrations (i.e., nitrate/nitrite, ammonium, phosphate, and silicate). Water quality parameters are sampled in 15-min intervals at six sampling platforms, while weather conditions are sampled in 15-min intervals at one station.	Mesquite, Aransas, and Copano Bays and Aransas Ship Channel	WSQ, NPS, FR, CR
Texas Beach Watch (TGLO)	Texas Beach Watch monitors water for <i>Enterococcus</i> bacteria as a surrogate of harder to detect, disease-causing microorganisms where sewage or storm runoff is present. Water quality advisories are recommended when <i>Enterococcus</i> levels exceed limits established by EPA. During the peak beach season (May-Sept), water samples are collected weekly. During the rest of the year samples are collected every two weeks.	Gulf of Mexico and bay beaches throughout the CBBEP area	PH, WSQ, NPS, CR
Texas Streamflow Program (USGS)	Rivers and creeks are monitored for daily stream flow volume.	Rivers and creeks throughout the CBBEP area	FR, CR
Water Level Stations (NOAA)	In addition to measuring tidal heights, NOAA Water Level stations also record 11 different oceanographic and meteorological parameters. These include wind speed and direction, water current speed and direction, air and water temperature, and barometric pressure. Measurements are collected every six minutes.	Aransas National Wildlife Refuge, Rockport, Corpus Christi, Packery Channel, Bob Hall Pier, South Bird Island, Baffin Bay, Rincon del San Jose	WSQ, CR
Nueces Bay Salinity Monitoring (CBI)	Multiple sites in the Nueces River, Delta, and Bay are monitored for routine field parameters, salinity, water temperature, dissolved oxygen, and pH at 30-minute intervals.	Nueces River, Nueces Delta, and Nueces Bay	WSQ, FR, CR

TABLE 4 (CONT'D). DESCRIPTIONS OF THE MAJOR ENVIRONMENTAL MONITORING PROGRAMS AND ACTIVITIES WITHIN THE CBBEP PROGRAM AREA.

Program/Activity Name (Lead Agency)	Program/Activity Description	Location	Relevant Action Plans
Seafood and Aquatic Life Group Survey (TDSHS)	The TDSHS tests fish and aquatic life tissues from public waters of Texas to determine contaminant levels and to assess human health risks from consumption of fish or aquatic life. The DSHS informs the public of unsafe contaminant levels in fish and aquatic life by issuing consumption advisories and possession bans (closures).	Rivers, creeks, and bays throughout the CBBEP area	PH, HLR
Baffin Bay Water Quality Monitoring (TAMUCC)	A suite of water quality parameters are sampled by volunteers on a monthly basis and following rain events throughout Baffin Bay. Nutrient addition bioassays are also conducted to determine whether nitrogen or phosphorus is primarily responsible for the excessive algal growth.	Baffin Bay	WSQ, NPS, FR
Estuary Monitoring Program (TWDB, TPWD)	Hydrolab datasondes are deployed at multiple sites throughout Coastal Bend bays to provide high-frequency data (most measurements every 15-60 min) on salinity patterns resulting from changing river flows or meteorological events. Data supports calibration and validation of estuarine hydrodynamic and salinity transport models and is used for development of freshwater inflow-salinity relationships to aid in water resources planning.	Bays throughout CBBEP area	WSQ, FR, CR
Plankton Monitoring Program (TAMU, UTMSI, MANERR)	A FlowCAM is used to analyze water samples collected at MANERR water quality monitoring stations on a monthly basis for the composition of microplankton. Continuous monitoring is performed in the Aransas Ship Channel using the Imaging FloCytobot (IFCB). Both systems are imaging flow cytometers designed to characterize particles in the microplankton size range. The FlowCAM and IFCB conduct routine monitoring of microplankton samples for presence of <i>Karenia brevis</i> and other harmful algal species.	Mesquite, Aransas, and Copano Bays and Aransas Ship Channel	HLR, PH, CR
National Phytoplankton Monitoring Network (NOAA – NCCOS)	The National Phytoplankton Monitoring Network is a community-based network of volunteers monitoring marine phytoplankton and harmful algal blooms. Volunteers collect water samples and use digital microscopy to identify species of phytoplankton. Data is reported to the Marine Biotoxins Program using an on-line database. Samples are collected weekly or biweekly.		HLR, PH, WSQ
Resource Monitoring Program (TPWD)	Fisheries-independent monitoring of finfish and shellfish communities is conducted within the Coastal Bend bays using bag seines, bay trawls, gill nets, and oyster dredges. Data include the number of each species captured, the average total length of each species in every sample, and hydrological data, such as water temperature and salinity while sampling.	Gulf of Mexico and bays throughout CBBEP area	HLR, WSQ, FR, CR
Sport-Harvest Monitoring Program (TPWD)	Fisheries surveys and trailer counts are performed at boat ramps in the Coastal Bend. Trailer counts are used to determine the amount of boating pressure at each site, and fisheries surveys are then used to collect data on amount of angler effort, the quantity, size, and species of fish landed that day, and the general area where anglers captured their fish.	Bays throughout CBBEP area	HLR, TR

TABLE 4 (CONT'D). DESCRIPTIONS OF THE MAJOR ENVIRONMENTAL MONITORING PROGRAMS AND ACTIVITIES WITHIN THE CBBEP PROGRAM AREA.

Program/Activity Name (Lead Agency)	Program/Activity Description	Location	Relevant Action Plans
Commercial Harvest Monitoring Program (TPWD)	Commercial fishery landings are monitored annually through a mandatory self-reporting system for licensed seafood and bait dealers. Regularly scheduled intercept surveys of shrimp and finfish dealers are also conducted to augment commercial landing information.	Bays throughout CBBEP area	HLR, PH, CR
Coastal-Change Analysis Program (NOAA)	The NOAA Coastal-Change Analysis Program produces a nationally standardized inventory of U.S. coastal intertidal areas, wetlands, and adjacent uplands on a rotating five-year collection cycle. Maps of the Coastal Bend region are available for 5-year increments starting in 1996.	Watershed and bays of the CBBEP area	HLR, CR
National Wetlands Inventory (USFWS)	The National Wetlands Inventory was developed by the USFWS to provide geospatially referenced information on the status, extent, characteristics, and functions of wetland, riparian, deepwater, and other related aquatic habitats through a series of topical maps. The most recent NWI maps for most of the Coastal Bend are based on sub-meter, true color digital imagery collected in 2006 and National Agriculture Imagery Program county mosaics from 2004 CIR imagery. Habitats were delineated in a heads-up, on-screen environment at a relative scale of 1:10,000. Wetland and riparian areas were delineated based on vegetation, visible hydrology, and geography in accordance with adopted USFWS classification procedures.	Watershed and bays of CBBEP area	HLR, CR
Texas Seagrass Monitoring Program (UTMSI)	The Texas Seagrass Monitoring Program uses a hierarchical strategy to establish the quantitative relationships between physical and biotic parameters that ultimately control seagrass condition, distribution, and persistence. Tier 1 includes a remote sensing component (typically at 1:24,000 resolution) for status and trends mapping that is regularly updated at about five-year intervals. Tier 2 is a regional rapid assessment program using fixed stations sampled annually from a shallow-draft vessel, along with high resolution photoimagery analysis for deep edge delineation. Tier 3 includes an integrated landscape approach that includes permanent stations and transects that are aligned with high resolution photoimagery to examine the presumptive factors associated with changes in seagrass maximum depth limits and patchiness.	Bays throughout CBBEP area	HLR, WSQ, NPS, TR, CR
Surface Elevation Tables (MANERR, USFWS, CBBEP)	Surface Elevation Table (SET) measurements allow researchers to evaluate elevation change around an in situ benchmark, and if dense temporal measurements are made, the vertical trajectory of the surface can be calculated. SET measurements are taken at fixed locations, typically on an annual basis.	Aransas and Nueces Bay	HLR, CR
Texas Colonial Waterbird Society Surveys (TPWD, USFWS, CBBEP, Audubon Texas, TGLO, TAMU, TNC)	Texas Colonial Waterbird Surveys are performed annually during the last week of May and the first week of June. Data collected includes: number of adults, number of nests, and estimated number of breeding pairs. Surveys began in 1973, but sampling duration varies by monitoring site due to staffing and budget constraints.	Rookeries throughout CBBEP area	HLR, TR, CR

TABLE 4 (CONT'D). DESCRIPTIONS OF THE MAJOR ENVIRONMENTAL MONITORING PROGRAMS AND ACTIVITIES WITHIN THE CBBEP PROGRAM AREA.

Program/Activity Name (Lead Agency)	Program/Activity Description	Location	Relevant Action Plans
Christmas Bird Count (National Audubon Society)	Every year from Dec 14 – Jan 5, volunteers participate in the Christmas Bird Count. Data collected during the Christmas Bird Count includes number of individuals observed by species. There are multiple active Christmas Bird Count sites within the Coastal Bend, but sampling duration at sites varies based on volunteer participation.	Aransas National Wildlife Refuge, Rockport, Welder Wildlife Refuge, Port Aransas, Corpus Christi, Flour Bluff, Kingsville, Kenedy County	HLR, CR
Whooping Crane Census (USFWS)	Distance sampling is used to survey the areas where Whooping Crane territories are known to occur. To ensure each area is surveyed in a uniform and consistent pattern, transects that are 1 km apart are established for each sampling area. Each survey is conducted by a pilot and two observers looking out different sides of the plane. Upon detecting a crane, the observers record the bird's location on a high-resolution satellite image using a touch screen laptop equipped with a wireless GPS. Surveys are conducted at approximately 60 meters altitude and 160 km/hr. Surveys are performed the last two weeks of Nov and the first two weeks of Dec.	Aransas National Wildlife Refuge and surrounding area	HLR
Sea Turtle Patrol (NPS, UTMSI)	Systematic surveys are conducted daily during nesting season (Mar-Jul) on Gulf beaches of North Padre and Mustang Islands. Data collected include date and location of observation, number of eggs, length and width of nesting turtles, and tag numbers of nesting turtles.	Gulf beaches of North Padre and Mustang Islands	HLR
Mussel Watch (NOAA)	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, chlorinated pesticides, major elements, and trace elements.	Mesquite, Aransas, Copano, Corpus Christi, and Nueces Bay	HLR, WSQ, CR

Programmatic Monitoring

Ultimately, the success of *The Bays Plan* will be judged by indications of improved health and abundance of living resources and increased uses and value of the Coastal Bend's natural resources. The environmental monitoring described above is necessary to detect and chronicle these responses. However, because of the natural variability of estuarine systems and the time it may take for expected improvements to be observed, the implementation of management actions must also be tracked to provide early indications of program success. Programmatic monitoring also establishes accountability for organizations assigned to lead particular actions, and it provides managers with information about the status of various programs and the degree to which programs are or are not achieving their intended outcomes. With this type of information, managers can modify *The Bays Plan* or specific actions as needed to ensure that desired outcomes are being reached (Hunt et al., 2001).

The CBBEP annually documents and assesses progress in implementing projects outlined in its Annual Work Plan, all of which identify the goals, objectives, and actions of *The Bays Plan* they strive to achieve. This information is used in combination with environmental condition data to determine programmatic success, and *The Bays Plan, 2nd Ed.* recommends that these programmatic assessments be continued through the Annual Work Plan process.

Informational Products

The CBBEP will strive to develop and sustain a rich array of informational products related to monitoring that are tailored to the special needs and interests of a broad range of stakeholders. All of these products will rely on readily available data sources that are considered useful for measuring the effectiveness of management actions/ programs and for tracking progress towards environmental and ecosystem goals and objectives.

One such product is the CBBEP's "Environmental Indicators Report," which utilized monitoring data from CBBEP and partners to track environmental variables and determine status and trends of important indicators over time, such as the number of impaired water bodies. The report used 19 indicators to examine six focal questions related to public health (contact recreation and seafood consumption), water and sediment quality, habitat, fish and wildlife populations, and freshwater inflows. A full summary of the indicator report is provided in Chapter 2.

This report brings together data collected by researchers from the academic and agency communities as it applies to understanding the environmental dynamics of the Coastal Bend bays and estuaries. The results of the report are useful for determining the implementation progress of actions in *The Bays Plan* and for evaluating and modifying actions. The indicators used in the report also provide a means for the CBBEP to try and link protection and

restoration efforts with ecosystem conditions. The CBBEP anticipates reviewing and updating its "Environmental Indicators Report" every 10 years. Focal questions, indicators, and data sources will be examined closely to during the revision process to ensure they are adequate for addressing current priority issues.

The CBBEP will also strive to produce public-friendly subject matter reports describing the status of different aspects of the ecosystem (e.g., habitat, colonial waterbird populations) on a more frequent basis and distribute them widely so that the broader community is aware of the CBBEP's work and the state of the ecosystem. The CBBEP will utilize its "Living on the Edge" publications to produce these types of reports 2-3 times per year. These particular publications will be promoted through social media and will be distributed to local press outlets to try and reach a broader audience.

TABLE 5. SUMMARY TABLE OF ALL ACTIONS AND STEPS RELATED TO MONITORING IN THE BAYS PLAN, 2ND ED. A PRIORITIZATION, TIMEFRAME, AND ESTIMATED COST ARE PROVIDED.

Action	Step	Timeframe	Priority	Cost
PH 1.1: Support efforts to protect recreational water quality through studies on waterborne health issues, including pathogens, chemicals, and Harmful Algal Blooms.	Step 1: Support water quality monitoring programs that provide notifications to recreational users (e.g., Texas Beach Watch, Harmful Algal Bloom hotline).	2020-2040	High	\$\$
MC 1.3: Support efforts to maintain and improve the Vessel Traffic Information System and any additional navigational aids, such as the Physical Oceanographic Real-Time System (PORTS).	Step 1: Coordinate the location, installation, and modification of electronic monitors in Corpus Christi Bay and its approaches to provide real-time wind, tide, and current information to mariners via a phone, radio, or Internet link.	2020-2040	High	\$\$\$-\$\$\$\$
HLR 1.2: Restore and enhance degraded habitats and create new habitats where feasible.	Step 4: Develop and implement monitoring plans for restored, enhanced or created habitats to assess habitat function improvements.	2020-2040	Medium	\$\$
HLR 2.5: Improve understanding of harmful algal blooms and their impact on living resources.	Step 2: Support efforts to monitor coastal waters to assess critical concentrations of HAB bloom activity.	2020-2040	High for Baffin Bay; Medium for other bay systems	\$\$
CB 1.1: Implement successful waterbird management actions to reverse declines in colonial nesting waterbirds in the Coastal Bend.	Step 2: Monitor population trends of nesting colonial waterbirds. If necessary, identify potential causes of declines and develop management strategies to address those causes.	2020-2040	High	\$\$
CB 2.1: Advance the conservation of migratory shorebirds through research, monitoring, and stewardship.shorebird species that utilize the Central Flyway and visit the Coastal Bend.	Step 1: Conduct monitoring of sites of local importance to shorebirds, assess their threats, and work with willing landowners/managers to develop and implement appropriate management actions.	2020-2040	High	\$\$

TABLE 5 (CONT'D). SUMMARY TABLE OF ALL ACTIONS AND STEPS RELATED TO MONITORING IN THE BAYS PLAN, 2ND ED. A PRIORITIZATION, TIMEFRAME, AND ESTIMATED COST ARE PROVIDED.

Action	Step	Timeframe	Priority	Cost
WSQ 2.1: Support efforts to quantify total constituent loadings and identify possible transport pathways, sources, and fates.	Step 1: Support efforts to coordinate additional data acquisition, including citizen science programs, to determine relative contributions and loadings from point and non-point sources.	2020-2040	High for segments listed on 303d list; Medium for unlisted segments	\$\$\$
	Step 2: Support efforts to coordinate additional data acquisition to determine transport pathways, sources, and fates of constituents.	2020-2040	Medium	\$\$\$
WSQ 2.2: Support analyses of the biological and ecological effects of constituents.	Step 1: Support studies and projects that determine the responses of flora/fauna (i.e., biological, chemical, and physiological changes) and ecological effects to varying levels of constituents entering the bays.	2020-2040	High for Baffin Bay; Medium for other bay systems	\$\$\$
	Step 2: Support studies and projects that examine the potential interactions among constituents, as well as the interaction between constituents and environmental parameters (e.g., temperature, dissolved oxygen, salinity).	2020-2040	Medium	\$\$\$
WSQ 3.1: Ensure that water and sediment quality standards and criteria are adequate and appropriate.	Step 1: Support studies that examine water and sediment quality standards and criteria, as well as biological criteria, for various portions of the project area to coincide with the State's review process or as needed.	2020-2040	Low	\$\$-\$\$\$
NPS 1.5: Support efforts to improve the quality of urban stormwater runoff.	Step 3: Support studies and assessments that improve the quality of urban stormwater runoff.	2020-2040	High for Corpus Christi area; Medium for other urban areas	\$\$
FW 1.1: Improve scientific understanding of the freshwater, nutrient, and sediment supply needs of the estuaries.	Step 1: Continue use of current methods and assess new methods of monitoring salinity; productivity of bays; inflow quantity and quality; direct bay rainfall; and climate trends and forecasting.	2020-2040	High	\$\$
	Step 4: Continue to coordinate and assess new data collection needs, identify new locations, and deploy new streamflow and rainfall gauges (e.g., tidal river flow index-velocity gauges) throughout the project area as needed.	2020-2040	High	\$\$\$
CR 1.1: Facilitate and support studies to better project and understand the biological, chemical, physical, and ecological effects of climate change.	Step 1: Facilitate research and monitoring of key abiotic parameters related to climate variability (e.g., temperature, precipitation, salinity, dissolved oxygen, pH, carbon dioxide, water level).	2020-2040	Medium	\$\$

CHAPTER

16

Finance Strategy



CONTENTS

Ongoing Support
Enhanced Funding Strategy

The Bays Plan, 2nd Ed. provides a framework for investing in the health of the Coastal Bend bays and estuaries and their watersheds. These investments can produce real value through improved environmental quality and enhancements in the region’s economy and quality of life. Wise investment in the Coastal bend bays and estuaries and its watersheds will ultimately provide more resilient and sustainable returns in property values, water quality, storm protection, recreation and tourism, and other goods and services. Therefore, the CBBEP and the *The Bays Plan, 2nd Ed.* should be considered an asset with real value that is worth investing in.

Ongoing Support

There are two types of costs associated with implementation of the *The Bays Plan, 2nd Ed.* The first cost is associated with maintaining the CBBEP staff as described in Chapter 4. The second type of cost is the expense to implement the action items identified in *The Bays Plan, 2nd Ed.*. Anticipated costs have been allocated to each action item included in the Plan. These estimated costs are meant to be “ballpark” estimates and are not intended to represent final budgetary allocations. Such final adjustments of cost will necessarily be done during the implementation of an action, when more detailed information about existing level of efforts, available funds, and other design criteria can be more accurately assessed. The accuracy of the anticipated cost estimates contained in

the implementation strategies are limited by the quality of current information, and in many cases, the cost is based solely on “best professional judgment.” Regardless, the estimates provide some idea of the level of effort implied in the Action Plan.

The investments needed to support the CBBEP’s estuarine research, protection, and restoration efforts do not come from a single program or government agency (Table 6). Funding is needed across jurisdictions, including federal, state, and local governments in partnership with the private sector, including individuals, corporations, and foundations. Historically, the CBBEP has attracted funding and support through strategic partnerships with numerous organizations, and CBBEP has repeatedly shown its ability to leverage the support provided by partners to implement high-value projects and programs. Maintaining and expanding these strategic partnerships will be critical to the ability of CBBEP to provide sustained support for the current budget and for additional growth over the next 10-20 years.

Federal, state, and local government grants have historically constituted the majority of funding for the CBBEP. As part of the National Estuary Program, the CBBEP receives federal funds from the EPA under Section 320 of the Clean Water Act. While these funds account for only a portion of the government revenue used to support program operation and *Bays Plan* implementation, these federal funds play a very important role in leveraging

TABLE 6. LIST OF THE CBBEP’S MAJOR FUNDING SOURCES.

FUNDING SOURCES	
GOVERNMENT	
EPA (Clean Water Act 320)	\$602,000 (yearly funding can vary slightly)
TCEQ	\$742,000 (yearly funding can vary slightly)
Local Governments	\$282,500
Federal Grants	\$150,000 (can vary greatly from year to year based on project type and number of grants received)
State Grants	\$150,000 (can vary greatly from year to year based on project type and number of grants received)
FOUNDATIONS	
Large/National	\$2,500,000 (can vary greatly from year to year based on project type and number of grants received)
Regional	\$125,000 (can vary greatly from year to year based on project type and number of grants received)
Family/Community	\$15,000 (can vary greatly from year to year based on project type and number of grants received)
CORPORATIONS	
Corporate Grant	\$100,000 (can vary greatly from year to year based on project type and grants received)
Donations/Sponsorships	\$110,000
OTHER	
Court Penalties	\$35,000
Easements/ROWS	\$35,000

additional dollars from other governmental organizations. Other government funds come from the TCEQ, local governments (City of Corpus Christi, City of Ingleside, City of Portland, City of Port Aransas, City of Rockport, Nueces County, and San Patricio County), and the Port of Corpus Christi Authority (PCCA).

Funding from EPA and TCEQ has been received annually since 1994 when work began on the development of *The Bays Plan*. Local government and PCCA contributions began in 1999 when *The Bays Plan* was complete, with nine entities currently contributing to the CBBEP each year. These sources have historically been a consistent source of funding. However, these contributions are subject to appropriations, which can change from year to year. The CBBEP has also received support from several corporate sponsors and foundations on an annual basis.

The CBBEP applies for a number of grants each year to support its general operations, as well as specific projects like marsh restoration, invasive species management, shorebird research, and education programs. Many of these grant opportunities are also associated with government funding sources, such as the Texas General Land Office – Coastal Management Program and the U.S. Fish and Wildlife Service – Coastal Program. In recent years, however, the CBBEP has increased the amount of grant funding it receives from private foundations.

Enhanced Funding Strategy

Historical support for the CBBEP from federal, state, and local sources has led to the implementation of actions and projects that have resulted in a Texas Coastal Bend with cleaner water and sediment, healthier habitats, greater public access, and a more aware and engaged public. However, many of the priority issues identified 20 years ago still remain and several new issues have arisen. Ongoing investment in the Coastal Bend bays and estuaries is essential to capitalize on yesterday's successes, sustain today's momentum, and lay the groundwork for a healthy future ecosystem. While some of the proposed actions in *The Bays Plan, 2nd Ed.* could be accomplished through ongoing support of existing sources, implementation of a broader suite of actions will require the CBBEP to leverage both funding and partnerships.

The funding categories that provide the most potential for additional investment in the CBBEP include foundations, corporations, and major gifts from individuals. In recent years, the CBBEP has received contributions from several local, regional, and national foundations, but these funds still only represent a small percentage of the overall annual revenue. Major gifts from individual donors have not historically been a significant source of funds for the

CBBEP and present an area for great potential growth. Corporate donations also present an opportunity for potential revenue growth - CBBEP has historically received support from several corporate sponsors, but the number of contributors and the amount contributed has remained relatively constant over the last several years.

As the CBBEP continues to evolve, it is critical for the organization to increase the diversity of its funding sources in order to support the current budget and account for additional growth over the next 5-10 years. The continued growth of CBBEP will depend on having the people with the necessary skills, connections, and demographics and on implementing the proper cultivation strategies. This will require the active involvement and development of the CBBEP staff, members of the Board of Directors, existing partners, and volunteers. This also includes putting in place, within the next three years, the appropriate systems, policies, and procedures to support a comprehensive development program (e.g., fund development strategy, donor database, gift acceptance policy, donor website, etc.). Training opportunities related to fundraising should also be made available to staff on a regular basis.

Below is a list of potential funding sources being considered as potential options for CBBEP's future fund development strategies

Government Grants and Contracts

Government grants and contracts are currently a large source of funding for the CBBEP, and they will continue to be important moving forward. The CBBEP will continue to work with EPA and TCEQ to ensure that funding for base operations continues. Grant proposals for specific projects/programs will also continue to be an important strategy moving forward and proposals will be directed both at the programmatic activities that are core to the mission of the organization, as well as organizational development activities that ensure growth and capacity-building of the CBBEP (Table 7).

Foundations

Foundations provide the CBBEP an opportunity to seek support for specific projects/programs and, when possible, general operations support. In recent years, the CBBEP has received contributions from several local, regional, and national foundations, but these funds still only represent a small percentage of the overall annual funding. Opportunities exist to identify additional foundations whose funding priorities align with the mission and vision of the CBBEP (Table 7). CBBEP will focus on maintaining relationships with existing foundation partners, while also striving to build relationships with new foundation

partners. Relationship-building over the next five year is the key to successfully bringing in foundation support.

Corporations

Corporate donations/grants present an opportunity for future funding growth. The CBBEP has historically received support from several corporate sponsors annually, but the number of contributors and the amount contributed has remained relatively constant over the last several years. Increased economic growth in the Coastal Bend provides an opportunity to identify additional corporate partners that would be willing to invest in the CBBEP. It also presents an opportunity to visit with existing partners about increasing their level of support. To help facilitate the addition of new corporate donors, standard outreach materials and recognition processes will be developed within the first two years of Plan implementation.

Major Individual Donors

Major gifts from individual donors have not been a significant source of funds for the CBBEP and present an area for great potential growth. A personalized process of cultivation, solicitation, and recognition (e.g., brochures, website, donor forms, etc.) will need to be developed in the next three years to grow this revenue category. As a part of the individual donor program, there needs to be a focus on identifying opportunities for CBBEP to acquire donor-advised funds, which represent the fastest growing

technique in personal philanthropy. The CBBEP must carefully cultivate relationships with donors who make their gifts via donor-advised funds. CBBEP should also explore the possibility of forming collaborative programs and alliances with other entities with a similar mission, so as to present a more appealing option for donor-advised funding.

The CBBEP must also work to put the proper systems and procedures in place to allow for planned gifts. A planned gift is any major gift, made in lifetime or at death as part of a donor's overall financial and/or estate planning. Whether a donor uses cash, appreciated securities/stock, real estate, partnership interests, personal property, life insurance, a retirement plan, etc., the benefits of funding a planned gift can make this type of charitable giving very attractive to both donors and non-profits. Establishing a planned giving program will provide significant revenue opportunities to the CBBEP as it develops relationships with donors and supporters. Estate gifts will come to when donors have confidence that their estate contribution will provide long-term conservation benefits to the community. That confidence will come through years of relationship building that will be important components of the major donor programs. CBBEP will strive to ensure that the legal mechanisms and communication pieces (e.g., website, brochures) are in place for planned gifts within the next three years. However, the process of building relationships that lead to new revenue will take much longer.

TABLE 7. LIST OF POTENTIAL FUNDING OPPORTUNITIES CBBEP AND ITS PARTNERS COULD PURSUE TO IMPLEMENT BAYS PLAN ACTIONS.

FUNDING SOURCES
FEDERAL
EPA: Smart Growth Grants, Urban Water Small Grants, Environmental Education Local Grants Program, and other EPA grants
NFWF: Gulf Environmental Benefit Fund, Pulling Together Initiative, Conservation Partners Program, and other NFWF grants
RESTORE Act: Direct Component, Comprehensive Plan Component, Spill Component, NOAA RESOTRE Act Science Program
NOAA: Coastal and Marine Habitat Restoration Grants, Bay Watershed and Training (B-WET) Grants, NERRS Science Collaborative, Marine Debris Program Grants, and other NOAA grants
NRCS: Environmental Quality Incentives Program, Agricultural Conservation Easement Program, and other NRCS grants
STATE
TCEQ: Section 604B Funds, Section 319 Funds
TGLO: Coastal Management Program, Coastal Erosion Planning & Response Act Program, Gulf of Mexico Energy Security Act
TPWD: Landowner Incentive Program, Section 6 Grants, Recreation Grants, and other TPWD grants
FOUNDATIONS
Large/National: National Fish and Wildlife Foundation, Disney Conservation Fund, and other national/large foundations
Local/Regional: Ed Rachal Foundation, Trull Foundation, Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation, Meadows Foundation, Earl C. Sams Foundation, Shield-Ayres Foundation, Dixon Water Foundation, Coastal Bend Community Foundation, Harvey Weil Grant, and other local/regional foundations
Corporate: AEP, Cheniere, CITGO-Caring for Our Coast, ExxonMobil, Flint Hills, Phillips 66, ConocoPhillips, Valero, Wells Fargo

LITERATURE CITED

- Biasutti, M., A.H. Sobel, S.J. Camargo, and T.T. Creyts. 2012. Projected changes in the physical climate of the gulf coast and Caribbean. *Climatic Change* 112(3-4): 819-845.
- CBBEP. 1998. Implementation Strategy for the Coastal Bend Bays Plan. Published by Texas Natural Resource Conservation Commission, Austin, TX SFR-60/CBBEP-2.
- CBBEP. 2010. Environmental Indicators Report. Coastal Bend Bays & Estuaries Program Publication.
- Church, J. A., and N.J. White. 2011. Sea-level rise from the late 19th to the early 21st century. *Surveys in Geophysics* 32(4): 585-602.
- Combs, S. 2012. The impact of the 2011 drought and beyond. Texas Comptroller of Public Accounts. Publication #96-1704.
- Culbertson, J., L. Robinson, P. Campbell, and L. Butler. 2004. Fisheries Report. Trends in Texas Commercial Fishery Landings, 1981-2001. Texas Parks and Wildlife Department, Coastal Fisheries Division, Management Data Series No. 224. 147 pp.
- Diffenbaugh, N.S., M. Scherer, and R.J. Trapp. 2013. Robust increases in severe thunderstorm environments in response to greenhouse forcing. *PNAS* 110(41): 16361-16366.
- Evans, A., Madden, K., and S. Morehead. 2012. The Ecology and Sociology of the Mission-Aransas Estuary: An Estuarine and Watershed Profile. University of Texas Marine Science Institute Publication. 183 pp.
- Geophysical Fluid Dynamics Laboratory. 2015. Global Warming and Hurricanes. National Oceanic and Atmospheric Administration. <http://www.gfdl.noaa.gov/global-warming-and-hurricanes> (Accessed October 2015)
- Hunt, C.D., L.A. McLeod, S. Mathies, and A.O. Mintz. 2001. Coastal Bend Bays & Estuaries Program: Regional Monitoring Plan. Coastal Bend Bays & Estuaries Program Publication, CCBNEP-28. 146 pp.
- HDR Engineering, Inc. 2015. 2015 Coastal Bend Regional Water Plan. Coastal Bend Regional Water Planning Group Publication. 764 pp.
- Hu, X., J.B. Pollack, M.R. McCutcheon, P.A. Montagna, and Z. Ouyang. 2015. Long-term alkalinity decrease and acidification of estuaries in northwestern Gulf of Mexico. *Environmental Science & Technology* 49(6): 3401-3409.
- Huson, H. 1935. El Copano: The Ancient Port of Bexar and La Bahia. The Refugio Timely Remarks, Refugio, Texas.
- IPCC. 2013a. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.
- IPCC. 2013b. Annex I: Atlas of Global and Regional Climate Projections [van Oldenborgh, G.J., M. Collins, J. Arblaster, J.H. Christensen, J. Marotzke, S.B. Power, M. Rummukainen and T. Zhou (eds.)]. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA Jones et al., 1996
- Jones, E.R., G.S. Ketcham, and J. Richards. 1996. Characterization of the Human Uses of the Corpus Christi Bay National Estuary Program Study Area Contract Number 52-000000-08. Unpublished report. 195 pp.
- Jones, L.L., A. Tanyeri-Abur, K. Yu, and C. Hanson. 1997. Economic Impacts on Regional and State Economies of Human Uses of the Coastal Resources of the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-16. 62 pp.
- Krieger, A. D. 2002. We Came Naked and Barefoot: The Journey of Cabeza de Vaca across North America. University of Texas Press, Austin, Texas.
- Lee, J. 2014. The Economic Significance of Tourism and Nature Tourism in Corpus Christi: 2014 Update. Corpus Christi Convention and Visitors Bureau. 34 pp.
- Loerzel, J., Knapp, L., Gorstein, M. 2015. Gauging the Social Values of Ecosystem Services in the Mission-Aransas National Estuarine Research Reserve, Technical Report submitted to the National Oceanic and Atmospheric Administration.

- Lluch-Cota, S.E., M. Tripp-Valdez, D.B. Lluch-Cota, J.J. Bautista-Romero, D. Lluch-Belda, J. Verbesselt, and H. Herrera-Cervantes. 2013. Recent trends in sea surface temperature off Mexico. *Atmósfera* 26(4): 537-546.
- Martin Associates. 2016. The Economic Impacts of Port Of Corpus Christi, 2015. Final Report submitted to the Port of Corpus Christi Authority. 30 pp.
- Montagna, P.A., Hutchison, L.M., Scholz, D., Palmer, T., Arismendez, S., Yoskowitz, D., 2011. Nueces Estuary Ecosystem Management Initiative: An Ecosystem Services-based Plan. Final Report submitted to the Coastal Bend Bays & Estuaries Program for project number 1018. Texas A&M University - Corpus Christi, Harte Research Institute for Gulf of Mexico Studies, 170 pp.
- Morehead, S., Beyer, T.G., Dunton, K., 2007. Community Characterization of the Mission-Aransas National Estuarine Research Reserve and Surrounding Areas. Revised May 3, 2007. UTMSI Report TR/07-001. University of Texas Marine Science Institute, Port Aransas, Texas, 42 pp.
- Murdock, M., and J. Brenner. 2016. Texas Coastal Bend Regional Climate Change Vulnerability Assessment. Report submitted to the Coastal Bend Bays and Estuaries Program (CBBEP). The Nature Conservancy, Arlington, 44 pp.
- Nicolau, B. and A. Nuñez. 2006. Regional Coastal Assessment Program 2004. Coastal Bend Bays and Estuaries Program, CBBEP-53. 119 pp.
- NOAA. 2018. Historical Hurricane Tracks. National Oceanic and Atmospheric Administration, Office for Coastal Management. <https://coast.noaa.gov/hurricanes/> (Accessed January 2018).
- NOAA. 2016a. Coastal Change Analysis Program: Land Cover Atlas. National Oceanic and Atmospheric Administration, Office of Coastal Management. <https://coast.noaa.gov/ccapatlas/> (Accessed September 2016).
- NOAA. 2016b. Coastal County Snapshots – Ocean Jobs Snapshot. National Oceanic and Atmospheric Administration, Office for Coastal Management. <https://coast.noaa.gov/snapshots/> (Accessed September 2016).
- Nueces River and Corpus Christi and Baffin Bay BBASC, 2012. Environmental Flow Standards and Strategies Recommendations Report. Final Submission to the Environmental Flows Advisory Group and the Texas Commission on Environmental Quality.
- Parris, A., Bromirsji, P., Burkett, V., Cayan, D., Culver, M., Hall, J., Horton, R., Knuuti, K., Moss, R., Obeysekera, J., Sallenger, A.H., Weiss, J., 2012. Global Sea level Rise Scenarios for the US National Climate Assessment. NOAA Technical Report. National Oceanic and Atmospheric Administration, p. 37.
- US DOC. 2016. Regional Economic Information System. U.S. Department of Commerce, Bureau of Economic Analysis. <https://bea.gov/regional/> (Accessed September 2016).
- Ricklis, R.A. 1997. Prehistoric and Early Historic People and Environment in the Corpus Christi Bay National Estuary Program Study Area. CCBNEP Occasional Paper No. 1. 17 pp.
- Ricklis, R.A. 2004. Prehistoric Occupation of the Central and Lower Texas Coast. In T.K. Perttula (Ed.) *The Prehistory of Texas*, pp. 155-180. Texas A&M University Press, College Station, Texas.
- Shafer, M., D. Ojima, J.M. Antle, D. Kluck, R.A. McPherson, S. Petersen, B. Scanlon, and K. Sherman. 2014. Ch. 19: Great plains. In: *Climate Change Impacts in the United States: The Third National Climate Assessment*. J.M. Melillo, T.C. Richmond, and G.W. Yohe (Eds.). U.S. Global Change Research Program, pages 441-461.
- South Texas Economic Development Center. 2016. Review of South Texas Economy 2016. Texas A&M University – Corpus Christi. 40 pp.
- Tremblay, T, J. Vincent, and T. Calnan. 2008. Status and Trends of Inland Wetland and Aquatic Habitats in the Corpus Christi Area. Bureau of Economic Geology. 101 pp.
- Texas Department of State Health Services. August 2005. Characterization of Potential Health Risks Associated with Consumption of Fish and Shellfish from Nueces Bay. Texas Department of State Health Services Publication. 30 pp.
- Texas Parks and Wildlife Department. TPWD, Wildlife Division, Diversity and Habitat Assessment Programs; TPWD County Lists of Protected Species and Species of Greatest Conservation Need (Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, Refugio, and San Patricio counties). Accessed Aug 1, 2016.
- Texas Parks and Wildlife Department. Commercial Fishing License Buyback Programs. Texas Parks and Wildlife Department. <http://tpwd.texas.gov/fishboat/fish/commercial/buyback.phtml> (Accessed June 2017).

- Trapp, R.J., N.S. Diffenbaugh, H.E. Brooks, M.E. Baldwin, E.D. Robinson, and J.S. Pal. 2007. Changes in severe thunderstorm environment frequency during the 21st century caused by anthropogenically enhanced global radiative forcing. *PNAS* 104(50): 19719-19723.
- Tunnell, J.W. and S. A. Alvarado. 1996. Current Status and Historical Trends of the Estuarine Living Resources within the Corpus Christi Bay National Estuary Program Study Area B Vol. 4 of 4 (checklist of species). Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-06D. 298 pp.
- Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville. 2014. Ch. 2: Our changing climate. In: *Climate Change Impacts in the United States: The Third National Climate Assessment*. J.M. Melillo, T.C. Richmond, and G.W. Yohe (Eds.). U.S. Global Change Research Program, pages 19-67.
- Ward, G.H. and N.E. Armstrong. 1997a. Current Status and Historical Trends of Ambient Water, Sediment, Fish and Shellfish Tissue Quality in the Corpus Christi Bay National Estuary Program Study Area (summary report). Texas Natural Resource Conservation Commission, Austin, Texas. CCBNEP-13. 270 pp.
- Warren Pinnacle Consulting. 2015. Evaluation of regional SLAMM results to establish a consistent framework of data and models. Warren Pinnacle Consulting, Inc. Waitsfield, VT. 158 pp.
- White, W., T. Tremblay, R. Waldinger, and T. Calnan. 2008. Status and Trends of Wetland and Aquatic Habitats on Texas Barrier Islands Coastal Bend. Bureau of Economic Geology. 64 pp.

APPENDIX A

Revised Action Plans and their relationship to previous actions

TOURISM AND RECREATION ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Maintain, manage, and expand tourism and recreational opportunities in a way that enhances the local economy and protects the natural resources of the bays.	Efforts are ongoing. CBBEP continues to work with partners on ecotourism and recreation projects.
Objective TR 1: Enhance the reputation of the Coastal Bend as being a premier ecotourism destination for people to experience Texas' coastal natural resources.	Efforts are ongoing. There is an ongoing need to enhance local tourism by promoting Coastal Bend ecotourism opportunities.
TR 1.1: Collaborate with tourism organizations to adopt a theme of resource protection and stewardship in their promotion of tourism.	Efforts are ongoing to work with tourism organizations. Action was edited to emphasize collaboration between CBBEP and these partners.
Objective TR 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.	Efforts are ongoing. Although there are numerous public access sites located within the Coastal Bend, there is a continued need to look for additional opportunities to improve access.
TR 2.1: Provide for the appropriate number of improved, well-managed public access sites.	Efforts are ongoing. CBBEP has completed several projects targeted at improving public access in the Coastal Bend and will continue to work with partners on promoting this objective.
Objective TR 3: Minimize adverse impacts to coastal natural resources caused by recreational uses of the bays and enhance resources for recreational use where appropriate.	Efforts are ongoing by CBBEP and partners to reduce impacts from recreational uses on habitats and living resources.
TR 3.1: Support the development and implementation of management strategies that reduce or avoid impacts from recreational uses.	Efforts are ongoing. Action edited to reflect CBBEP's supportive role in the development and management of projects targeted at reducing recreational impacts.
BTR-4: Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	The need to restore and create habitats, such as artificial reefs, is addressed within the Habitat and Living Resources Action Plan. Restoration efforts that are a result of these actions will also benefit human uses such as recreation.

LEGEND

No change from Coastal Bend Bays Plan

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Addition of new goal, objective, or action

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SHORELINE MANAGEMENT ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Minimize impacts to natural resources from shoreline activities occurring within the program boundary.	Goal was edited to improve wording and provide clarity.
Objective SM 1: Support environmentally sound shoreline management.	There is still a need to support local partners in shoreline management efforts, but the objective was edited to be more inclusive of broader efforts by CBBEP and partners to improve shoreline management. Specific references to planning and permitting were removed.
SM 1.1: Advise and assist local partners with shoreline management issues.	Efforts are ongoing to work with local partners on shoreline management issues. Action was modified to show that working with partners may include both advising and assisting (i.e., providing resources).
SM 1.2: Support efforts to promote enhanced management of riverine shorelines and riparian habitat.	Healthy rivers and streams are an important component of maintaining the quality of our bays. The proposed action was added to the Plan to show the importance of proper management of riverine shorelines and maintenance of riparian buffers for maintaining the quality of our bays.

SM-1: Conduct a shoreline inventory to gain site-specific understanding of shoreline management needs.	This action is considered to be complete. Partner organizations, such as GLO, UTBEG, and HRI have completed several projects related to inventorying shoreline management needs (e.g., Texas Shoreline Change Project, Texas Coasts, and Environmental Sensitivity Index).
SM-3: Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	The Coastal Bend Land Trust was established and is overseen by CBBEP. The need to continue to support habitat protection and open space preservation is captured in the Habitat and Living Resources Action Plan.

LEGEND

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BAY DEBRIS ACTION PLAN	
Goal, Objective, Action	Rationale
Goal: Reduce bay debris in the Coastal Bend to ensure minimal impact to people, aquatic life, and natural resources.	Efforts are ongoing. CBBEP continues to work with partners to reduce bay debris.
Objective BD 1: Reduce the amount of debris in the bays and estuaries throughout the Coastal Bend.	Efforts are ongoing. Edited to reflect the need to reduce overall debris <u>in</u> the bay - intended to capture efforts to both reduce the amount of debris reaching the bay and reduce the amount of debris that is already in the bay.
BD 1.1: Support activities to reduce the amount of debris reaching the bays.	Efforts are ongoing to reduce the amount of debris entering the bays. Broadened scope of action by removing specific references to targeting trash disposal and solid waste management - specific targets will be outlined in implementation strategy.
BD 1.2: Support activities to remove existing debris in the bay.	Proposed action reflects the need for CBBEP and partners to broaden efforts to include removal of debris that already exists within the bay.

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PUBLIC HEALTH ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Ensure public health associated with contact recreation and seafood consumption.	Efforts are ongoing. Goal still captures the continued desire by CBBEP and partners to ensure public health.
Objective PH 1: Minimize the threat of waterborne illness and disease.	Efforts are ongoing. Edited to make more clear and concise.
PH 1.1: Support efforts to protect recreational water quality through studies on water borne health issues, including pathogens, chemicals, and Harmful Algal Blooms.	Efforts are ongoing. Edited to more clearly reflect the supportive role of CBBEP. Also broadened the types of studies conducted to include HABs.
Objective PH 2: Reduce the risk of illness and disease associated with consumption and handling of fish and shellfish caught in local waters.	Efforts are ongoing. Edited to include both consumption and handling.
PH 2.1: Support health risk assessments associated with consumption and handling of seafood.	Efforts are ongoing. Edited to more clearly reflect CBBEP's supportive role with partners. Also edited to include both consumption and handling.

Objective 3: Improve availability and data analysis of public health parameters through integration of water quality and epidemiological and injury information.	Both the objective and action were determined to not be feasible and high-priority items.
PH-3: Develop and implement a method to collect epidemiological and injury data from regional and local health care providers	Both the objective and action were determined to not be feasible and high-priority items.

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MARITIME COMMERCE ACTION PLAN

Goal, Objective, Action	Rationale
<p>Goal: Enhance maritime traffic safety while reducing the rate of maritime incidents from shipping, terminal operations, and marine pipelines.</p>	<p>It is still an extremely high priority to improve maritime traffic safety and reduce potential incidents. This is particularly important for the Port of Corpus Christi which has expanded export operations (e.g., black oil, LNG, and increased commodities). There has also been an increase in the diversity of the fleet.</p>
<p>Objective MC 1: Enhance commercial maritime traffic safety.</p>	<p>Efforts are ongoing to maintain maritime safety and reduce incidents – this is a high priority.</p>
<p>MC 1.1: Support efforts to implement the Corpus Christi Ship Channel Improvement Project and other improvements.</p>	<p>Several components of the Corpus Christi Ship Channel Improvement Project (CCSCIP) have been completed, but efforts to deepen/widen the ship channel and create barge shelves are ongoing and continue to need support. The Port has a permit to complete the project but funding still needs to be obtained. The CCSCIP has a defined boundary but additional improvement projects may be needed outside of this area - action allows for improvements in these other areas as well.</p>
<p>MC 1.2: Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.</p>	<p>Although navigation ranges are routinely updated by the USCG, there still remains a need for additional improvements and new ranges (e.g., La Quinta Channel).</p>
<p>MC 1.3: Support efforts to maintain and improve the Vessel Traffic Information System and any additional navigational aids, such as the Physical Oceanographic Real-Time System (PORTS).</p>	<p>The Port of Corpus Christi has installed and is already operating a Vessel Traffic Information System, but installation of monitoring equipment associated with other monitoring programs, such as the PORTS, would provide additional beneficial navigation aids.</p>
<p>MC 1.4: Continue to support vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.</p>	<p>This is an ongoing activity - the USCG requires specific qualifications, training, and licensing of commercial vessel operators.</p>
<p>MC 1.5: Support the setback policies for the Gulf Intracoastal Waterway.</p>	<p>There are concerns about structures encroaching on the Gulf Intracoastal Waterway - needs to be continued support of setback policies to prevent collisions and potential damage.</p>
<p>Objective MC 2: Reduce impacts from maritime oil and hazardous material spills.</p>	<p>Oil and hazardous material spill prevention and response continue to be top priority issues for the Coastal Bend area.</p>
<p>MC 2.1: Continue to maintain and improve regional oil spill response capability.</p>	<p>Improvements have been made to the regional spill response capability, but there is a need to continue to support efforts such as spill drills, unified command drills, and acquisition of equipment/supplies.</p>
<p>MC 2.2: Continue to maintain and improve hazardous spill response planning and resources to ensure public protection.</p>	<p>There have been significant improvements to coordination of hazardous materials spill response planning and resources, but these efforts require continued support.</p>
<p>Objective MC 3: Improve the response strategy to marine pipeline incidents.</p>	<p>There is a continued need to address spills from pipelines, especially older, unidentified structures.</p>

MARITIME COMMERCE ACTION PLAN

Goal, Objective, Action	Rationale
MC 3.1: Support data management systems to locate existing pipelines and points of contact for current ownership.	Action was not feasible as previously written, and therefore, was edited to reflect the continued need to use available data sources to identify the location of pipelines, materials being carried, age of pipelines, and ownership. This will improve timing and effectiveness of response to incidents.
Objective MC 4: Reduce the potential for introductions of non-native species caused by maritime operations.	Improvements have been made in regulations of ballast water and invasive species, but there is a continued need to address introduction of non-native species.
MC 4.1: Continue to support the prevention of the introduction of non-native species through improved ballast water management.	Improvements have been made through the passage of a number of regulations designed to control the introduction of non-native species in ballast water. Continued support of the implementation of these regulations is needed.

LEGEND

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DREDGING ACTION PLAN	
Goal, Objective, Action	Rationale
Goal: Ensure that all dredging activities are planned and conducted in ways that consider the cost effectiveness of the operation, while minimizing ecological impacts and maximizing the beneficial uses of dredged material.	There is still a strong need to ensure that dredging activities are planned and conducted effectively. Focusing on the beneficial use of dredge material is particularly important.
Objective D 1: Improve dredged material management practices.	Dredging techniques are considered standard, so removed reference to improving dredging techniques. Focus should be on improving dredged material management practices.
D 1.1: Support the activities of the Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material as required.	Beneficial Use Plan Implementation Group was established as part of the Corpus Christi Ship Channel Improvement Project, but group is not actively meeting at this time. There is a need to re-establish this group, and use it as a model for a regional BUG that includes other interested partners throughout the Coastal Bend Region.
D 1.2: Support the approved (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	A long term (50 years) dredged material management plan for the Corpus Christi Ship Channel was developed as part of the Corpus Christi Ship Channel Improvement Project. Maintenance dredging has been evaluated for beneficial use feasibility and has identified and regularly places maintenance material to Pelican Island for rookery enhancement. Continued support is needed.
D 1.3: Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, private marine terminals, and private and public marinas.	There still a need to develop this type of plan – action was expanded to also include private marine terminals.
D 1.4: Develop a long-term (50 year) Regional Habitat Management Plan that utilizes dredged material from private and public sources.	There is a need to develop a "Regional Habitat Management Plan" that considers the use of dredged material for erosion control, habitat creation/restoration, or conversion of one aquatic habitat type for another type deemed to be of higher ecological and social value in order to meet resource management and societal needs.

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HABITAT AND LIVING RESOURCES ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Increase and preserve the quantity, quality, and diversity of habitats and living resources.	Efforts are ongoing. The conservation of habitat and living resources continues to be a high priority in the Coastal Bend.
Objective HLR 1: Preserve, restore, enhance, and create coastal habitats.	Efforts are ongoing. Added habitat enhancement and reworded objective to indicate the priority of conservation strategies (i.e., preserving habitat is top priority, followed by restoration, enhancement, and creation).
HLR 1.1: Preserve functional, natural habitats of all major types.	Efforts are ongoing. CBBEP has preserved coastal habitats through previous acquisitions and will continue to use fee simple acquisition and conservation easements for future habitat preservation
HLR 1.2: Restore and enhance degraded habitats and create new habitats where feasible.	Efforts are ongoing. Action was reworded to include enhancement and to reflect priority of conservation strategies.
HLR 1.3: Support efforts to identify and minimize adverse impacts of activities and operations on coastal habitats.	While seismic activity is still a concern for resource managers, there is a need to edit this action to include a broader suite of activities and operations that could impact coastal habitats (e.g., brine discharge, wind farms, LNG export).
Objective HLR 2: Ensure long-term sustainability of native living resources.	Efforts are ongoing. Conservation of living resources continues to be a high priority for CBBEP and partners.
HLR 2.1: Develop and implement adaptive management plans to ensure sustainability for species of concern.	Efforts are ongoing. Action was expanded to include both development and implementation of plans. Action was also edited to reflect need to use adaptive management planning.
HLR 2.2: Support rescue and rehabilitation programs of native animal species.	Efforts are ongoing. Action was edited to reflect CBBEP's supportive role in these types of projects. Also edited to show focus on supporting projects that support native species.
HLR 2.3: Support effective commercial and recreational fisheries management.	Efforts are ongoing. Action was previously focused on management of commercial shrimping activities, but it was edited to include a broader range of commercial fisheries (e.g., oysters, black drum), as well as recreational fisheries.
HLR 2.4: Support efforts to identify and minimize adverse impacts of activities and operations on coastal living resources.	While impacts from cooling water intakes are still concerning for resource managers, there is a need to edit this action to include a broader suite of activities and operations that could impact coastal living resources (e.g., brine discharge, wind farms, LNG export).
HLR 2.5: Improve understanding of harmful algal blooms and their impact on living resources.	Efforts are ongoing but action was difficult to accomplish as previously written. Action was edited to more accurately reflect efforts that are underway regarding harmful algal blooms.
HLR 2.6: Develop and support adaptive management plans to minimize introductions and impacts from invasive species.	Efforts are ongoing. Action was expanded to include development and implementation of management plans. Also edited to show need to use adaptive management planning. Finally, the term invasive species was used because it captured both native and non-native species that threaten ecosystems.

HABITAT AND LIVING RESOURCES ACTION PLAN

Goal, Objective, Action	Rationale
HLR-7: Reduce bycatch from bay shrimp trawling.	This action is no longer a priority issue with little to no bay and bait shrimping occurring within the bay systems of the Coastal Bend. Bycatch concerns will also be included in the modified HLR-6.

LEGEND

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COASTAL BIRDS ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Conserve coastal birds and the habitats they depend upon in the Coastal Bend of Texas.	The South Texas coast is one of the most unique areas in North America and is renowned for its exceptional bird life. Sustainability of bird species of concern has been a priority since the CBBEP was established and the number of activities and funding that have been dedicated to this effort have lead to the development of a new goal.
Objective CB 1: Reverse population declines in colonial nesting waterbirds in the Coastal Bend.	The populations of many colonial nesting waterbirds within the Coastal Bend are declining due to a variety of factor. CBBEP and partners are focused on managing these birds and their habitats to try and reverse these declines.
CB 1.1: Implement successful waterbird management actions to reverse declines in colonial nesting waterbirds in the Coastal Bend.	Efforts are ongiong by CBBEP and partners to implement effective management actions that will aid in the recovery of declining colonial nesting waterbird populations in the Coastal Bend.
Objective CB 2: Advance the conservation of migratory shorebirds through research, monitoring, and stewardship.	There is a need to better understand and conserve highly migratory shorebird species. CBBEP and partners are collaborating to gather critical information about these species so that conservation efforts may be improved.
CB 2.1: Conduct conservation-oriented monitoring and management actions to benefit shorebird species that utilize the Central Flyway and visit the Coastal Bend.	Efforts are ongoing by CBBEP and partners to conduct research projects that will help managers better understand the abundance, distribution, nest success, habitat usage, migratory connectivity, and other aspects of migratory shorebirds.

LEGEND

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LAND CONSERVATION AND STEWARDSHIP ACTION PLAN	
Goal, Objective, Action	Rationale
Goal: Ensure the survivability of species that depend on coastal habitats in the Coastal Bend.	Despite their value, coastal habitats are stressed and at risk. Efforts are needed to conserve these at-risk habitats and help ensure the survivability of the species that depend on them.
Objective LCS 1: Use land acquisition and stewardship techniques to conserve and protect coastal habitats in the Coastal Bend.	The CBBEP Land Conservation & Stewardship Program was established for purposes of using acquisition and stewardship to accomplish this goal.
LCS 1.1: Promote the stewardship of coastal resources through the implementation of responsible and sustainable adaptive management techniques on both CBBEP properties and those of willing landowners.	The CBBEP Land Conservation and Stewardship Program has acquired and is responsible for managing properties in the following areas of the Coastal Bend: Nueces River, Nueces River Delta, Nueces Bay, Mustang Island, Lamar Peninsula, Aransas River Delta, and Mission River Delta. CBBEP promotes stewardship through the implementation of responsible and sustainable adaptive management techniques at all its properties. CBBEP also fosters stewardship by forming partnerships with willing landowners to either conserve or manage their property for priority species.
LCS 1.2: Collaborate with partners to identify and protect properties with high conservation value through donation, acquisition, or conservation easements.	Land acquisition for protection is one of the most economical methods of conservation. This can occur through the donation or purchase of land or conservation easements from willing sellers. Since starting on land acquisition efforts in 2002, CBBEP has worked to acquire either fee simple title or conservation easements for more than 12,000 acres of freshwater marsh, forested wetlands, mudflats, riparian corridors, and native upland habitat for conservation management.

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WATER AND SEDIMENT QUALITY ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Maintain and/or enhance water and sediment quality.	Efforts are ongoing by CBBEP and partners to maintain and/or enhance water and sediment quality.
Goal: Understand total loadings, transport pathways, and biological and ecological effects of loadings to the bay system.	Efforts are ongoing. Goal was expanded to include understanding of both biological and ecological effects.
Objective WSQ 1: Improve the quality of ambient water and sediment in impaired or stressed segments to attain standards and criteria.	Efforts are ongoing. CBBEP and partners continue to support efforts to improve impaired and stressed water bodies.
WSQ 1.1: Support the implementation of plans and projects to improve water and sediment quality in identified segments.	Efforts are ongoing. Edited to reflect CBBEP's supportive role in implementation by partners. Expanded to include support of both plans and projects.
WSQ 1.2: Continue to support permitting rules for mariculture and aquaculture.	Efforts are ongoing. Edited to show that efforts are on-going. Removed specific reference to shrimp farms in order to show broader focus on all mariculture/aquaculture operations.
Objective WSQ 2: Assess total loadings, transport pathways, sources, and fates of constituents.	Efforts are ongoing. Expanded beyond just quantifying loadings and identifying transport pathways - now includes identification of sources and fates of constituents.
WSQ 2.1: Support efforts to quantify total constituent loadings and identify possible transport pathways, sources, and fates.	Efforts are ongoing. Expanded beyond just quantifying loadings and identifying transport pathways - now includes identification of sources and fates of constituents. Edited to reflect CBBEP's supportive role of partner efforts.
WSQ 2.2: Support analyses of the biological and ecological effects of constituents.	Efforts are ongoing. Changed to reflect CBBEP's supportive role of multiple partner assessments of biological and ecological effects of constituents.
Objective WSQ 3: Evaluate and assess segment-specific water and sediment quality standards.	Efforts are ongoing. Edited to show the continued need for CBBEP and partners to evaluate and assess water and sediment quality standards.
WSQ 3.1: Ensure that water and sediment quality standards and criteria are adequate and appropriate.	Edited to reflect proper terminology for water and sediment quality standards and criteria.

LEGEND

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NONPOINT SOURCE MANAGEMENT ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Improve management of all loadings to the bay system.	Efforts are ongoing. CBBEP and partners continue to support efforts to improve management of loadings to the bay.
Objective NPS 1: Assess and improve nonpoint source management throughout the region.	Edited to show that focus has changed from development of plans to assessment of existing nonpoint source management.
NPS 1.1: Assist local governments, small businesses, industries, and organizations in their efforts to reduce loadings.	Proposed action reflects CBBEP's efforts to work with a broad group of potential partners on multiple initiatives to reduce loadings.
NPS 1.2: Provide assistance to small businesses and industries in the region that are subject to the TPDES permit program or have point or nonpoint source control needs.	Efforts are ongoing. Modified to show change from NPDES permit to TPDES permit. Also broadened to include both point and nonpoint source control needs.
NPS 1.3: Assist local governments and organizations to implement On-Site Sewage Facility (OSSF) programs and projects.	Efforts are ongoing. Broadened to include assistance of both local governments and other organizations involved with implementing both OSSF programs and projects.
NPS 1.4: Support agricultural water quality management plans, programs, and projects.	Efforts are ongoing. Edited to reflect CBBEP supportive role in the development and implementation of plans, programs, and projects.
NPS 1.5: Support efforts to improve the quality of urban stormwater runoff.	Proposed action was added to specifically emphasize the need to address stormwater runoff issues in the Coastal Bend.

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	This action item was completed. In order to build on previous accomplishments, a new NPS-1 is proposed above.
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FRESHWATER RESOURCES ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Optimize regional freshwater inflows to meet long term human and environmental needs.	Efforts are ongoing. Modified to more accurately reflect efforts by CBBEP and partners to optimize inflows through broader efforts than just planning.
Objective FW 1: Support the development and implementation of regional and local water management strategies.	Efforts are ongoing. Changed to show the need for CBBEP and partners to support implementation of strategies and move beyond just planning.
FW 1.1: Improve scientific understanding of the freshwater, nutrient, and sediment supply needs of the estuaries.	Efforts are ongoing. Expanded to include freshwater, nutrient, and sediment needs of the estuary - not just freshwater.
FW 1.2: Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate environmental needs in comprehensive planning.	Efforts are ongoing. Action still accurately reflects CBBEP's support of Coastal Bend Regional Water Planning and Group and other water planning groups/organizations.
FW 1.3: Support efforts that optimize environmental flows to the bays and estuaries of the Coastal Bend.	Efforts are ongoing. Edited to emphasize "optimal" environmental flows as the proper terminology since "increased" freshwater inflows may not be the standard throughout the entire year. Also, broadened to reflect multi-faceted efforts by CBBEP and partners to optimize environmental flows - not just focused on direct contributions of water.
FW 1.4: Effectively communicate the purpose and results of environmental flow efforts.	Efforts are ongoing. Changed to reflect the need to communicate about a broad scope of environmental flow efforts by CBBEP and partners - not just a need to communicate about plans and programs.

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PUBLIC EDUCATION AND OUTREACH ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Increase public understanding and stewardship of bay resources.	Goal was edited to more concisely state the overall goal of the public education and outreach program.
Objective PEO 1: Implement an innovative public education and outreach strategy to improve understanding and stewardship of bay resources.	Objective was edited slightly to capture the idea that CBBEP does not just "develop and distribute information." Other strategies are used to implement the public education and outreach strategy (e.g., public forums, stewardship activities).
PEO 1.1: Develop and distribute information and outreach materials for targeted audiences.	Efforts are ongoing by CBBEP to use a variety of techniques for distributing information about relevant topics to targeted audiences. The action was edited to better capture these broad range of efforts.
PEO 1.2: Support events that focus attention on bay resources and uses.	Action was broadened beyond just the scope of Earth Day - Bay Day to include other events that are supported by CBBEP and their partners.
PEO 1.3: Promote public participation in stewardship activities.	Proposed action will support CBBEP's efforts to conduct stewardship activities (e.g., planting days, clean-up events) that involve partners and the general public.
PEO 1.4: Support public meetings that improve understanding and stewardship of bay resources.	Action was broadened to include a larger range of public events that are supported by CBBEP and partners - public forums are still a component of this but other meetings are also supported.
PEO 1.5: Promote recognition of individuals and programs that protect our bays and estuaries.	Edited to reflect recognition programs for both individuals <u>and</u> programs. Also removed reference of promoting public participation since this is now captured more clearly in PEO-3.

Objective 2: Implement a regional approach to develop and distribute environmental education curricula for Coastal Bend school districts.	CBBEP has greatly expanded its K-12 educational programming since the 1998 Bays Plan was published. As a result, K-12 education will have a separate chapter in the revised Bays Plan. Curriculum development and updates will be covered in this chapter.
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.	CBBEP has greatly expanded its K-12 educational programming since the 1998 Bays Plan was published. As a result, K-12 education will have a separate chapter in the revised Bays Plan. Curriculum development and updates will be covered in this chapter. In addition, CBBEP has acquired several properties, which have been the focus area for their educational programming.
Objective 3: Promote public participation in environmental stewardship programs to increase awareness and instill individual responsibility.	Objective 1 was expanded to incorporate stewardship programs as part of the broader public education and outreach strategy. There was no longer a need for Objective 3.

LEGEND

No change from Coastal Bend Bays Plan

Goal, objective, or action from Coastal Bend Bays Plan was revised

Addition of new goal, objective, or action

Deletion of a goal, objective, or action from Coastal Bend Bays Plan

DELTA DISCOVERY ACTION PLAN

Goal, Objective, Action	Rationale
<p>Goal: Increase environmental literacy and stewardship of coastal watersheds through formal and informal education utilizing the Nueces Delta Preserve, other CBBEP properties, and partner sites.</p>	<p>CBBEP has greatly expanded its K-12 educational programming since the 1998 Bays Plan was published. Formal education programs are hosted at CBBEP facilities and at partner sites. This goal was developed to reflect the purpose of these programs.</p>
<p>Objective DD 1: Enhance the capacity of students to think critically about the environment and their role in watershed stewardship by connecting them to nature through guided discovery.</p>	<p>Through hands-on, guided discovery, the CBBEP formal education programs are designed to connect classroom learning to the real world, build critical thinking, and foster stewardship.</p>
<p>DD 1.1: Provide authentic field based experiences for PK-12 students and beyond that are aligned to cross curricular state/national standards.</p>	<p>Action was developed to reflect hands-on field experiences provided by CBBEP at the Nueces Delta, other CBBEP properties, and partner sites. Curriculum is field based and aligned with state/national standards, providing students a connection between classroom instruction and practical application through outdoor experiences.</p>
<p>DD 1.2: Provide professional development and resources for educators that allow them to connect instruction with real-world application.</p>	<p>Action was added to reflect the professional development workshops and resources provide by CBBEP to educators and interpreters. These tools are designed to allow participants to more readily incorporate the outdoor experiences into formal classroom instruction and connect instruction to real world application.</p>
<p>DD 1.3: Identify and promote partnership opportunities with like-minded organizations to develop and/or deliver programs that support the Delta Discovery mission of environmental education and coastal watershed protection.</p>	<p>Action was added to reflect collaborative programs that CBBEP educators will work on with partner organizations. Several of these partnership already exist and additional collaborative programs are likely to occur in the future.</p>
<p>Objective DD 2: Expand opportunities for children, adults, and families to participate in experiential outdoor learning programs.</p>	<p>CBBEP properties and partner sites provides ideal opportunities for informal education programs that are designed to connect children, adults, and families with nature and is looking to expand these programs.</p>
<p>DD 2.1: Provide outdoor learning opportunities that facilitate hands-on investigations of and experiences in the natural environment.</p>	<p>Action was added to reflect the informal education programs that CBBEP will offer that are geared towards children, adults, and families. These efforts are ongoing and will continue in the future.</p>

LEGEND

No change from Coastal Bend Bays Plan

Goal, objective, or action from Coastal Bend Bays Plan was revised

Addition of new goal, objective, or action

Deletion of a goal, objective, or action from Coastal Bend Bays Plan

COASTAL RESILIENCE ACTION PLAN

Goal, Objective, Action	Rationale
Goal: Understand, project, mitigate, and adapt for climate change impacts to increase resiliency of estuaries and coastal communities in the Coastal Bend.	Proposed goal is intended to capture the need to address climate change impacts that affect the resiliency of Coastal Bend communities, as well as the need to help these communities better prepare for ongoing and future changes. This issue was not addressed in previous plan.
Objective CR 1: Integrate climate change science into strategic planning and adaptive management.	Proposed objective reflects the need to use climate change science in local planning and management efforts. This was not included in previous plan.
CR 1.1: Facilitate and support studies to better project and understand the biological, chemical, physical, and ecological effects of climate change.	Proposed action reflects need to support local climate change research projects. This was not addressed in previous plan.
CR 1.2: Assist in developing and implementing adaptive management plans that conserve and protect coastal resources and their ecosystem services by incorporating climate change.	Proposed action reflects need to incorporate climate change information and research into local planning and management efforts. This was not included in previous plan.
Objective CR 2: Improve climate change literacy in order to build capacity for adapting and mitigating to climate change.	Proposed objective reflects the need to improve understanding of local climate change impacts in order to be better prepared for future changes. This was not addressed in previous plan.
CR 2.1: Develop or use formal and informal climate change education materials that are locally relevant to enhance climate literacy.	Proposed action reflects the need to develop and distribute educational materials that highlight local climate change research and can be used with a variety of audiences. This was not included in the previous plan.

LEGEND

No change from Coastal Bend Bays Plan

Goal, objective, or action from Coastal Bend Bays Plan was revised

Addition of new goal, objective, or action

Deletion of a goal, objective, or action from Coastal Bend Bays Plan

APPENDIX B

Threatened and Endangered Species

TABLE 8. LIST OF ENDANGERED AND THREATENED SPECIES FOUND WITHIN THE CBBEP 12-COUNTY PROGRAM AREA. (SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT, WILDLIFE DIVISION, DIVERSITY AND HABITAT ASSESSMENT PROGRAMS, 2016).

COMMON NAME	SCIENTIFIC NAME	FEDERAL	STATE
AMPHIBIANS			
Black-spotted newt	<i>Notophthalmus meridionalis</i>		T
South Texas siren (large form)	<i>Siren</i> sp 1		T
Mexican treefrog	<i>Smilisca baudinii</i>		T
Sheep frog	<i>Hypopachus variolosus</i>		T
BIRDS			
Brown Pelican	<i>Pelecanus occidentalis</i>	DL	
Reddish Egret	<i>Egretta rufescens</i>		T
White-faced Ibis	<i>Plegadis chihi</i>		T
Wood Stork	<i>Mycteria americana</i>		T
Bald Eagle	<i>Haliaeetus leucocephalus</i>	DL	T
White-tailed Hawk	<i>Buteo albicaudatus</i>		T
Zone-tailed Hawk	<i>Buteo albonotatus</i>		T
Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	LE	E
Peregrine Falcon	<i>Falco peregrinus</i>	DL	T
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	DL	T
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	DL	
Attwater's Greater Prairie-Chicken	<i>Tympanuchus cupido attwateri</i>	LE	E
Whooping Crane	<i>Grus americana</i>	LE	E
Piping Plover	<i>Charadrius melodus</i>	LT	T
Eskimo Curlew	<i>Numenius borealis</i>	LE	E
Red Knot	<i>Calidris canutus rufa</i>	T	
Interior Least Tern	<i>Sterna antillarum athalassos</i>	LE	E
Sooty Tern	<i>Sterna fuscata</i>		T
Cactus Ferruginous Pygmy-Owl	<i>Glaucidium brasilianum cactorum</i>		T
Northern Beardless-Tyrannulet	<i>Camptostoma imberbe</i>		T
Rose-throated Becard	<i>Pachyramphus aglaiae</i>		T
Tropical Parula	<i>Parula pityayumi</i>		T
Texas Botteri's Sparrow	<i>Aimophila botterii texana</i>		T
FISHES			
Opossum pipefish	<i>Microphis brachyurus</i>		T
Smalltooth sawfish	<i>Pristis pectinata</i>	LE	E
MAMMALS			
Southern yellow bat	<i>Lasiurus ega</i>		T
Coues' rice rat	<i>Oryzomys couesi</i>		T
Red wolf	<i>Canis rufus</i>	LE	E
Black bear	<i>Ursus americanus</i>		T
Louisiana black bear	<i>Ursus americanus luteolus</i>	DL	T
White-nosed coati	<i>Nasua narica</i>		T
Ocelot	<i>Leopardus pardalis</i>	LE	E
Jaguarundi	<i>Herpailurus yaguarondi</i>	LE	E

TABLE 8 (CONT'D.) LIST OF ENDANGERED AND THREATENED SPECIES FOUND WITHIN THE CBBEP 12-COUNTY PROGRAM AREA. (SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT, WILDLIFE DIVISION, DIVERSITY AND HABITAT ASSESSMENT PROGRAMS, 2016).

COMMON NAME	SCIENTIFIC NAME	FEDERAL	STATE
Jaguar	<i>Panthera onca</i>	LE	E
West Indian manatee	<i>Trichechus manatus</i>	LE	E
REPTILES			
Loggerhead sea turtle	<i>Caretta caretta</i>	LT	T
Green sea turtle	<i>Chelonia mydas</i>	LT	T
Atlantic hawksbill sea turtle	<i>Eretmochelys imbricata</i>	LE	E
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	LE	E
Leatherback sea turtle	<i>Dermochelys coriacea</i>	LE	E
Texas tortoise	<i>Gopherus berlandieri</i>		T
Reticulate collared lizard	<i>Crotaphytus reticulatus</i>		T
Texas horned lizard	<i>Phrynosoma cornutum</i>		T
Texas scarlet snake	<i>Cemophora coccinea lineri</i>		T
Black-striped snake	<i>Coniophanes imperialis</i>		T
Texas indigo snake	<i>Drymarchon melanurus erebennus</i>		T
Northern cat-eyed snake	<i>Leptodeira septentrionalis septentrionalis</i>		T
Timber rattlesnake	<i>Crotalus horridus</i>		T
MOLLUSKS			
Golden orb	<i>Quadrula aurea</i>	C	T
PLANTS			
South Texas ambrosia	<i>Ambrosia cheiranthifolia</i>	LE	E
Black lace cactus	<i>Echinocereus reichenbachii var albertii</i>	LE	E
Walker's manioc	<i>Manihot walkerae</i>	LE	E
Slender rushpea	<i>Hoffmannseggia tenella</i>	LE	E
LE or LT = Federally Listed Endangered or Threatened; PE or PT = Federally Proposed Endangered or Threatened; C = Federal Candidate for Listing; DL or PDL = Federally Delisted or Proposed for Delisting; E or T = State Listed Endangered or Threatened; NT = Not tracked or no longer tracked by the State			

APPENDIX C

Species of Greatest Conservation Need

TABLE 9. LIST OF SPECIES OF GREATEST CONSERVATION NEED (SGCN) WITHIN THE CBBEP 12-COUNTY PROGRAM AREA. (SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT, WILDLIFE DIVISION, DIVERSITY AND HABITAT ASSESSMENT PROGRAMS, 2016).

AMPHIBIANS	REPTILES	PLANTS (cont.)
Southern Crawfish Frog (<i>Lithobates areolatus areolatus</i>)	Texas diamondback terrapin (<i>Malaclemys terrapin littoralis</i>)	Velvet spurge (<i>Euphorbia innocua</i>)
BIRDS	Spot-tailed earless lizard (<i>Holbrookia lacerata</i>)	Low spurge (<i>Euphorbia peplidion</i>)
Snowy Plover (<i>Charadrius alexandrinus</i>)	Keeled earless lizard (<i>Holbrookia propinqua</i>)	Sand sheet leaf-flower (<i>Phyllanthus abnormis</i> var. <i>riograndensis</i>)
Western Snowy Plover (<i>Charadrius alexandrinus nivosus</i>)	Mexican blackhead snake (<i>Tantilla atriceps</i>)	Texas milk vetch (<i>Astragalus reflexus</i>)
Mountain Plover (<i>Charadrius montanus</i>)	PLANTS	Drummond's rushpea (<i>Caesalpinia drummondii</i>)
Western Burrowing Owl (<i>Athene cunicularia hypugaea</i>)	Texas shrimp-plant (<i>Yeatesia platystegia</i>)	South Texas rushpea (<i>Caesalpinia phyllanthoides</i>)
Sprague's Pipit (<i>Anthus spragueii</i>)	Roughseed sea-purslane (<i>Sesuvium trianthemoides</i>)	Stinking rushpea (<i>Pomaria austrotexana</i>)
Henslow's Sparrow (<i>Ammodramus henslowii</i>)	Shortcrown milkvine (<i>Matelea brevicoronata</i>)	Net-leaf bundleflower (<i>Desmanthus reticulatus</i>)
Sennett's Hooded Oriole (<i>Icterus cucullatus sennetti</i>)	Falfurrias milkvine (<i>Matelea radiata</i>)	Sand Brazos mint (<i>Brazoria arenaria</i>)
Audubon's Oriole (<i>Icterus graduacauda audubonii</i>)	Arrowleaf milkvine (<i>Matelea sagittifolia</i>)	Tharp's rhododon (<i>Rhododon angulatus</i>)
FISHES	Plains gumweed (<i>Grindelia oolepis</i>)	Amelia's abronia (<i>Abronia ameliae</i>)
American eel (<i>Anguilla rostrata</i>)	Coastal gay-feather (<i>Liatris bracteata</i>)	South Texas gilia (<i>Gilia ludens</i>)
Texas pipefish (<i>Syngnathus affinis</i>)	Welder machaeranthera (<i>Psilactis heterocarpa</i>)	Texas almond (<i>Prunus minutiflora</i>)
MAMMALS	Burridge greenthread (<i>Thelesperma burridgeanum</i>)	Texas peachbush (<i>Prunus texana</i>)
Aransas short-tailed shrew (<i>Blarina hylophaga plumbea</i>)	Wright's trichocoronis (<i>Trichocoronis wrightii</i> var. <i>wrightii</i>)	Bailey's ballmoss (<i>Tillandsia baileyi</i>)
Cave myotis bat (<i>Myotis velifer</i>)	Threeflower broomweed (<i>Thurovia triflora</i>)	Buckley's spiderwort (<i>Tradescantia buckleyi</i>)
Maritime pocket gopher (<i>Geomys personatus maritimus</i>)	Large selenia (<i>Selenia grandis</i>)	South Texas spikesedge (<i>Eleocharis austrotexana</i>)
Plains spotted skunk (<i>Spilogale putorius interrupta</i>)	Yellow-flowered alicocha (<i>Echinocereus papillosus</i>)	Indianola beakrush (<i>Rhynchospora indianolensis</i>)
INSECTS	Jones' nailwort (<i>Paronychia jonesii</i>)	Elmendorf's onion (<i>Allium elmendorffii</i>)
Los Olmos tiger beetle (<i>Cicindela nevadica olmosa</i>)	Bristle nailwort (<i>Paronychia setacea</i>)	Refugio rain-lily (<i>Zephyranthes refugiensis</i>)
Tibial scarab (<i>Anomala tibialis</i>)	Kleberg saltbush (<i>Atriplex klebergorum</i>)	Lila de los llanos (<i>Echeandia chandleri</i>)
Texas asaphomyian tabanid fly (<i>Asaphomyia texensis</i>)	Texas stonecrop (<i>Lenophyllum texanum</i>)	Awnless bluestem (<i>Bothriochloa exaristata</i>)
Manfreda giant-skipper (<i>Stallingsia maculosus</i>)	Tree dodder (<i>Cuscuta exaltata</i>)	Texas windmill-grass (<i>Chloris texensis</i>)
Superb grasshopper (<i>Eximacris superbum</i>)	Cory's croton (<i>Croton coryi</i>)	Mexican mud-plantain (<i>Heteranthera mexicana</i>)

APPENDIX D

Stakeholders participating in Bays Plan revision process

Human Uses	
Jake Herring	Director Land Conservation and Stewardship
Art Morris	Citizen
Gary Moore	City of Portland
Jace Tunnell	Mission-Aransas National Estuarine Research Reserve
William Zagorski	San Patricio County
Jesse Solis	Texas General Land Office
Jennifer Lawrence	Texas General Land Office
Perry Trial	Texas Parks and Wildlife Department

Maritime Commerce and Dredging	
Rosario Martinez	Senior Project Manager
Colleen Johnson	360factors
Louis Adams	Aransas and Corpus Christi Pilots
Tom Salazar	Corpus Christi Area Oil Spill Control Association
Bob Paulison	Port Industries of Corpus Christi
Dan Koesema	Port of Corpus Christi Authority
Paul Carangelo	Port of Corpus Christi Authority
Howard Gillespie	Texas Department of Transportation - Ferry Operations
Jimmy Martinez	Texas General Land Office
Hans Miller	United States Army Corps of Engineers
Leslie Olson	United States Army Corps of Engineers
Steve Howard	United States Army Corps of Engineers
Joe Harrington	Valero

Habitat and Living Resources	
Rosario Martinez	Senior Project Manager
Jake Herring	Director of Land Conservation and Stewardship
David Newstead	Director of Coastal Bird Program
Owen Fitzsimmons	Senior Conservation Biologist
Barbara Gurtner	City of Rockport
Megan Robillard	Harte Research Institute for Gulf of Mexico Studies
Elizabeth Smith	International Crane Foundation
Katie Swanson	Mission-Aransas National Estuarine Research Reserve
Mary Kay Skoruppa	Naismith Engineering
Ryan Fikes	National Wildlife Federation
James Dodson	San Antonio Bay Partnership
Michael Womack	South Texas Botanical Gardens
Aaron Baxter	Texas A&M University - Corpus Christi
James Simons	Texas A&M University - Corpus Christi
Jennifer Lawrence	Texas General Land Office
Jesse Solis	Texas General Land Office
Jackie Robinson	Texas Parks and Wildlife Department
Paul Silva	Texas Parks and Wildlife Department

Habitat and Living Resources (cont'd)	
Chad Stinson	United States Fish and Wildlife Service
Beau Hardegree	United States Fish and Wildlife Service
Ken Dunton	University of Texas Marine Science Institute

Water and Sediment Quality / Freshwater Resources	
Rae Mooney	Project Manager
Sharon Bailey Lewis	City of Corpus Christi
Brittany Mouttet	City of Corpus Christi
Nikki Gordon	City of Corpus Christi
Philippe Tissot	Conrad Blucher Institute
Jace Tunnell	Mission-Aransas National Estuarine Research Reserve
Katie Swanson	Mission-Aransas National Estuarine Research Reserve
Alicia Walker	National Park Service
Rocky Freund	Nueces River Authority
Adriana Leiva	Texas Parks and Wildlife Department
Brandi Reese	Texas A&M University - Corpus Christi
Jeremy Conkle	Texas A&M University - Corpus Christi
Jeffrey Turner	Texas A&M University - Corpus Christi
Xinping Hu	Texas A&M University - Corpus Christi
Simon Geist	Texas A&M University - Corpus Christi
Terry Palmer	Texas A&M University - Corpus Christi
Lee Schroer	Texas General Land Office
Alex Nunez	Texas Parks and Wildlife Department
Brian Koch	Texas State Soil and Water Conservation Board
Ken Dunton	University of Texas Marine Science Institute

Environmental Education and Outreach	
Kathryn Tunnell	Communications Manager
Lari Jo Johnston	Director of Environmental Education
Leigh Perry	Environmental Education Coordinator
Josh Sendejar	Environmental Education Assistant
Manny Cantu	City of Corpus Christi - Oso Bay Wetlands Preserve
Amanda Rose	Corpus Christi Independent School District
Sarah Coles	Corpus Christi Museum of Science and History
Natalie Bernard	Gregory-Portland Independent School District
Carolyn Rose	Mission-Aransas National Estuarine Research Reserve
Kristin Evans	Texas State Aquarium
Sally Palmer	University of Texas Marine Science Institute
Crystal Mead	Wildlife in Focus

APPENDIX E

Summary of public comments received and responses

COASTAL BEND BAYS PLAN, 2ND EDITION

RESPONSE TO PUBLIC COMMENTS

The goal of *The Bays Plan* revision process was to create a *Bays Plan, 2nd Ed.* that continues to meet the needs of stakeholders in industry, local government, academia, and resource management and can be used for years to come. The CBBEP recognizes the importance of stakeholder involvement in both the development and implementation of comprehensive management strategies, and therefore, initiated a collaborative effort to gather feedback from stakeholders and revise *The Bays Plan* based on the most recent priority issues and the current and future needs of local communities.

Local stakeholders were allowed opportunities to provide input to *The Bays Plan, 2nd Ed.* throughout the course of its development through special meetings of the CBBEP Implementation Teams. These special sessions were used to discuss *The Bays Plan* and seek feedback from local partner agencies and organizations about a particular focus area of the *Plan* (e.g., water and sediment quality, habitat and living resources, human uses). Once a draft of *The Bays Plan, 2nd Ed.* was complete, notices were published on the CBBEP website and social media pages to notify the general public of the opportunity to comment on the *Plan*. Individuals had the opportunity to submit written comments via the website. Additionally, a public meeting was held on April 9, 2018 in Corpus Christi, Texas to provide the public with the opportunity to hear an overview of *The Bays Plan, 2nd Ed.* and provide comments orally or in writing. Specific comments received on *The Bays Plan, 2nd Ed.* are provided below, along with a description of how the CBBEP chose to address (or not address) those comments within the revised *Plan*.

Comment	Description of how comment was addressed
Inappropriate advocacy for expansion of deep draft navigation channels, and for development in general.	CBBEP recognizes the Port of Corpus Christi's important role in the local economy, as well as the growth that the Port has experienced in recent years. The Coastal Bend Bays Plan, 2nd Edition includes maritime commerce and dredging actions that are designed to minimize negative environmental impacts to the estuary and maximize benefits to the bays and the regional economy. For this reason, CBBEP supports the Port's efforts to widen and deepen the Corpus Christi Ship Channel in order to ensure safer transportation of products in and out of the Port and lessen the likelihood for accidents and spills.
A lack of attention to water quality.	The Coastal Bend Bays Plan, 2nd Edition includes three goals and ten actions related to water quality and nonpoint source pollution. The emphasis that CBBEP places on water quality is also evident in the number of water quality projects included in CBBEP's Annual Work Plans, which are available on the CBBEP website (www.cbbep.org).

Comment	Description of how comment was addressed
<p>A lack of concern for the requirements of Section 320 of the Clean Water Act.</p>	<p>CBBEP understands the importance of Section 320 of the Clean Water Act and the role it played in establishing National Estuary Programs and improving water quality in our bays and estuaries, including the Coastal Bend. CBBEP supports the requirements of the Clean Water Act by implementing restoration, research/ monitoring, and various other types of projects that address local water quality issues. Although CBBEP is focused on improving water quality, it has also adopted a broader mission of maintaining the integrity of the entire estuarine system — its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic values.</p>
<p>A tendency to adopt responsibilities that aren't part of Section 320 of the Clean Water Act, and to ignore those that are.</p>	<p>The Coastal Bend Bays Plan was initially developed with input from local stakeholders to address the unique environmental conditions and issues of the Coastal Bend and to support local priorities. As a result, CBBEP adopted a mission of not only improving water quality, but also maintaining the integrity of the entire estuarine system - its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic values.</p>
<p>More specifically, the program appears to be taking on responsibility for climate change and sea level rise, that don't relate to Section 320 of the Clean Water Act. A NEP can't solve all problems in an area, but they should try to solve those that are mentioned in Section 320</p>	<p>CBBEP has chosen to address issues that will help both communities and the estuary be more resilient to changing conditions. This approach was determined based on the results of a recently completed climate change vulnerability assessment and discussions with stakeholders about CBBEP's role and priorities. This approach also supports a key part of CBBEP's mission which is to protect and restore the bays and estuaries of the Coastal Bend, while supporting local coastal communities continued reliance on and use of the estuary.</p>
<p>A tendency to work outside the program geographic area</p>	<p>CBBEP focuses the majority of its resources on addressing priority issues in the 12-county Coastal Bend region. However, there are many issues which cross jurisdictional boundaries (e.g., coastal bird populations), and CBBEP has sometimes found it necessary to work outside the Coastal Bend region. Funds from Section 320 of the Clean Water Act are only used for activities within the National Estuary Program boundary.</p>
<p>A focus on birds that exceeds what can reasonably be justified under Section 320 of the Clean Water Act</p>	<p>Following the completion of the Coastal Bend Bays Plan and the formation of CBBEP, there was a realization that coastal bird populations had decreased dramatically within the Coastal Bend region. Since coastal bird populations are an important indicator of estuarine health, CBBEP formed the Coastal Bird Program to address the major issues that were causing these declines, and ultimately address broader issues within the estuarine system.</p>

Comment	Description of how comment was addressed
<p>A tendency to downplay the significance of certain estuarine environmental problems</p>	<p>CBBEP has completed several assessments of the health of the Coastal Bend bays and estuaries - the results of these assessments are available on the CBBEP website (www.cbbep.org). The results of CBBEP's most recent Indicator Report are summarized in the Coastal Bend Bays Plan, 2nd Edition. Although most indicators show that the estuary is in good condition, there are several places where issues of concern are noted. A full copy of this report is available online and provides more detail about the results of each indicator and the areas of concern. CBBEP recognizes that there continue to be issues of concern in Coastal Bend bays and estuaries, and it should be noted that CBBEP works with its stakeholders on an annual basis to identify the highest priority issues within the region. Through its Implementation Teams, CBBEP stakeholders help develop projects and programs to address these issues of concern.</p>
<p>An apparent program policy choice to avoid the use of regulatory programs to implement the CCMP, despite Section 320 of the Clean Water Act</p>	<p>CBBEP is a 501(c)3 organization and does not have regulatory authority. However, CBBEP works closely with regulatory agencies, like TCEQ, TPWD, and EPA, to ensure that current regulations are sufficient to maintain water quality and ecological integrity and to develop new regulations for issues which may arise.</p>
<p>Over-reliance on habitat acquisition as the primary habitat management tool</p>	<p>CBBEP determined that habitat acquisition is a beneficial tool for accomplishing numerous goals outlined in the Coastal Bend Bays Plan, and therefore, has continued to use this tool throughout its program boundary.</p>
<p>A post-CCMP program governance structure that does not include a separate Scientific/Technical Advisory Committee, nor a Local Governments Advisory Committee. A governance structure that appears to relegate key State and Federal agencies to working-level committees, rather than having a voice on the major policy/management committee(s).</p>	<p>CBBEP incorporates scientific/technical input through its implementation teams and advisory committees. Each team has numerous representatives from the scientific community. Through CBBEP's implementation teams, scientific and technical experts are able to advise CBBEP on priority issues and help develop an Annual Work Plan that addresses these issues. As a result, these teams play a critical role in determining what CBBEP will accomplish each year. These teams also include representatives from key state and federal agencies.</p>

APPENDIX F

Research Needs Identified During "The Bays Plan, 2nd ed."

BD 1.1: Support activities to reduce the amount of debris reaching the bays.

Improve efforts to remove improperly disposed of solid waste from stormwater drainage systems.

PH 1.1: Support efforts to protect recreational water quality through studies on waterborne health issues, including pathogens, chemicals, and Harmful Algal Blooms.

Water quality monitoring programs that provide notifications to recreational users (e.g., Texas Beach Watch, Harmful Algal Bloom hotline).

Support efforts to better understand the impacts of waterborne pathogens (e.g., *Vibrio vulnificus*) and HABs (e.g., red tide) on recreational water quality.

PH 2.1: Support health risk assessments associated with consumption and handling of seafood.

Support efforts to collect sufficient fish and shellfish data to be used in human consumption risk assessments from selected subsections of the project area.

Determine sources of pollutants related to fish and shellfish consumption risk assessments.

MC 1.3: Support efforts to maintain and improve the Vessel Traffic Information System and any additional navigational aids, such as the Physical Oceanographic Real-Time System (PORTS).

Installation, and modification of electronic monitors in Corpus Christi Bay and its approaches to provide real-time wind, tide, and current information to mariners via a phone, radio, or internet link.

Assess the need for a Vessel Traffic System.

MC 2.1: Continue to maintain and improve regional oil spill response capability.

Evaluate and prioritize high-risk areas based on environmental, social, and public health vulnerabilities. Incorporate this information into contingency planning documents.

Evaluate alternative spill response equipment and technologies in conjunction with equipment deployment.

MC 2.2: Continue to maintain and improve hazardous spill response planning and resources to ensure public protection.

Determine areas where the public is at greatest risk from accidental spills/releases of hazardous materials.

MC 3.1: Support data management systems to locate existing pipelines and points of contact for current ownership.

For existing marine pipeline data management systems, identify data gaps and evaluate opportunities for potential improvements (e.g., digitization, web interface).

HLR 1.1: Preserve functional, natural habitats of all major types.

Use publicly available mapping platforms to identify and inventory the current location and protection status of all natural habitat types within the project area.

Prioritize habitat types and geographic areas based on needs, stressors, and threats, taking into account current and future impacts such as climate change and coastal development.

HLR 1.2: Restore and enhance degraded habitats and create new habitats where feasible.

Identify habitat types and geographic areas for potential restoration, enhancement, and creation projects.

Prioritize habitat types and geographic areas based on needs, stressors, and threats, taking into account current and future impacts such as climate change and coastal development.

HLR 1.3: Support efforts to identify and minimize adverse impacts of activities and operations on coastal habitats.

Establish a baseline for determining habitat impacts from activities/operations by quantifying and characterizing the key components of coastal habitats.

Identify stakeholders impacted by loss and/or degradation of habitat.

HLR 2.1: Develop and implement adaptive management plans to ensure sustainability for species of concern.

Develop management plans for species of concerns.

HLR 2.3: Support effective commercial and recreational fisheries management.

Examine TPWD fisheries monitoring data to better understand major fisheries management issues.

HLR 2.4: Support efforts to identify and minimize adverse impacts of activities and operations on coastal living resources.

Establish a baseline for determining impacts from activities and operations by quantifying species abundance.

Identify stakeholders impacted by loss and/or degradation of species.

HLR 2.5: Improve understanding of harmful algal blooms and their impact on living resources.

Monitor coastal waters to assess critical concentrations of HAB bloom activity.

Conduct experimental research to better understand the factors that trigger and sustain HAB bloom development. In addition, determine the effects of toxins and secondary impacts on living coastal resources.

HLR 2.6: Develop and support adaptive management plans to minimize introductions and impacts from invasive species.

Identify the distribution and ecological impacts associated with existing invasive and nuisance species.

Identify techniques for the treatment and control of current and potential invasive/nuisance species, and conduct demonstration projects to determine the effectiveness of these techniques.

CB 1.1: Implement successful waterbird management actions to reverse declines in colonial nesting waterbirds in the Coastal Bend.

Monitor population trends of nesting colonial waterbirds. If necessary, identify potential causes of declines and develop management strategies to address those causes.

Maintain an active role in the Texas Colonial Waterbird Society and participate annually in the Texas Colonial Waterbird Survey.

CB 2.1: Advance the conservation of migratory shorebirds through research, monitoring, and stewardship of shorebird species that utilize the Central Flyway and visit the Coastal Bend.

Conduct monitoring of sites of local importance to shorebirds, assess their threats, and work with willing landowners/managers to develop and implement appropriate management actions.

Conduct and facilitate projects that fill essential knowledge gaps related to migratory connectivity of species of conservation concern, through use of traditional methods, as well as innovative technologies.

WSQ 1.1: Support the implementation of plans and projects to improve water and sediment quality in identified segments.

Assessments and planning that address problematic levels of heavy metals, dissolved oxygen, bio-markers of fecal pollution, and other water quality issues identified by stakeholders for specific portions of the project area that are of concern (e.g., low dissolved oxygen in Corpus Christi Bay).

WSQ 1.2: Continue to support permitting rules for mariculture and aquaculture.

Research on water quality and invasive species issues associated with aquaculture and mariculture techniques and procedures.

WSQ 2.1: Support efforts to quantify total constituent loadings and identify possible transport pathways, sources, and fates.

Coordinate additional data acquisition, including citizen science programs, to determine relative contributions and loadings from point and non-point sources.

Coordinate additional data acquisition to determine transport pathways, sources, and fates of constituents.

Refinement of existing models and the development of new models related to constituent loadings, transport pathways, sources, and fates.

WSQ 2.2: Support analyses of the biological and ecological effects of constituents.

Studies and projects that determine the responses of flora/fauna (i.e., biological, chemical, and physiological changes) and ecological effects to varying levels of constituents entering the bays.

Studies and projects that examine the potential interactions among constituents, as well as the interaction between constituents and environmental parameters (e.g., temperature, dissolved oxygen, salinity).

WSQ 3.1: Ensure that water and sediment quality standards and criteria are adequate and appropriate.

Studies that examine water and sediment quality standards and criteria, as well as biological criteria, for various portions of the project area to coincide with the State's review process or as needed.

NPS 1.5: Support efforts to improve the quality of urban stormwater runoff.

Studies and assessments that improve the quality of urban stormwater runoff.

FW 1.1: Improve scientific understanding of the freshwater, nutrient, and sediment supply needs of the estuaries.

Continue use of current methods and assess new methods of monitoring salinity; productivity of bays; inflow quantity and quality; direct bay rainfall; and climate trends and forecasting.

Continue to develop and assess methods for linking environmental flows to the ecological health and productivity of Coastal Bend bays and estuaries.

Continue to coordinate and assess new data collection needs, identify new locations, and deploy new streamflow and rainfall gauges (e.g., tidal river flow index-velocity gauges) throughout the project area as needed.

FW 1.3: Support efforts that optimize environmental flows to the bays and estuaries of the Coastal Bend.

Continue to implement projects and assess the ecology and economics of beneficial reuses of wastewater.

Investigate the feasibility and environmental impacts of alternative freshwater supply sources such as desalinization and aquifer storage and recovery.

CR 1.1: Facilitate and support studies to better project and understand the biological, chemical, physical, and ecological effects of climate change.

Research and monitoring of key abiotic parameters related to climate variability (e.g., temperature, precipitation, salinity, dissolved oxygen, pH, carbon dioxide, water level).

Assessments of climate change impacts on ecosystem structure and function, including studies of the interaction between climate change and existing stressors (e.g., invasive species, urban development).

Improved/refined modeling (e.g., SLAMM) of future climate change impacts on local resources.

Improved/refined climate change vulnerability assessments.

APPENDIX G

CBBEP By-laws

September 30, 1999
BY-LAWS
OF
COASTAL BEND BAYS & ESTUARIES PROGRAM, INC.

This **COASTAL BEND BAYS & ESTUARIES PROGRAM, INC.**, is being created based on six basic principles:

- Governance of the Coastal Bend Bays & Estuaries Program, Inc. ("Program") will include local governments, based on their financial participation, State and Federal resource agencies, and other diverse stakeholders.
- Local government participation is purely voluntary. A local government can withdraw at any time without penalty, subject only to meeting its obligation as to any financial commitments previously made.
- The Program will have no powers of taxation or regulation, nor formal permit review role.
- Program activities will only be conducted within the territorial jurisdiction of a local government with the consent of that government.
- The Program is authorized to accept funding from Federal, State, local, and private sources to carry out its activities.
- The Program will be housed and administratively supported by the Port of Corpus Christi Authority, with policy decisions made by the Program's Executive Council.

The Program is created pursuant to the Interlocal Agreement entered into by some of the participants to implement the Bays Plan, and is hereby adopted by reference.

The management conference of the Corpus Christi Bay National Estuary Program has developed and unanimously adopted the Coastal Bend Bays Plan (the "Bays Plan") for the program area, which was presented by Governor George W. Bush to the EPA for approval and approved by the EPA on February 26, 1999. The Bays Plan is specifically incorporated herein by reference and made a part of these by-laws. The Bays Plan defines the program area as lands and waters within Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, Refugio and San Patricio Counties, but focuses primarily upon the coastal counties -- Aransas, Kenedy, Kleberg, Nueces, Refugio, and San Patricio Counties.

The Bays Plan seeks to ensure that the Coastal Bend bays and estuaries remain a vibrant part of the region's environmental and economic landscape by preserving and enhancing their roles as a recreational resource, international seaport, and habitat for fish and wildlife.

The Bays Plan addresses the Coastal Bend Bays Priority Issues, including limited freshwater inflows into bays and estuaries, the condition of living resources, loss of wetlands and estuarine habitats, degradation of water and sediment quality, altered estuarine circulation, bay debris, and public health issues. The Bays Plan encompasses six Action Plans, including human uses, which includes actions related to bay tourism and recreation, bay debris, public health, and shoreline management; maritime commerce and dredging; habitat and living resources; water and sediment quality, which includes issues relating to point sources and nonpoint source runoff from both agriculture and urban sources; freshwater resources; and public education and outreach. In addition, the Bays Plan includes a detailed implementation strategy, governance structure, regional monitoring strategy, and Federal consistency review procedures. The Bays Plan emphasizes regional cooperation and flexibility that allows the Program to select the most cost-effective and environmentally beneficial bay improvement options for their communities to meet the specific goals of the Bays Plan. Promotion of viable and enhanced local economies was established as a key element of the Bays Plan.

The directors desire to adopt an organizational framework to ensure that the Bays Plan is properly and effectively implemented.

By the creation of the Coastal Bend Bays & Estuaries Program, Inc., the directors hope to create a consensus based organization that seeks mutually agreeable solutions to problems the participants hold in common. Absolutely nothing in these by-laws is to be construed to usurp any prerogative of any unit of local government, political subdivision of the State of Texas, or State agency, nor place any restriction on such a unit. When used herein, the term "local government" shall mean a unit of general local government that is a county governed by a commissioners court, or a city or town governed by a municipal body, under the Texas Open Meetings Act, Chapter 551 of the Texas Government Code.

ARTICLE I
Organization

Section 1. The name of this Program is **Coastal Bend Bays & Estuaries Program, Inc.**

Section 2. The office of this Program is
1305 N. Shoreline, Suite 205
Corpus Christi, Texas 78401

Section 3. The principal office of this Program shall be 1305 N. Shoreline, Suite 205, Corpus Christi, Texas 78401, but may be moved from time to time and from place to place by vote of the Executive Council.

Section 4. The Program may also have offices at such other places within the State of Texas as the Board of Directors may from time to time determine.

Section 5. The Program will maintain a registered office and registered agent. The Board of Directors may change the registered office and registered agent as permitted in the Texas Non-Profit Corporation Act.

Section 6. The specific and primary purpose for which this Program is formed is to implement the Bays Plan by whatever plans, projects and programs that shall be approved and adopted by the Program.

Section 7. This Program shall possess all the rights and powers granted by the laws of Texas to this Program or to any non-profit corporation, and may from time to time do any one or more of the acts and things which are necessary or expedient for the administration of the affairs and attainment of the purposes of the Program. The Program shall not pay dividends or otherwise accrue distributable profits or permit the realization of private gain.

Section 8. The Bays Plan shall be subject to review by the Executive Council five (5) years from the effective date, and every five (5) years thereafter.

Section 9. Limitations of Powers:

- a. The Program, the Executive Council, and the Bays Council shall have no powers of taxation or regulation, nor formal permit review role.
- b. The Program shall not authorize or undertake any project within the jurisdiction of a local government, including its extra-territorial jurisdiction, without the consent of that government. Consent will be assumed unless written objection is specifically issued by the local government to the Executive Council.
- c. Any participant in the Program, including any local government, can withdraw at any time without penalty, subject only to meeting its obligations as to any financial commitment previously made.

Article II
Board of Directors

Section 1. The Board of Directors will manage corporate affairs, except as herein delegated to the Executive Council.

Section 2. The number of members of the Board of Directors which shall constitute the whole Board shall be seven (7). The number of members which shall constitute the whole Board may be changed by resolution approved by 100% of the Board of Directors present and voting at any meeting of the Board. Each member shall

hold office until his or her successor shall qualify. Initially, the Board of Directors of the Coastal Bend Bays & Estuaries Program, Inc. shall consist of seven (7) members, as follows:

- a. A representative of the Bays Council;
- b. A representative of Nueces County;
- c. On a rotating basis, a representative from Aransas, Kleberg, or San Patricio Counties (initially chosen by San Patricio, then Kleberg, then Aransas);
- d. A representative of the City of Corpus Christi;
- e. A representative of the Port of Corpus Christi;
- f. A representative of the Coastal Bend Bays Foundation; and
- g. A representative of the Port Industries of Corpus Christi.

Section 3. The property, business and fiscal affairs of the Program shall be managed by its Board of Directors which may exercise all such powers of the Program and do all such lawful acts and things as are authorized by statute, the Interlocal Agreement, the Coastal Bend Bays Plan and these by-laws, except as herein delegated to the Executive Council. The Board of Directors may establish any committees, task forces, or advisory groups as it deems necessary. The Board of Directors shall create an Audit Committee to ensure that audit findings are implemented, to assist in the audit process, and to provide fiscal monitoring, procurement procedures, travel guidelines, personnel policies, conflict of interest policies and policies regarding the role and responsibilities of individuals serving on the Board of Directors and the Management Conference.

Section 4. Meetings of Board of Directors for any purpose may be held at such time and place within or without the State of Texas as shall be stated in the notice of the meeting. No action will be taken at a meeting held outside of the Program area. Members may attend a meeting by issuing a proxy to someone to attend or vote in their place. Any such proxy will be valid only if it is in writing. Facsimile copies of signatures shall be acceptable on all waivers, consents and proxies.

Section 5. All annual meetings of the Board of Directors shall be held on the fourth Monday of August, if not a legal holiday and if so, then on the first weekday thereafter, unless otherwise determined by the Board. Annually, the Board of Directors shall vote to impanel the seven (7) representatives, above.

Section 6. Written notice of the annual meeting shall be served upon or mailed to each member of the Board at such address as appears on the books of the Program with notice requirement in conformity with the Texas Open Meetings Act.

Section 7. Special meetings of the Board of Directors, for any purpose or purposes, unless otherwise prescribed by statute or

the Interlocal Agreement, may be called by the Chair, the President, the Executive Director of the Program or if requested in writing by any member of the Board of Directors entitled to vote. Such request shall state the purpose or purposes of the proposed meeting.

Section 8. Written notice of a special meeting of the Board of Directors stating the time and place and purpose or purposes thereof, shall be served upon or mailed to each member entitled to vote to such address as appears on the books of the Program with notice requirement in conformity with the Texas Open Meetings Act.

Section 9. A majority of no less than four (4) of the members present in person, or by proxy, shall be requisite and shall constitute a quorum at all meetings of the Board of Directors for the transaction of business, except as otherwise provided by statute, the Interlocal Agreement or these by-laws.

Section 10. When a quorum is present at any meeting, if required, the vote of 83% of the members present in person, or by proxy, and voting for a motion shall decide any question brought before such meeting, unless the question is one upon which by express provisions of the statutes, the Interlocal Agreement, or these by-laws, a different vote is required in which case such express provisions shall govern and control the decision of such question.

Section 11. Whenever under the provisions of the statutes, the Interlocal Agreement, or these by-laws, notice is required to be given to any member, it shall not be construed to mean personal notice, but such notice may be given in writing, by mail postage prepaid, addressed to such member at such address as appears on the books of the Program, and such notice shall be deemed to be given at the time when the same shall be thus mailed.

Article III Executive Council

Section 1. The number of members of the Executive Council which shall constitute the whole Executive Council shall be eleven (11). The number of members which shall constitute the whole Executive Council may be changed by resolution approved by 100% of the Executive Council present and voting at any meeting of the Executive Council. Each member shall hold office until his or her successor shall qualify. Initially, the Executive Council of the Coastal Bend Bays & Estuaries Program, Inc. shall consist of eleven (11) members, as follows:

- a. A representative of the Bays Council;
- b. A representative of Nueces County;

- c. On a rotating basis, a representative from Aransas, Kleberg, or San Patricio Counties (initially chosen by San Patricio, then Kleberg, then Aransas);
- d. A representative of the City of Corpus Christi;
- e. A representative of the Port of Corpus Christi;
- f. A member of the Texas Legislature chosen by a caucus of the state legislators representing the Coastal Bend Bays & Estuaries program area;
- g. A representative of the Environmental Protection Agency;
- h. A representative of the Texas General Land Office;
- i. A representative of the Texas Natural Resource Conservation Commission;
- j. A representative of the Coastal Bend Bays Foundation; and
- k. A representative of the Port Industries of Corpus Christi.

Section 2. The Executive Council shall manage the implementation of the Coastal Bend Bays Plan and fulfill such other duties as are delegated to it by the Board of Directors. This delegation by the Board of Directors shall not include any power to authorize contracts with a Federal, state or local government or agency. Upon completion of the review, correction and comment of the proposed work plan by the Executive Council, the Executive Director shall submit the work plan to the TNRCC for approval.

Section 3. Meetings of Executive Council for any purpose may be held at such time and place within or without the State of Texas as shall be stated in the notice of the meeting. No action will be taken at a meeting held outside of the Program area. Members may attend a meeting by issuing a proxy to someone to attend or vote in their place. Any such proxy will be valid only if it is in writing. Facsimile copies of signatures shall be acceptable on all waivers, consents and proxies.

Section 4. All annual meetings of the Executive Council shall be held on the fourth Monday of August, if not a legal holiday and if so, then on the first weekday thereafter, unless otherwise determined by the Executive Council. Periodically, the Executive Council shall vote to impanel the eleven (11) representatives above.

Section 5. Written notice of the annual meeting shall be served upon or mailed to each member of the Executive Council at such address as appears on the books of the Program with notice requirement in conformity with the Texas Open Meetings Act.

Section 6. Special meetings of the Executive Council, for any purpose or purposes, unless otherwise prescribed by statute or the Interlocal Agreement, may be called by the Chair, the President, the Executive Director of the Program or if requested in writing by any three (3) members of the Executive Council entitled

to vote. Such request shall state the purpose or purposes of the proposed meeting.

Section 7. Written notice of a special meeting of the Executive Council stating the time and place and purpose or purposes thereof, shall be served upon or mailed to each member entitled to vote to such address as appears on the books of the Program with notice requirement in conformity with the Texas Open Meetings Act.

Section 8. A majority of no less than six (6) of the members present in person, or by proxy, shall be requisite and shall constitute a quorum at all meetings of the Executive Council for the transaction of business, except as otherwise provided by statute, the Interlocal Agreement or these by-laws.

Section 9. When a quorum is present at any meeting, if required, the vote of more than 83% of the members present in person, or by proxy, and voting for a motion shall decide any question brought before such meeting, unless the question is one upon which by express provisions of the statutes, the Interlocal Agreement, or these by-laws, a different vote is required in which case such express provisions shall govern and control the decision of such question.

Section 10. Whenever under the provisions of the statutes, the Interlocal Agreement, or these by-laws, notice is required to be given to any member, it shall not be construed to mean personal notice, but such notice may be given in writing, by mail postage prepaid, addressed to such member at such address as appears on the books of the Program, and such notice shall be deemed to be given at the time when the same shall be thus mailed.

Section 11. Any member of the Executive Council may cause an item to be referred to the Board of Directors.

Article IV Bays Council

Section 1. The Bays Council shall be initially comprised of one designated representative of each of the participants in the Program, and such additional persons designated by the Executive Council from time to time. The Bays Council shall oversee the programs, projects and research of the Program, with final approval of the Executive Council or, in certain cases, the Board of Directors. The Bays Council and Executive Council are jointly referred to herein and in the Bays Plan as the Estuary Council.

Section 2. Meetings of Bays Council for any purpose may be held at such time and place within the Program twelve county area as shall be stated in the notice of the meeting. Members may attend a meeting by issuing a proxy to someone to attend or vote in their

place. Any such proxy will be valid only if it is in writing. Facsimile copies of signatures shall be acceptable on all waivers, consents and proxies.

Section 3. Meetings of the Bays Council, for any purpose or purposes, unless otherwise prescribed by statute or the Interlocal Agreement, may be called by the Chair or a Co-Chair of the Bays Council, the Executive Director of the Program or if requested in writing by any three (3) members of the Bays Council entitled to vote. Such request shall state the purpose or purposes of the proposed meeting.

Section 4. Written notice of a meeting of the Bays Council stating the time and place and purpose or purposes thereof, shall be served upon or mailed to each member entitled to vote to such address as appears on the books of the Program with notice requirement in conformity with the Texas Open Meetings Act.

Section 5. A majority of the members present in person, or by proxy, shall be requisite and shall constitute a quorum at all meetings of the Bays Council for the transaction of business, except as otherwise provided by statute, the Interlocal Agreement, or these by-laws.

Section 6. When a quorum is present at any meeting, if required, the vote of more than 50% of the members present in person shall decide any question brought before such meeting, unless the question is one upon which by express provisions of the statutes, the Interlocal Agreement, or these by-laws, a different vote is required in which case such express provisions shall govern and control the decision of such question.

Section 7. Whenever under the provisions of the statutes, the Interlocal Agreement, or these by-laws, notice is required to be given to any member, it shall not be construed to mean personal notice, but such notice may be given in writing, by mail postage prepaid, addressed to such member at such address as appears on the books of the Program, and such notice shall be deemed to be given at the time when the same shall be thus mailed.

Section 8. Any member of the Bays Council may cause an item to be referred to the Executive Council.

Article V Management Conference

Section 1. The Executive Council shall oversee and guide a Management Conference consisting of the Executive Council, Bays Council, Scientific-Technical Advisory Committee ("STAC"), and Citizen's Advisory Committee ("CAC"). The Executive Council may establish any additional committees, task forces, or advisory

groups within the Management Conference as it deems necessary for the execution of its responsibilities.

Bays Council

Section 2. The Executive Council shall appoint an interim Chair of the Bays Council for a period not to exceed 180 days. Within 180 days of convening its first meeting, the Bays Council will elect a permanent Chair or Co-Chairs. The Chair will serve on the Executive Council. The Bays Council shall be specifically responsible for identification of the problems associated with the Program area; compilation of scientific and technical information on the status, trends, and cause of these problems; drafting of proposed amendments to the Coastal Bend Bays Plan ("Bays Plan") to address these problems at the ecosystem level; and determination of the means to implement the Bays Plan. The Bays Council shall work under the authority of the Executive Council to receive and act on advice and project findings from the Scientific/Technical Advisory Committee, Citizen's Advisory Committee, and other sub-committees, task forces, ad hoc advisory groups, etc. created by the Program. In all roles, the Bays Council shall strive to receive the concerns from, and to build consensus among, the user groups, local, state and federal agencies, private industries, environmental groups, the scientific community, and general public, concerning management planning and implementation for the Program area.

Scientific-Technical Advisory Committee

Section 3. Members shall be appointed by the Executive Council which shall also appoint an interim Chair and Vice-Chair for a period not to exceed 180 days. Within 180 days of convening its first meeting, the STAC will elect a permanent Chair and Vice-Chair. The Chair will serve on the Bays Council. The STAC shall be composed of scientists and other technical experts from academic and research institutions, local governmental entities, industry, bay user and interest groups, and state and federal agencies. The STAC will advise the Bays Council on matters of characterization; research, data management; and modeling, sampling, and monitoring efforts. This committee will review the development of any characterization requests for proposals and the submitted proposals, work plans and work products in addition to any other duties assigned by the Bays Council.

Citizen's Advisory Committee

Section 4. Members shall be appointed by the Executive Council, which shall also appoint an interim Chair and Vice-Chair for a period not to exceed 180 days. Within 180 days of convening its first meeting, the CAC will elect a permanent Chair and Vice-Chair. The Chair will serve on the Bays Council. The CAC shall be composed of the broadest possible spectrum of affected user groups and other interested parties. The CAC will advise the

Management Committee on matters pertaining to possible effects that different issues to be addressed by the Bays Plan may have on various user groups, private citizens, and other interest individuals/organizations. The CAC will solicit public interest and support public participation in the Program, and educate user groups about the bay systems and the purposes and benefits of proposed programs. The CAC shall provide input on program goals and objectives, assist with public participation activities, comment on funding levels and research priorities, recommend strategies for generating solutions, and assist and advise the Bays Council in its duties.

Removal

Section 5. For committees other than the Board of Directors or the Executive Council, if a member of any committee fails to personally attend three (3) consecutive regular meetings without the written approval of the Chair or a Co-Chair, or if for any reason resigns his/her appointment, a replacement shall be appointed by the Executive Council. If a member of any committee leaves the agency or organization or interest group or jurisdiction he/she represented at the time of appointment, or if for any reason resigns his/her appointment, a new representative may be nominated by the agency or organization or interest group or jurisdiction he/she represented. The appointment shall then be approved by the Board of Directors or the Executive Council, as the case may be.

Public Attendance

Section 6. All regular Board of Directors, Executive Committee and Bays Council meetings are open to the public. Executive sessions of the Board of Directors closed to the public may be scheduled for the consideration of matters authorized under the Texas Open Meetings Act or other applicable state laws, and are subject to all applicable state laws concerning disclosure. To encourage open communication among the members of the Management Conference, members of other committees of the Program are encouraged to attend Board of Directors, Executive Council and Bays Council meetings.

Staff Participation

Section 7. Each member of a committee may bring staff members(s) or other participants to meetings. Such staff members or participants shall not vote, but may participate fully in meeting discussions following recognition by the Chair, with recognition solely within the discretion of the Chair.

Parliamentary Procedures

Section 8. All meetings of any committee shall utilize parliamentary procedures. To the extent that disputes arise, Robert's Rules of Order, Revised, shall be consulted.

Agenda Development/Approval

Section 9. Each meeting agenda shall be developed by the Executive Director in consultation with the respective committee and approved by the Chair and shall include all items timely proposed by a member of the Board of Directors or the Executive Council. Items for potential inclusion on the agenda may be proposed by members of the committee, the Chair, and the Executive Director. Items for inclusion on the agenda shall be submitted to the Executive Director at least five days in advance of the meeting. The agenda and supporting materials for committee action shall be distributed to committee members and appropriate staff at least five days prior to the schedule date of the meeting. Other program information and Program products may be distributed by the Executive Director with the agenda, by separate mail, or at meetings.

Minutes

Section 10. Minutes of all meetings of the Board of Directors and the Executive Council shall be taken by the Secretary with the help of the staff and shall be distributed to members prior to or with the next subsequent meeting agenda. Certified agenda minutes from executive sessions shall be taken and filed in a confidential file at the Program office in accordance with Texas law.

Open Meetings Act

Section 11. All meetings of the Board of Directors, Executive Council, Bays Council and Estuary Council will comply with the requirements of the Texas Open Meetings Act, Chapter 551 of the Texas Government Code, as amended. These by-laws allow voting by electronic means, when allowed by the Texas Open Meetings Act.

Open Records Act

Section 12. The Program shall comply with the Texas Open Records Act, as amended.

Article VI Officers

Section 1. The officers of the of the Program shall be the Chair and Vice-Chair chosen by the Executive Council, the Chair and Vice-Chair of the Bays Council chosen by the Bays Council and the

President, Secretary, Treasurer and such additional officers chosen by the Board of Directors.

Section 2. At the respective first meeting and at each respective annual meeting, the Board of Directors, the Executive Council and the Bays Council shall choose officers as above indicated.

Section 3. The Board of Directors may appoint such other officers and agents as it shall deem necessary, who shall hold their offices for such terms and shall exercise such power and perform such duties as shall be determined from time to time by the Board of Directors.

Section 4. No salaries shall be paid to officers and agents of the Program unless the Board of Directors determines reasonable compensation is necessary for services rendered to or for the Program, other than for services rendered as an officer or member of the Board of Directors, the Executive Council or the Bays Council.

Section 5. The officers of the Program shall hold office until their successors are chosen and qualify in their stead. Any officers elected or appointed by the Board of Directors, the Executive Council, or the Bays Council, may be removed at any time by the affirmative vote of 100% of the members present and voting at a duly called meeting called for that purpose. If the office of any officer becomes vacant for any reason, the vacancy shall be filled by the Board of Directors, the Executive Council or the Bays Council as the case may be.

Executive Director

Section 6. The Executive Director shall be the administrative officer of the Program; he or she shall be an ex-officio member of all standing committees, shall have a part in the active management of the business of the Program, and shall see that all orders and resolutions of the Board of Directors and the Executive Council are carried into effect.

Chair/Vice Chair

Section 7. The Chair shall preside at all meetings of the the Executive Council or the Estuary Council, and shall perform such other duties as the Executive Council shall prescribe. In the absence of the Chair, the Vice-Chair shall perform the duties of the Chair.

President

Section 8. The President of the Program is the chief executive officer of the Program. The President shall preside at

all meetings of the Board of Directors. In the absence of the President, the Secretary shall preside over meetings of the Board of Directors. The President may execute any deeds, mortgages, bonds, contracts, or other instruments that the Board authorizes to be executed. However, the President may not execute instruments on the Program's behalf if this power is expressly delegated to another officer or agent of the Program by the Board of Directors, the Executive Council, these By-Laws or statute. The President will perform other duties prescribed by the Board of Directors and all duties incident to the office of President. There shall be no restriction on the President serving as either the Chair or Vice-Chair of the Program, but the President shall not serve as the Secretary or Treasurer of the Program.

Chair of the Bays Council

Section 9. The Chair of the Bays Council shall preside at all meetings of the Bays Council, and shall perform such other duties as the Bays Council shall prescribe. In the absence of the Chair of the Bays Council, the Vice-Chair of the Bays Council shall perform the duties of the Chair.

Secretary

Section 10. The Secretary shall be a member of the Board of Directors, shall record all votes and the minutes of the proceedings in a book to be kept for that purpose, and may attest to the signature of the Executive Director, the President or Chair or Vice-Chair of the Executive Council, when requested.

Treasurer

Section 11. The Treasurer shall monitor the funds and securities and shall keep full and accurate records of receipts and disbursements in books belonging to the Program and shall deposit all monies and other valuable effects in the name and to the credit of the Program in such depositories as may be designated by the Board of Directors. Such powers to prepare documents and to deposit may be delegated to the staff or Port of Corpus Christi Authority where appropriate.

Article VII

Functions of Coastal Bend Bays & Estuaries Program

Purpose

Section 1. On behalf of, and only with the concurrence of, the Estuary Council, the Program will coordinate and develop plans and programs that will protect and enhance the local environment to facilitate achievement of the Goals of the Bays Plan, produce net environmental benefits, promote efficiency, and lower costs of implementation.

Duties

Section 2. The Program shall:

- a. Develop and administer research and projects to carry out the Bays Plan.
- b. Develop and administer a cost-sharing monitoring program. Special emphasis should be placed on developing a cost effective method of developing data that can serve the largest possible range of program needs. Where testing or monitoring activities are contractually undertaken by the Program for a State agency or a local government, the Program's employees and contractors will be working on behalf of the State agency or local government requesting the services.
- c. Develop and administer programs to protect, conserve, and restore the rich and diverse habitats in the program area, so local residents and visitors can appreciate the natural wonders of the region.
- d. Develop funding mechanisms to achieve the Goals of the Bays Plan.
- e. Receive and administer funds received from local governments, political subdivisions and State and Federal agencies, and grants from non-government entities and individuals.
- f. Develop recommendations on how local governments can exercise their powers, under the existing laws and constitution of the State of Texas and the United States, in a manner that promotes the enhancement of the local environment and the development of the local economy, within real world constraints on funding.
- g. Ensure its activities are consistent with the Texas Coastal Management Program.

Elements

Section 3. In addition to the elements normally involved in weighing environmental issues, while fulfilling its purpose and performing its duties, the Program shall consider as elements in the decision making process the following elements of concern to local governments and citizens:

- a. Assisting local governments in their efforts to improve the health, safety, and general welfare of the local residents and visitors and improve the regional transportation infrastructure; drainage systems; sanitary sewers and treatment systems, including on-site treatment systems; recreational facilities; growth and development of local industries and agriculture; standard of living of local residents; and local economies.
- b. The development of practical, cost-effective solutions to allowing continued residential, commercial, industrial, and agricultural development in the region, while

limiting the adverse impacts of such development on the local environment.

- c. The needs of the participating State agencies and local governments, including assisting them achieve their required monitoring and testing through contract assistance and administration.

Permitted Activities

Section 4. The Program may:

- a. When approved by the Executive Council, the Program may comment on proposed permits and consistency determinations. Comments on Federal consistency shall be consistent with the Bays Plan's Federal project review procedure and strategy, as provided in the Federal Project Review Report submitted by the CCBNEP.
- b. Coordinate its activities with the Coastal Coordination Council, and take actions to ensure that the Texas Coastal Management Program advances the implementation of the Bays Plan.

Article VIII Responsibilities of the Parties

Interpretation of Agreement and Bays Plan

Section 1. These by-laws are intended to make the Bays Plan a guide by which regulatory actions may be taken within the framework of existing rules and regulations. Thus, if a Goal of the Bays Plan is being furthered by an Action Plan, the local governments and State agencies will attempt to allow such suggested actions to occur so long as they are within the parameters of existing rules and regulations. By participation in this Program, the local governments, State agencies and political subdivisions of State of Texas do not subordinate or relinquish any of their regulatory authority or the power to act independent and apart from this Program.

Responsibilities of all Parties

Section 2. The intent of the participants is to assure effective and timely implementation of recommended actions and to adjust strategies as needed in the future to protect the Coastal Bend bays and estuaries. To that end, each of the participants hereby agrees to:

- a. Determine how they will contribute toward the attainment of the Goals, including their individual goals and time frames for achieving those goals;
- b. Where they deem appropriate, submit their conceptual action plans outlining the projects, initiatives, and strategies that it will undertake to achieve the Goals for the Coastal Bend bays and estuaries; and

- c. Each participant shall appoint an individual, and alternate, to serve as its liaison with the Program on tracking and coordination the Bays Plan implementation and submit their name(s) in writing to the Program.

Additional Responsibilities of Agencies

Section 3. Additional Responsibilities of the Agencies Where They Deem Appropriate:

- a. The State and Federal agencies that are participants herein (an "Agency" or "Agencies") endorse the goals of regulatory flexibility incorporated in the Bays Plan. The flexibility contemplated is sometimes referred to as regulatory reinvention and is intended to facilitate achievement of the Goals of the Bays Plan to produce a net environmental benefit. The regulatory flexibility contemplated herein is an expression of intention to cooperate and to seek innovative solutions for the implementation of the Bays Plan.
- b. The Agencies agree that, to the extent that they deem appropriate and at their sole discretion, they may extend as much flexibility as is legally permissible to further the implementation of the Bays Plan.
- c. The responsibilities and roles of the implementing partners reflected in the Bays Plan are adopted herein.
- d. Each Agency shall appoint a representative to any Project Action Committee created under the Bays Plan that may fall within the scope of the Agency's regulatory authority, for the purpose of assisting the Program with the implementation of the proposed project.
- e. The Agencies will consider any comments received from the Estuary Council during that Agency's regulatory review process that would facilitate the implementation of the Bays Plan.
- f. The provisions of this Section 3 are the expressions of the intention of the Agencies to facilitate actions contemplated by the Bays Plan, and in no manner shall it provide any right of action by any of the participants claiming that the provisions of this Section 3 have been breached.

Additional Responsibilities of Local Governments

Section 4. Additional Responsibilities of the Local Governments Where They Deem Appropriate:

- a. Include the goals contained in its applicable Action Plans (as they may be amended from time to time) into its comprehensive plan and needed actions in its capital improvement plans as such are further amended from time to time.
- b. Identify regulatory flexibility to be exercised by local governments in attaining Goals of the Bays Plan.

- c. The provisions of this Section 4 are the expressions of the intention of the local governments to facilitate actions contemplated by the Bays Plan, and in no manner shall it provide any right of action by any of the Parties claiming that the provisions of this Section 4 have been breached.

Responsibilities of the Program

Section 5. The Program shall:

- a. Serve as the coordinating body for the Action Plans and assist the Parties in gathering information necessary for the development of Action Plans and the subsequent implementation thereof;
- b. Report annually to the Executive Council on the status of the implementation of Action Plans;
- c. Prepare, every two (2) years, an environmental monitoring report on conditions and trends in the Program area;
- d. Assist the participants in locating grants and other funds to aid in implementation of the projects set forth in the individual Action Plans;
- e. Coordinate outreach programs to promote public participation and facilitate restoration activities that support the Goals of the Bays Plan;
- f. Coordinate the re-examination and updating of the Bays Plan every five (5) years;
- g. Promote cooperation and build consensus among the Parties;
- h. Track research projects;
- i. Develop proposed action plans to address goals not being addressed through other Action Plans; and
- j. Participate through the Coastal Coordination Council in the Texas Coastal Management Program (CMP) Federal consistency review process to ensure that relevant Federally funded or permitted projects are consistent with the Goals of the Bays Plan.

Specific action to accomplish such goals must be approved by the Executive Council.

Article IX Budgeting and Funding

Program Budget

Section 1. The Executive Council is responsible for preparing the proposed budgets of the Program, and shall annually prepare and submit the budget to the Board of Directors for approval.

Fiscal Year

Section 2. The fiscal year of the Program shall be chosen by the Board of Directors from time to time. The Program's first fiscal year will begin January 1, 1999, and end on December 31, 1999.

Current Funding

Section 3. The Program is currently funded by the EPA and the TNRCC, with some funding assistance from local governments. The TNRCC funding of the Program shall remain unchanged through August 31, 1999, at which time the participants will be responsible for the funding as set forth in the Interlocal Agreement. The EPA has agreed to continue its funding through September 30, 1999. It is anticipated that annual funding will continue from the EPA and the State of Texas. It is understood that during calendar year 1999 there will be overlaps in funding and efforts that will be provided in parallel between the CCBNEP and the Program.

Initial Budget

Section 4. For the period commencing on January 1, 1999, and continuing through December 31, 1999, the initial budget is attached to this agreement as Exhibit A. Each participant agrees to the annual payment as specified in Section 5, payable in equal monthly payments due on or before the 10th day of each month of each year. Accelerated annual or quarterly payments are requested.

Annual Funding

Section 5. In order to remain a participant, each participant shall make its annual cash payment, subject to appropriation by the participant, in the amount specified on the line for that participant on Exhibit B. Failure to make such payment shall automatically terminate such participant's rights and obligations under this Agreement, unless the Board of Directors votes to the contrary. The term "participants" shall mean local governments, State and Federal resource agencies and other diverse stakeholders who enter into a memorandum of understanding or contract with the Program to implement the Bays Plan.

Financial Obligations of Parties

Section 6. Each participant's financial obligations under this Agreement are limited to appropriations made by each participant in its sole discretion.

Budgets

Section 7.

- a. During the month of June, following preparation of a tentative budget, the Executive Council shall publish a notice of its intention to prepare a proposed budget.

Following an appropriate hearing, the Executive Council shall prepare a proposed budget during the month of June of each year for the Program covering its proposed operation and requirements for the next ensuing fiscal year.

- b. The Board of Directors shall give consideration to objections filed against the budget and in its discretion, may amend, modify or change the proposed budget. The Board of Directors, before the first day of each fiscal year, following appropriate notice and hearing, shall adopt the final budget for the Program, which shall thereupon be the operating and fiscal budget for the Program for the ensuing fiscal year.
- c. The Executive Council shall provide copies of the proposed budget to the participants, and such proposed budget shall be accompanied by the estimated annual contribution of each of the participants.

Contract for Support Services

Section 8. The Board of Directors may enter into a contract, or contracts, with the Port of Corpus Christi Authority, or other political subdivision, local government, individuals or private business, to serve as the Program's fiscal agent and to provide administrative support, including providing necessary office space and utilities.

Article X Miscellaneous

Default

Section 1. In the event any participant fails to make its annual cash payment pursuant to Article VIII, Section 5, such participant's rights shall be terminated, unless the Board of Directors votes to the contrary, and the Board of Directors shall remove such non-complying participant from the Program. Prior to any such vote by the Board of Directors, the non-complying participant shall be given a notice of its non-compliance and an opportunity to remedy the problem within a reasonable period or to have a public hearing before the Board of Directors, if there is a dispute whether a default exists. If any participant is discharged under this Section 1, then: a. all monies previously paid hereunder shall be conclusively deemed earned and not subject to return to such participant; b. any future funding responsibility of such participant shall terminate; and c. the agreement shall continue as to the remaining participants. Provided, however, any funds paid before termination but not expended shall only be used by the Program in accordance with the approved budget for which such contribution was made.

Notices

Section 2. Any and all notices required or permitted to be given hereunder shall be in writing, and shall be provided if either personally delivered to the participant, transmitted by electronic mail to the address listed, or sent by U.S. certified or registered mail, postage prepaid, return receipt requested, to the mailing address listed, all such notices being effective upon delivery to and receipt by the participants, unless the respective participant or participants notify all other participants in writing in accordance herewith of a change of address and/or representative at such address authorized to receive any and all such notices, in which case any and all such notices shall be delivered and/or mailed as aforesaid to said participant or participants at such new address with respect to such participant.

Withdrawal of a Party

Section 3. Notwithstanding anything contained in this Agreement to the contrary, any participant hereto shall have the right to withdraw as a participant by providing thirty (30) days prior written notice to the Executive Director and the Chair of the Executive Council as set forth in Article IX, Section 2, above. On the day following the end of such thirty (30) day period, the withdrawing participant shall no longer be considered a participant and its representatives will no longer be members of any council under these by-laws. If a participant withdraws under this Section 3: (a) all monies previously paid hereunder shall be conclusively deemed earned and not subject to return to such participant; (b) any future funding responsibility of such participant for the longer of the period of such thirty (30) days or until the next fiscal year shall be required; (c) this Program shall continue as to the remaining participants; and (d) the withdrawing participants is no longer entitled to the benefits of being a participant to this Program, except to the extent Article I, Section 9, paragraph b, as amended from time to time, provides all local governments with certain benefits.

Article XI General Provisions

Annual Statement

Section 1. The Executive Director shall present at each annual meeting and when called for by vote at any special meeting, a full and clear statement of the business and conditions of the Program.

Checks

Section 2. All checks or demands for money and notes of the Program shall be signed by such officer of officers or such other person or persons as the Board of Directors may from time to time designate and authorize.

Audit

Section 3. The books and records shall be audited annually by an independent certified public accountant chosen by the Board of Directors from time to time.

Article XII Indemnification

Section 1. Any person made a part to, or involved in, any civil, criminal or administrative action, suit or proceeding by reason of the fact that he, his testator or intestate, is or was a director, officer or employee of the Program, or of any Program which he, his testator or intestate, served as such at the request of the Program, shall be indemnified by the Program against reasonable expenses incurred by him or imposed on him in connection with, or resulting from, the defense of such action, suit or proceeding, or in connection with, or resulting from, any appeal therein, except with respect to matters as to which it was adjudged in such action, suit or proceeding that such officer, director or employee is liable to the Program or to such other corporation for negligence or misconduct in the performance of his duties. As used herein the term "expenses" shall include all obligations incurred by such person for the payment of money, including without limitation, attorney's fees, judgments, awards, fines, penalties and amounts paid in satisfaction of judgment or in settlement of any such action, suit or proceeding, except amounts paid to the Program or such other Program by him. A judgment or conviction (whether based on a plea of guilty or nolo contendere or its equivalent, or after trial) shall not of itself be deemed an adjudication that such Director, officer or employee is liable to the Program or such other corporation for negligence or misconduct in the performance of his duties. Determination of the right to such indemnification and the amount thereof may be made, at the option of the person to be indemnified, pursuant to procedure set forth from time to time in the by-laws or by any of the following procedures: (a) order of the court or administrative body or agency having jurisdiction of the action, suit or proceeding, (b) resolution adopted by 100% of a quorum of the Board of Directors of the Program without counting in such majority or quorum any directors who have incurred expenses in connection with such action, suit or proceeding, (c) if there is no quorum of directors who have not incurred expenses in connection with such action, suit or proceeding, then by resolution adopted by a majority of directors who have not incurred such expenses, (d) resolution adopted by 100% of a quorum of the directors entitled to vote at any meeting, or (e) order of any court having jurisdiction over the Program. Any such determination that a payment by way of indemnity should be made shall be binding upon the Program. Such right of indemnification shall not be exclusive of any other right which such directors, officers and employees of the Program, and the other persons above mentioned, may have or hereafter acquire and,

without limiting the generality of such statement, they shall be entitled to their respective rights of indemnification under any by-law, agreement, vote of Board of Directors, provision of law or otherwise, as well as their rights under this article. The provisions of this article shall apply to any member of any committee appointed by the Board of Directors, as fully as though such person had been a director, officer or employee of the Program.

Section 2. To the extent permitted by the law of the State of Texas and by federal regulation, neither the Board of Directors nor any of its members individually, shall be liable for the negligent acts or omissions of any employee, agent or representative selected with reasonable care, nor for anything the Board may do or refrain from doing in good faith, including the following: errors in judgment, acts done or committed on advise of counsel, or mistakes of fact or law.

Article XIII Conflicts of Interest

Section 1. No employee, officer, agent, member of the Board of Directors, the Executive Council, the Bays Council, or other committee (or staff representative or proxy) shall participate in any decision or vote which would constitute a conflict of interest under federal or state law. Any potential conflicts of interest shall be clearly stated by the member (or staff representative or proxy) prior to any discussion on the agenda item with which the member (or staff representative or proxy) is in conflict. Any member (or staff representative or proxy) in potential conflict of interest shall abstain from discussing or voting on the agenda item. However, any such member (or staff representative or proxy) may supply information at the request of the Chair during discussion on the issue. No member shall: (1) case a vote on the provision of services by that person (or any organization which that person directly represents), or (2) vote on any matter which would provide direct financial benefit to that person, or (3) participate in the selection, award or administration of a subgrant, procurement or contract supported by public funds subject to this section where, to the person's knowledge, a conflict of interest, real or apparent, would be involved. Such a conflict would arise when any of the following has a direct financial or other substantive interest in any organization which may be considered for award: (a) the officer, employee, or agent, (b) any member of his or her immediate family, (c) his or her partner, or (d) a person or organization which employs, or is about to employ, any of the above.

Section 2. In the event of any such conflict, such person shall disclose the material facts as to his or her interest or benefit from the proposed action, and in the event the measure requires approval by the Board of Directors, Executive Council, or

Bay Council, the proposed action may be approved upon the affirmative vote of the requisite majority of the disinterested members, even though the disinterested members be less than a quorum. Such interested members may be counted in determining the presence of a quorum at the meeting at which such issue is considered. For the purposes of this section "direct financial benefit" does not include any situation in which a member (or any organization which that member directly represents) may from time to time employ persons participating in a program administered by an independent contractor not controlled by or related to the member.

Section 3. No member shall: (1) solicit or accept gratuities, favors, or anything of monetary value from contractors or supplier, potential contractors or suppliers, parties to sub-agreements, or (2) solicit, accept or agree to accept any benefits for exercising official authority and performing their duties.

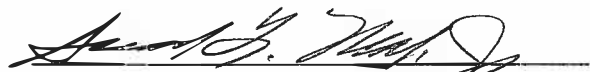
Section 4. For the purpose of this provision, the term "immediate family" shall be defined in Chapter 171 of the Texas Local Government Code to include persons related in the first degree by either affinity or consanguinity.

Section 5. No employee, officer or agent of the Program shall participate in selection, or in the award of administration of a subgrant or subcontract supported by public funds if a conflict of interest, real or apparent, would be involved. Such a conflict arises when the employee, officer or agent, any member of his immediate family, his or her partner, or an organization which employs, or is about to employ any of the above, has financial or other interest in the subcontractor selected. The officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential contractors, or parties to subcontracts. To the extent permitted by State or local law or regulations, such standards of conduct will provide for penalties, sanctions, or other disciplinary actions for violations of such standards by the Program's officers, employees, or agents, or by contractors or their agents. See UGMS, Part III, Subpart C, Sec. ____ .36 (3).

Article XIV Amendments

Section 1. These by-laws and the articles of incorporation may be altered, amended or repealed at any regular meeting or any special meeting of the Board of Directors at which a quorum is present or represented by proxy, provided notice of the proposed alteration, amendment or repeal is contained in the notice of such special meeting, by the affirmative vote of 100% of the members of the Board of Directors present in person, or by proxy, and voting for such motion entitled to vote at such meeting.

Executed this the _____ day of September, 1999.



Samuel L. Neal, Jr., Secretary