

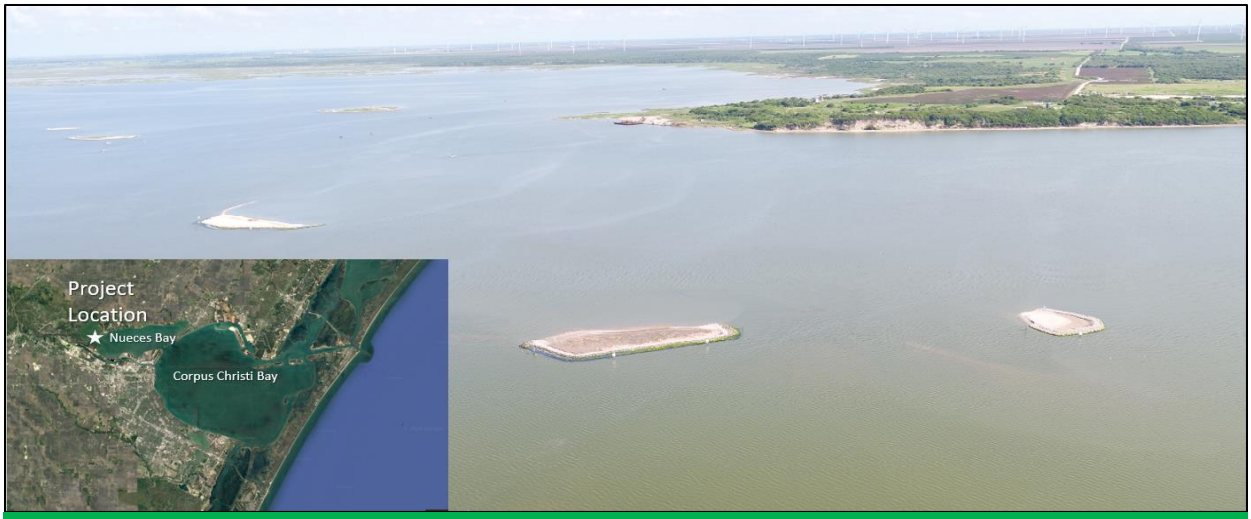



Coastal Erosion Planning & Response Act

A REPORT TO THE 87TH LEGISLATURE

Texas General Land Office

George P. Bush, Commissioner



Nueces Bay Rookery Island Restoration

Cover Imagery, clockwise from top: Revetment at Indian Point; seabirds on water in Rockport, coastal crowd at Port Aransas, snow covers the beaches of Galveston Island (Imagery courtesy of Galveston Park Board), wading birds in a marsh (imagery courtesy of The Nature Conservancy), dune scarps in Brazoria County.

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BEG
The University of Texas Bureau of Economic Geology

BMMP
Beach Monitoring and Maintenance Plan

BUDM
Beneficial Use of Dredged Materials

CBBEP
Coastal Bend Bays and Estuaries Program

CEPRA
Coastal Erosion and Planning Response Act

CCAC
Coastal Coordination and Advisory Committee

CMP
Coastal Management Program

ERP
Erosion Response Plan

FEMA
Federal Emergency Management Agency

GBF
Galveston Bay Foundation

GPB
Galveston Park Board

GOMESA
Gulf of Mexico Energy Security Act

GIWW
Gulf Intracoastal Waterway

GLO
General Land Office

NAWCA
North American Wetlands Conservation Act

NFWF
National Fish and Wildlife Foundation

NGO
Non-Governmental Organization

NRDA
Natural Resources Damage Assessment

NWR
National Wildlife Refuge

OBA
Texas Open Beaches Act

PCCA
Port of Corpus Christi Authority

RESTORE
Resources and Ecosystems Sustainability, Tourism Opportunities, and Revived Economies of the Gulf States Act of 2012

SPI
South Padre Island

TPWD
Texas Parks and Wildlife Department

TNC
The Nature Conservancy

USACE
United States Army Corps of Engineers

USFWS
United States Fish and Wildlife Service

INTRODUCTION

Texas has 367 miles of gulf-facing shoreline and approximately 3,300 miles of bay shoreline. It also has some of the highest erosion rates in the country with some locations losing more than 62 feet per year. Coastwide, there is an average of four feet of erosion each year. Texas Natural Resources Code §33.601 defines coastal erosion as:

"The loss of land, marshes, wetlands, beaches, or other coastal features within the coastal zone because of the actions of wind, waves, tides, storm surges, subsidence, or other forces."

The distribution and extent of erosion along the Texas coast is illustrated in Figure 1. Eighty percent of the shoreline is classified as critically eroding where the rate of shoreline retreat is greater than two feet per year. The highest erosion rates occur along the upper Texas coast from Matagorda County northward, and on the lower Texas coast along South Padre Island in Willacy and Cameron counties (Table 1). On average, 235 acres, or the equivalent of 178 football fields, is lost each year within the state's bays, estuaries, and navigation channels.

The General Land Office (GLO) Rules for Management of the Beach/Dune System (31 TAC §15.2 [32]) define an eroding area as a portion of the shoreline that is experiencing a historical erosion rate of greater than two feet per year based on data published by the University of Texas Bureau of Economic Geology (BEG) (Jeffrey Paine, Shoreline Movement Along the Texas Gulf Coast, 1930s to 2019). Section 33.601(4) of the Natural Resources Code defines a coastal erosion area as:

"A coastal area that is experiencing an historical erosion rate, according to the most recently published data of the BEG."

The Commissioner finds coastal erosion to be a threat to:

- ***Public health, safety or welfare;***
- ***Public beach use or access;***
- ***General recreation;***
- ***Traffic safety;***
- ***Public property or infrastructure;***
- ***Private, commercial, and residential property;***
- ***Fish or wildlife habitat; and***
- ***Any area of regional or national importance.***

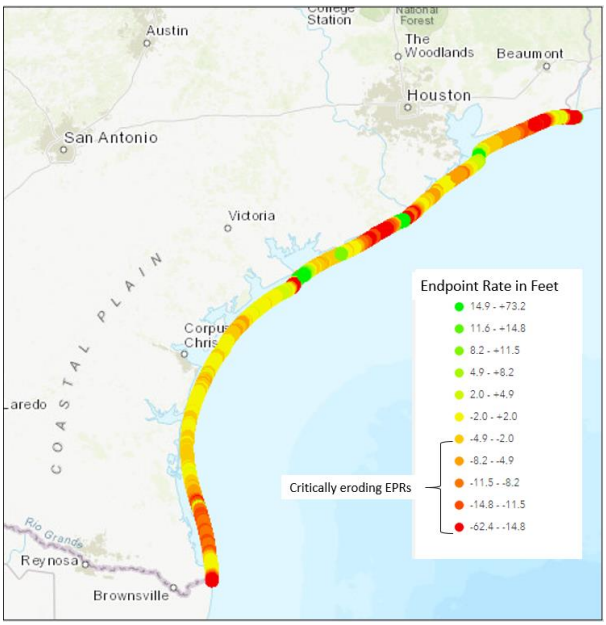

Figure 1 1950-2019 BEG Shoreline Change Rate (Jeffrey Paine, BEG Coastal Studies, 2021)

Coastal erosion contributes to property loss, decreases property value, and negatively impacts tourism opportunities in local communities. It also results in the loss of beaches, dunes, and wetlands; critical habitats needed to protect coastal communities from tropical storm and hurricane impacts. Coastal erosion can also be detrimental to coastal resources such as the Gulf Intracoastal Waterway (GIWW), ports and ship channels, petrochemical facilities, road infrastructure, and other types of commercial businesses. (Texas General Land Office, 2019).

To combat coastal erosion, secure natural resource areas and protect the economies of coastal communities, the Coastal Erosion Planning and Response Act (CEPRA) was enacted on September 1, 1999, during the 76th Legislative Session. The GLO's Coastal Resources Division, per TNRC 33.606, administers the CEPRA Program with the goal of reducing impacts to valuable coastal resources caused by coastal erosion. The program is also tasked with implementing coastal erosion avoidance, remediation, and planning and monitors the rate of shoreline movement in partnership with the BEG.

This report will give an overview of recently completed CEPRA projects, highlight current Cycle 11 projects, examine eroding areas of concern, discuss funding measures, and provide a calculated economic and natural resource benefit analysis that showcases how the CEPRA Program provides value to the state's economy. These reporting requirements are in accordance with Texas Natural Resources Code §33.608.

Miles and Percent of Critically Eroding Shoreline on the Texas Coast			
Region	Total Coastal Miles	Total Eroding Miles	Percent Eroding
Sabine Pass to San Luis Pass	88	71	81%
San Luis Pass to Pass Cavallo	89	73	82%
Pass Cavallo to Packery Channel	72	49	68%
Packery Channel to Mouth of Rio Grande	118	100	85%
Total	367	294	80%

Table 1 Miles of Critically Eroding Gulf-facing Shoreline

The CEPRA Program administers a wide variety of coastal projects including studies to evaluate erosion response methods; engineering and design of beach nourishment and dune restoration, habitat restoration of coastal wetlands and benthic habitats, shoreline protection using hard and soft techniques; scientific studies to collect data in support of the program; structure removal assistance and debris removal; and other projects that promote sound coastal stewardship.

Since CEPRA's inception, the Program has administered 11 CEPRA funding cycles. Each cycle consists of a two-year period that coincides with the Legislative biennium. Funding appropriated within the biennium must be encumbered and spent on projects within that biennium unless funding for a particular project is given "carryover" authority by the Legislature. Historically, "carryover" authority is given to projects leading to or involving construction that is not expected to be complete within that biennium.

The CEPRA Program partners with other state, federal, and local governments, as well as non-profit organizations to develop and fund coastal erosion projects. According to Texas Natural Resources Code, §33.603(e), beach nourishment projects require at least 25 percent match funding while other coastal erosion response studies or projects require at least 40 percent match.

VALUE OF THE CEPRA PROGRAM

Texas is the nation's top state for waterborne commerce with Texas ports representing over 82.8 billion in economic value each year (TCS, 2019). The CEPRA Program works with local and state governments, navigation districts, NGOs, and federal authorities to construct protective structures meant to ensure this level of commerce continues.

The value of the CEPRA Program is evident in every successful project implemented with the projects clearly illustrating that coastal restoration works. Figure 2 shows long-term versus short-term shoreline change rates along one of Texas' busiest barrier islands, Galveston Island. The maps show a dramatic decrease in erosion rates since the CEPRA Program began implementing erosion control and prevention in 2000. Areas once devastated by erosion now benefit from beach nourishment thanks to partnerships between local entities and the United States Army Corps of Engineers (USACE). On the bayside, CEPRA projects have restored a multitude of wetlands and marsh habitat, crucial for the island's fisheries and tourism industries. CEPRA has also partnered with local entities to conduct studies aimed at increasing beach, dune, and wetland resiliency to safeguard the island's ecology and economy for future generations to come.

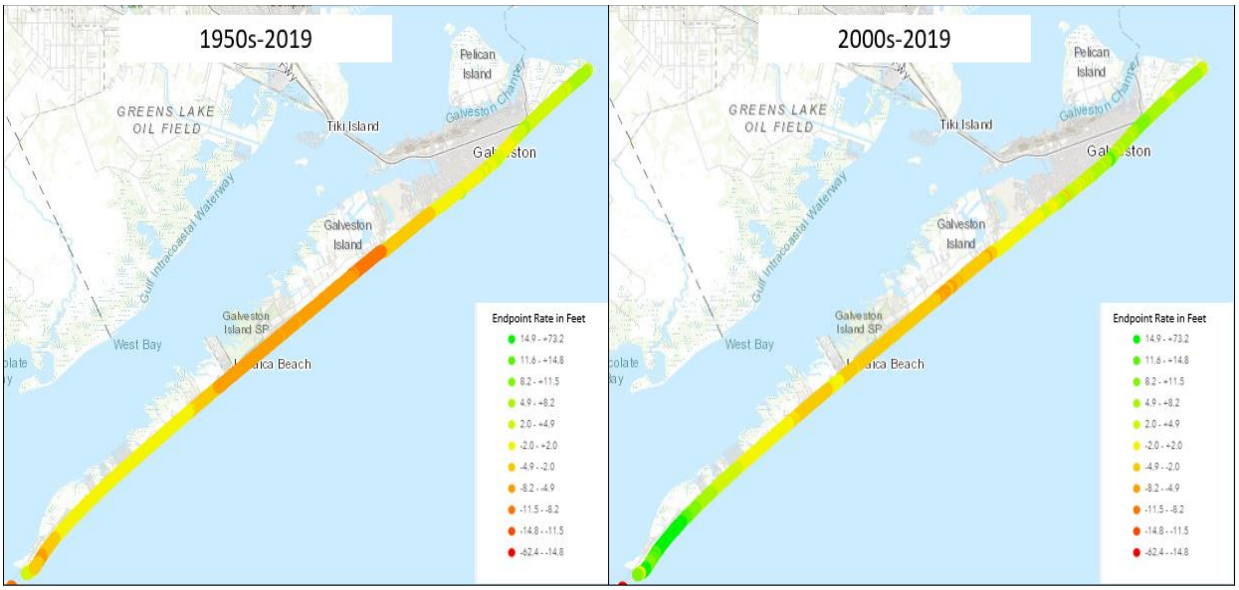

Figure 2. Galveston Island Texas Shoreline Change Rates (Jeffrey Paine, BEG Coastal Studies, 2021)

This project is a great example of how crucial it is for the CEPRA Program to maintain adequate funding and support so coastal restoration and erosion prevention projects can continue to help maintain the viability of Texas' coastal economy and ecosystems.

FINANCIAL STATUS OF THE CEPRA ACCOUNT

For the 87th Legislature, $12,846,668 in General Revenue will be utilized to implement CEPRA Cycle 11 projects and studies. GLO's General Revenue appropriation was reduced by $1,425,272 due to implementation of agency budget reductions required in HB 2, 87th Legislative Regular Session. GLO utilized federal FEMA funds to offset the loss in CEPRA General Revenue. Cycle 11 covers the period from September 1, 2019 to August 31, 2021. Thirty-one Cycle 11 biennium projects will be described in detail in upcoming report sections. The CEPRA appropriated funds were also leveraged against $113,080,887 in funding which includes (Table 2):

- $33,580,957 in local partner match funds.
- $716,810 in Economic Stabilization Funds (SB 500, 86th Legislative Regular Session)
- $36,456,680 in GOMESA funds.
- $9,324,934 in FEMA funds.
- $3,560,000 in NFWF funds.
- $5,340,000 in USFWS funds.
- $4,515,000. in RESTORE funds.
- $1,087,938 in BOEM funds.
- $832,500 in NAWCA funds.
- $17,245,000 in USACE in-kind.
- $392,844 in PCCA funds.
- $28,224 in CCA funds.

Funding Cycle	Projects Funded	CEPRA Funds	CEPRA Match Funding	Total Budget for Cycle
6 (FY10-11)	28	$15,907,639	$68,914,538	$84,822,177
7 (FY12-13)	26	$17,394,456	$41,972,295	$59,366,751
8 (FY14-15)	21	$17,038,734	$27,349,977	$44,388,711
9 (FY16-17)	18	$14,920,538	$11,462,267	$26,382,805
10 (FY18-19)	32	$14,271,940	$133,115,582	$147,387,522
11 (FY20-21)	31	$12,846,668	$113,080,887	$125,927,555

Table 2. Summary of CEPRA Funding Allocations by Cycle

Note: Cycle 11 CEPRA Match funds include funds from partnerships between the GLO and various entities representing restoration funding sources.

FINANCIAL ASSESSMENT OF NEEDS

Ample funding is imperative to the continued success of the CEPRA Program. Each biennium, the CEPRA Program receives numerous new funding applications however, funding limitations result in many projects remaining unfunded. These projects are categorized as "alternates" and may receive funding if an approved project is canceled. The entire need that was unmet for the Cycle 11 biennium totaled $221,675.

While the amount of designated alternate projects may seem underwhelming for Cycle 11, in most cycles this amount ranges in the millions and will certainly increase exponentially as coastal communities begin to undertake projects identified in the Texas Coastal Master Resiliency Plan (Master Plan). This plan identified an enormous need to restore marshes, wetlands, beaches, and barrier islands back to historic levels and expand historic footprints to increase shoreline resiliency and prevent future impacts from subsidence and sea level rise. The GLO has also partnered with the USACE to begin the Coastal Texas Study which centers on ensuring "strategic military ports", intracoastal waterways, recreational activities, and tourism in the state are kept safe from coastal erosion, relative sea level rise, coastal storm surge, habitat loss and water quality degradation (CTS, 2019). This study lays out massive resiliency footprints to combat the threats to our coastal communities and will require state, federal, and community funds and cooperation for success. The following sections will give a brief outline of avenues the CEPRA Program is evaluating to help fund these future restoration projects.

Gulf of Mexico Security Act (GOMESA) Funds

The 25-40% CEPRA match requirement is often a difficult stipulation for the coastal communities to meet. The CEPRA Program recognizes the importance of community involvement and the need to ensure all coastal communities can take part in restoration efforts that enhance local resiliency. To facilitate this, the CEPRA rules and guidance were amended to allow state GOMESA funds to be used as CEPRA projects partner match during construction. Use of GOMESA funding is prioritized to Tier 1 Master Plan projects.

GOMESA funds come from leasing revenues shared between the Gulf-producing states depending on the sum of the state's inverse distances from all applicable leased tracts. GOMESA Phase II will cap fund sharing between all Gulf-producing states at $500 million per fiscal year through year 2055, with 50% going directly towards all states and their political subdivisions and a dedicated 10% of the total for that fiscal year as a minimum will be received by every state. This creates a great opportunity for the states and their political subdivisions to implement much needed restoration.

GOMESA funds are dispersed to the GLO yearly and are allocated through the Coastal Management Program (CMP), CEPRA and other restoration programs. During this biennium, the CEPRA Program received $30,103,756.29 in GOMESA funding in 2019 for project implementation in 2020 and $49,547,644.72 for project implementation in 2021. The CEPRA Program is currently overseeing thirty-one Tier 1 projects. During the Cycle 11 biennium, CEPRA funded an additional eleven Tier 1 projects and four projects categorized under the "Coastwide Project" recommendations.

Hotel Occupancy Tax Bill

The 86th Legislature passed legislation that helps provide the CEPRA Program with dedicated funding. The law directs 2% of coastal counties state hotel occupancy tax revenue to be contributed to the CEPRA Program account. These funds will begin filtering into the CEPRA Program during the 2023 biennium. Acquisition of this dedicated funding source was a monumental moment for CEPRA as it represents a "permanent" CEPRA funding source that can be consistently relied upon to fund future projects.

COASTAL IMPACTS DURING BIENNIUM

The last biennium was memorable with a robust and devastating tropical storm season, a historic winter storm in February of 2021, and most notably, a global pandemic that created unprecedented obstacles for the coastal tourism industry. The coastwide effects of these events will undoubtedly result in an increase in CEPRA Cycle 12 applications and further highlights the importance of the CEPRA Program in maintaining communication with local coastal planners and communities.

CEPRA projects aid in protection against tidal fluctuations and tropical storm surge. The 2020 tropical storm season saw a consistent string of storms lingering in the Gulf of Mexico; many of which had devastating impacts to the Texas coast. Hurricane Hanna made landfall as a Category 1 in Kenedy County on July 25, 2020. Hurricane Laura made landfall as a Category 4 in Cameron Parish Louisiana on August 27, 2020. Tropical Storm Beta made landfall near the Matagorda peninsula on September 1, 2020, and Hurricane Delta made landfall as a Category 2 in Cameron Parish Louisiana on October 9, 2020. The following coastal counties and cities reflected on the impacts:

Galveston Island

Hurricanes and tropical storms did not make direct landfall on Galveston Island, but the frequency and persistence of their associated storm surge resulted in considerable beach and dune erosion (Figure 3). Hurricane Laura and Tropical Storm Beta resulted in the most extensive damage.

Figure 3. Dellanera Beach following Tropical Storm Beta; Imagery Courtesy of Galveston Park Board.

Brazoria County

During Hurricane Laura, Brazoria County suffered significant dune loss. Tropical Storm Beta's pronounced high tides did more damage to the shoreline than any other event and exposed old septic systems and pilings (Figure 4). As a result, stretches of beach are impassable and there is no drivable beach access from Beach Access 5 east to Treasure Island (McKenna, 2020).

Figure 4. Quintana Beach's dunes are severely scarped following Tropical Storm Beta

Matagorda County

Hurricane Hanna caused debris to stack up on FM 457. Hurricane Laura then moved the debris and scoured the landward side of the revetment. Tropical Storm Beta created 6-8 ft scour along some sections of shoreline. Rocks were moved into the roadway blocking transportation routes and dune sand was moved to areas directly adjacent to the GIWW (McKenna, 2020).

City of Port Aransas

Hurricane Hanna scoured the Gulf beaches. High tides associated with the 2020 storms caused beach erosion and increased erosion of the cuts from Hurricane Harvey in the Nature Preserve (McKenna, 2020).

City of Corpus Christi

Hurricane Hanna resulted in more damage to the area bay and Gulf beaches than Hurricane Harvey. Hanna initiated erosion of the Gulf beaches that continued through the 2020 storm season (McKenna, 2020).

City of South Padre Island

Impacts from the 2020 tropical storm season were increasingly worse with each storm; Tropical Storm Beta appeared to be the most damaging due to several days of high water (McKenna, 2020).

Cameron County

Tropical Storm Beta produced very high tides and did the most damage to the beaches. Water covered the beach across Park Road 100 and caused erosion of dunes (7-8 ft scarps) (McKenna, 2020).

Winter Storm Shirley

Winter Storm Shirley (February 13-17, 2021) was a major winter and ice storm that had widespread impacts across the United States, Northern Mexico, and parts of Canada. Texas endured record low temperatures that crippled local infrastructure and produced lasting snow, even along the Texas coast (Figure 5).

Figure 5. Snow blankets Galveston Island in February 2021.

The storm was devastating to local fauna and flora. The Texas Parks and Wildlife Department (TPWD) estimates a minimum of 3.8 million fish were killed along the Texas coast during the event (Texas Parks and Wildlife Department, 2021). The kill consisted of at least 61 species. Additionally, the National Park Service at Padre Island National Seashore and the Texas Coordinator for the Sea Turtle Stranding and Salvage Network reported 13,082 cold stunned turtles were recorded (per comms. 2021). Large disturbances to the natural environment make CEPRA projects, which restore beaches and marshes, even more important to the natural recovery of the ecosystems and flora and fauna that rely on the delicate systems. One of the highest returns for CEPRA funds is the ecological restoration provided by restoring habitat.

COVID-19 Pandemic

By April 2020, the COVID-19 virus was making its mark on communities worldwide prompting public areas, restaurants, and places of work to close. The realization that people could still "self-isolate" while being outdoors led to the soft opening of many state parks and public spaces like beaches. Coastal managers were met with many obstacles when trying to encourage safe gathering practices. Many coastal communities operate with funds established by local hotel taxes; without the use of the hotels, the funds for operation were greatly diminished. Local coastal communities also had to carefully manage crowd-gathering events and due to reduced funding, had to prioritize management of these activities over spending time on the implementation of local CEPRA projects.

The decrease in tourism during the COVID-19 pandemic might have direct potential impacts on the CEPRA Program particularly the upcoming CEPRA Cycle 12 biennium.

ECONOMIC AND NATURAL RESOURCE BENEFITS OF THE CEPRA PROGRAM

Texas' coastal assets, including infrastructure, industry, public and private property, beaches, dunes, wetlands, marshes, and parks, provide significant economic value. Erosion caused by natural and man-made activities such as storms or cuts in barrier islands damage these assets. The Texas Legislature requires the GLO to report the economic and natural resource benefits derived from CEPRA construction projects every biennium. The GLO contracted Taylor Engineering, Inc. to perform the benefit-cost (B/C) analyses for four Cycle 11 construction projects. The study reported

that the state of Texas received $8.77 in economic and financial benefits for every dollar the state invested in these projects. While most of the analyzed projects have CEPRA funding histories that precede Cycle 11, the study considers the project components (cost and benefits) that occurred in Cycle 11 (Figure 6):

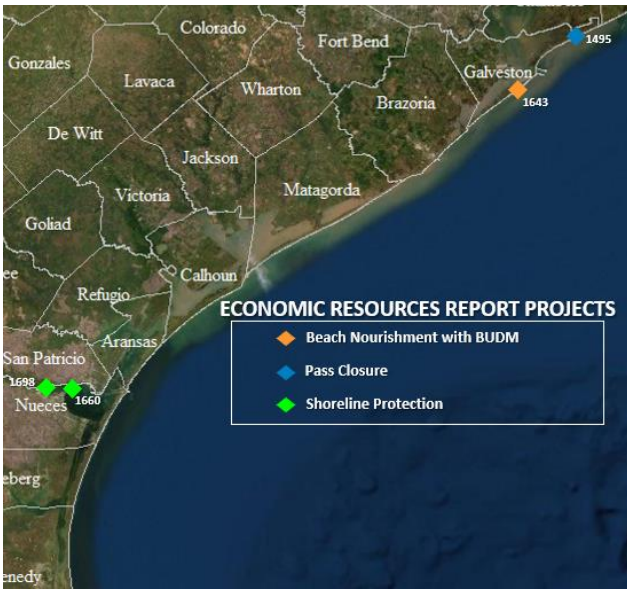

Figure 6. Economic Study Report Project Locations

Since the last iteration of the Economic Resources Cost-Benefit Report, only four CEPRA construction-based projects were completed. Hurricane Harvey resulted in a two-year delay in the release of CEPRA Cycle 10 funds which would normally be presented in the Cycle 11 report. The four projects evaluated are:

- **#1495 Rollover Pass Closure** (Closure of a Man-Made Pass; Galveston County, Bolivar Island, TX)
- **#1643 Babe's Beach Renourishment** (BUDM led by the USACE; Galveston County, Galveston Island, TX)
- **#1660 Indian Point Shoreline Protection Project** (Shoreline protection led by the GLO; Nueces County, Portland, TX)
- **#1698 Nueces Bay Rookery Island Restoration** (Shoreline Protection and Habitat Restoration; Nueces County, White's Point, TX

1495 Rollover Pass Closure
Internal Project
Phase: Post Construction; on-going monitoring
Budget: $12,287,407.67
Location: Galveston County
CEPRA Share: $4,427,839.03
GOMESA Share: $302,596.65
Project Description: The project completed fill of the man-made Rollover Pass with approximately 300,000 cy of material from an upland sand source. Substantial completion was achieved in May of 2020.


Figure 7. Rollover Pass Closure Project Location

1643 Babe's Beach Nourishment with Beneficial use of Dredge Material
Partner(s): Galveston Park Board and USACE
Phase: Completed
Budget: $24,500,000.00
Location: Galveston County
CEPRA Share: $7,750,000.00
GOMESA Share: $7,750,000.00
Project Description: The project used current USACE channel maintenance for the placement of BUDM onto Babe's Beach. The project is generally managed by the USACE with project partners (GLO and GPB) covering the incremental cost to place the BUDM onshore.

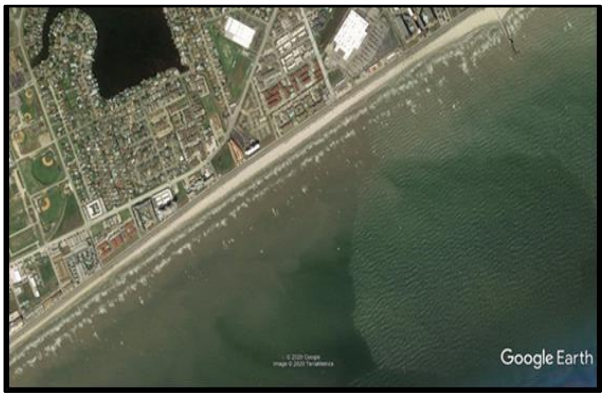

Figure 8. Babe's Beach Project Location

1660 Indian Point East Shoreline Protection Phase 2
Partner(s): NRDA, CBBEP, City of Portland, PCCA
Phase: Monitoring
Budget: $2,194,545.00
Location: San Patricio County
CEPRA Share: $5,000.00
GOMESA Share: $0.00
Engineer: HDR Engineering, Inc.
Project Description: The project completed additional shoreline protection in December of 2019 by installing 1,800 linear feet of breakwaters. The breakwaters protect coastal habitats from wave action, saltwater intrusion, and continued shoreline erosion, preserving 50 acres of critical seagrass, coastal marsh, lagoons, and associated uplands of Indian Point Park and the Sunset Lake Bird Sanctuary.

Figure 9. Indian Point East Shoreline Project Location

1698 Nueces Bay Rookery Island Shoreline Protection
Partner(s): CBBEP, PCCA, NFWF
Phase: Post Construction
Budget: $4,645,553.75
Location: Nueces County
CEPRA Share: $500,000.00
GOMESA Share: $773,110.00
Engineer: Scheibe Consulting, LLC
Project Description: In 2002 CBBEP worked in partnership with the GLO to install geotextile tubes to protect the Nueces Bay Rookery Islands. Upon inspection in 2015 it was observed that most of the geotextile tubes had failed. The project constructed additional erosion protection reduction structures around the islands and placed fill to restore habitat. The islands provide much needed nesting and loafing habitat for colonial waterbirds in addition to protecting nearby critical foraging areas.

Figure 10. Nueces Bay Rookery Island Shoreline Protection Project Location

The project benefits analyses classified and estimated economic and financial benefits associated with habitat, recreation, storm surge protections, primary production, gas sequestration, pollution abatement, aesthetics, out-of-state visitor spending, and non-Texas project funding. The stream of economic benefits over time varied from project to project depending on a project's durability. The period of analysis for the various projects began in 2019 and extended over a 20-year benefit period (2020-2039).

This study adopts a Texas accounting perspective. Funding from outside Texas and spending by visitors from outside the state represent financial benefits to the state. This perspective views project contributions normally considered a cost when viewed from a national or world perspective as a financial benefit. Costs funded by non-Texas dollars represent a financial benefit because money flows into the Texas economy. As appropriate, the findings reported here show this adjustment to reflect the Texas accounting perspective for the estimates of benefits and costs. This report serves to estimate the cost-effectiveness of the four projects listed above via benefit-cost ratios and net benefits on an individual project basis, and as a group, or "portfolio."

Table 3 presents a summary of the assessed projects. The direct and positive net benefits (benefit-to-cost ratios greater than one) from the four evaluated projects combined indicate that these projects yield high returns on investment for the state of Texas. Preserving Texas' coastal assets proves a worthy public investment strategy for Texas taxpayers and citizens

CEPRA Project Number / Name	County	Project Year[1]	Beginning of 2019		Benefit-to-Cost (B/C) Ratio[4]
			Discounted Cost[2] ($)	Discounted Benefits[3] ($)	
#1495 Rollover Pass Closure	Galveston	2019	$8,500,000	$16,379,936	1.9
#1643 Babe's Beach Nourishment with Beneficial use of Dredge Material	Galveston	2019	$1,872,069	$81,843,356	43.7
#1660 Indian Point East Shoreline Phase 2	Nueces/San Patricio	2019	$19,238	$1,995,076	103.7
#1698 Nueces Bay Rookery Island Shoreline Protection	Nueces	2019	$1,511,982	$4,187,916	2.8
Total			$11,903,289	$104,406,284	**8.8**

Table 3. CEPRA Cycles 8-11 Projects, Costs, and Benefits

Notes: [1]Project Year represents the year benefits begin to accrue and may not represent the actual construction year.
[2]Texas portion only; dollar values reflect present worth equivalents at the beginning of Project Year.
[3]Dollar values reflect present worth equivalents at the beginning of 2019 with a 2.45% discount rate
[4]Total B/C Ratio represents the Total Discounted Benefits divided by the Total Discounted Cost of all 4 projects combined (i.e., 227,818,318/20,624,356 = 11).

The leveraging of out-of-state and federal funding plays a substantial role in the economic benefit calculations of the projects. The fund created by the settlement of federal criminal charges resulting from the Deep Horizon Oil Spill was a contributor to the Indian Point Restoration Project. GOMESA funds supported the Babe's Beach and Nueces Bay Rookery Islands projects. Only Rollover Pass was funded entirely by the State of Texas with a small amount of GOMESA.

A discount rate of 2.45% was used in the benefit cost calculations to convert benefits and costs occurring at different points in time to comparable equivalent values ("discounted present worth") for comparison at the beginning of each project's period of analysis. In Table 4, the discounted present worth of benefits and costs is also converted to equivalent values at a common point in time, 2019. This makes the benefits and costs of the different projects comparable and additive, allowing them to be viewed as a portfolio. The discount rate chosen for this study represents an average of 20-year AAA corporate bond rates existing at the time of study initiation.

CEPRA CYCLE 11 PROJECTS

This section contains CEPRA Cycle 11 projects (Figure 11). Cycle 11 of the CEPRA Program approved thirty-one GLO- or Qualified Project Partner-led projects focused on beach nourishment; beach nourishment with Beneficial Use of Dredged Material (BUDM); Marsh and/or Habitat Restoration; Shoreline Protection; and Studies. **Denotes Hurricane Repair or Federal Emergency Management Agency (FEMA) Project.

Beach Nourishment with BUDM

Through partnerships with local communities and the USACE, the GLO continuously seeks opportunities to utilize material dredged from USACE-managed navigation channels to beneficially use in beach and dune nourishment or marsh restoration. BMMP maintained beaches or GLO-partnered structures qualify for repair when damaged during a tropical storm. FEMA reimburses repair costs up to 75% to 90% leaving the GLO and project partners to cover the remaining non-federal cost-share. **Denotes projects selected for Cycle 11 to repair damages due to tropical storm damage.

Beach Nourishment (BN)

Through USACE-permitted borrow sources, the GLO oversees small- and large-scale beach nourishment projects that facilitate beach and dune habitat restoration on Gulf and Bay beaches. GLO-engineered beaches are maintained through a Beach Monitoring and Maintenance Plan (BMMP) which actively ensures beaches maintain their engineered fill template above the 50% threshold to ensure reimbursement eligibility by FEMA in the event damage by tropical storm.

Shoreline Protection and Habitat Restoration

Methods of shoreline protection range from hard structures like revetments, riprap, breakwaters, and bulkheads to green softer structures like living shorelines and shoreline planting. Many projects involve some form of marsh restoration behind the protective structure. Habitat Restoration projects may compliment shoreline protection and involve restoring oyster reefs, rookery islands, marshes, and hydro-connectivity of ecosystems. **Denotes projects selected to repair damage from tropical storms.

Studies or Demonstration Projects

The GLO funds various studies which evaluate the status of erosion on the coast and ways to mitigate erosion and/or increase coastal resiliency.

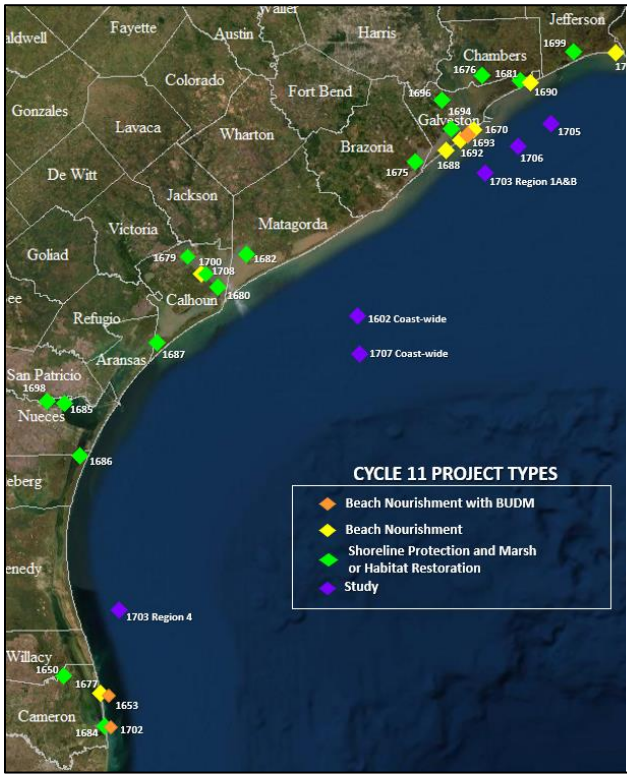

Figure 11. CEPRA CYCLE 11 Project Locations

1602- Beach Monitoring and Maintenance Plan (BMMP) Surveys
1650-Adolph Thomae Park Shoreline Protection Phase IV
1653-South Padre Island BN w/BUDM (state FY2021 event)
****1670**-Historic Seawall Hurricane Harvey FEMA Repairs
1675-Oyster Lake Habitat Protection and Restoration Phase III
1676-Gordy Marsh Shoreline Protection
1677-North Cameron County BN Phase I
1679-Magnolia Beach Shoreline Protection Phase 1
1680-Boggy Nature Park Phase I
1681- Anahuac National Wildlife Refuge Shoreline Protection
1682-OliverPoint Oliver Point Restoration
1684-Children's Beach Phase 1
1685- Causeway Rookery Island Shoreline Protection Phase II
1686-Triangle Tree Rookery Island Shoreline Protection Phase
1687-Matagorda Island West Marsh Protection
1688-Jamaica Beach USACE Permit
1690-Bolivar Peninsula Beach & Dune Restoration Design & Engineering
1692-West Galveston Seawall to 8 Mile Road Engineering and Design
1693-Babe's Beach BUDM
1694-Jones Bay Oystercatcher Habitat Restoration
****1696**-Dickinson Bayou Habitat Restoration
1698-Nueces Rookery Islands Restoration
1699-Willow Lake Shoreline Stabilization and Star Lake Water Control Structure
1700- SH 316 Shoreline Stabilization
1702-Isla Blanca Park BN w/BUDM (state FY2021 event)
1703-Longshore Transport Modeling
1704-Texas Point BN
1705-Region I Sediment Mapping Surveys
1706-Trinity River Valley Paleochannel Investigation
1707- Economic and Natural Resource Benefits of the CEPRA Program; A Study of Cycles 10-11
1708- Powderhorn Lake and WMA Shoreline Protection Project

BUDM PROJECTS

1653 City of South Padre Island BUDM
Partner(s): City of South Padre Island and USACE
Phase: In progress
Budget: $10,407,816.00
Location: Cameron County
CEPRA Share: $2,416,276.00
GOMESA Share: $2,193,750.00
Project Description: Beach nourishment project beneficially using beach-quality material from federal maintenance dredging of the Brownsville Ship Channel (Brazos Island Harbor) jetty and entrance channel segments by the USACE Galveston District. The project is presently supporting the state FY2021 BUDM event, anticipated to get underway in April 2021, regulatory updates to the City's existing USACE permit for beach nourishment and conducting the annual beach monitoring survey for 2021.

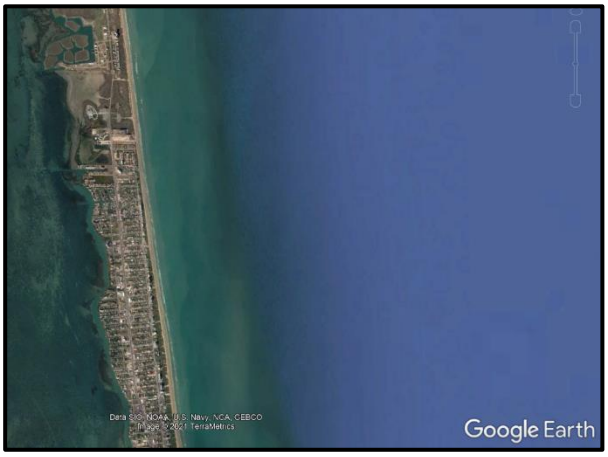

Figure 12. SPI Project location

1693 Babes Beach BUDM
Partner(s): Galveston Park Board and USACE
Phase: Construction
Budget: $49,000,000.00
Location: Galveston County
CEPRA Share: $3,000,000.00
GOMESA Share: $5,000,000.00
Project Description: The project will use current USACE channel maintenance for the placement of BUDM onto Babe's Beach for both the 2021 and 2023 Event. The project is generally managed by the USACE with project partners (GLO and GPB) covering the incremental cost to place the BUDM onshore.

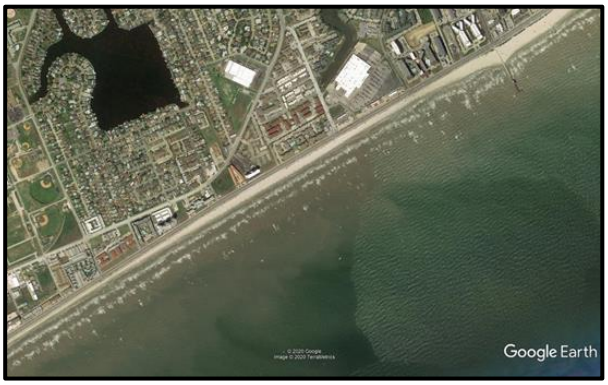

Figure 13. Babe's Beach Project location

1702 Isla Blanca Park BUDM
Partner(s): Cameron County and USACE
Phase: In progress
Budget: $1,816,500.00
Location: Cameron County
CEPRA Share: $511,125.00
Project Description: Beach nourishment project beneficially using beach-quality material from federal maintenance dredging of the Brownsville Ship Channel (Brazos Island Harbor) jetty and entrance channel segments by the USACE Galveston District. The project is presently supporting the state FY2021 BUDM event, anticipated to get underway in April 2021. The GLO partners with the USACE-Galveston District to facilitate the direct beach placement of suitable dredge material on the beach, and with the County for cost-sharing of the incremental (non-federal) cost for beach placement of dredge material.

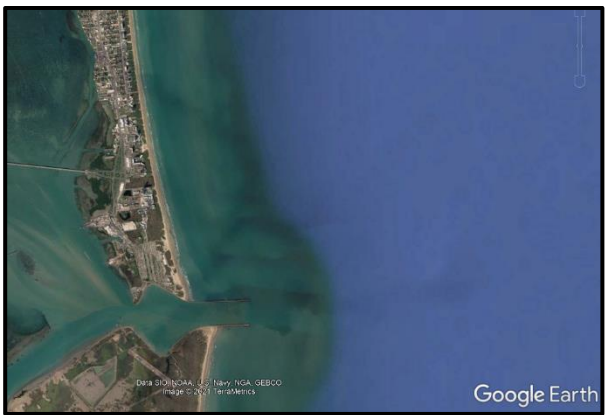

Figure 14. Isla Blanca Project location

BEACH NOURISHMENT PROJECTS

1670 Historic Seawall Hurricane Harvey FEMA Repairs

Partner(s): Galveston Park Board
Phase: Engineering & Design (E&D) and Construction
Budget: $7,168,099.00
Location: Galveston County
GLO Share: $716,809.90
Project Description: Senate Bill 500 dollars are slated as the local cost share amount for a FEMA public assistance grant project worksheet (PW) 3706. The project is to replace sediment on the engineered beach along Seawall Blvd between 12th and 61st street on Galveston Island.

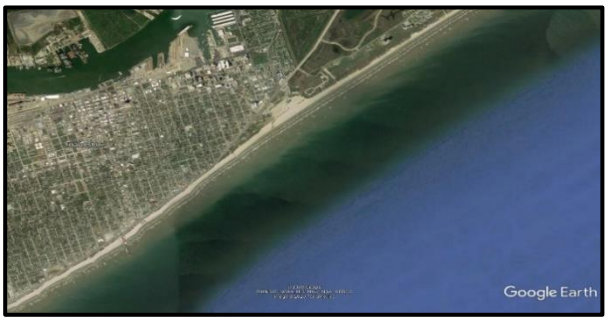

Figure 15. Historic Seawall Hurricane Harvey FEMA Repair Project

1677 North Cameron County Beach Nourishment Phase I

Partner(s): Cameron County Parks & Recreation Department
Phase: Permitting
Budget: $175,000.00
Location: Cameron County
CEPRA Share: $131,250.00
Project Description: The project is to obtain a USACE permit for Cameron County covering 12 miles of beach for future beach nourishment. Any additional cultural resource identification, permitting, cost estimates, and surveys/data collection will be conducted to ensure the completion of the USACE permit.

Figure 16. North Cameron County Project Location

1688 Jamaica Beach USACE Permit

Partner(s): City of Jamaica Beach
Phase: Permitting
Budget: $58,000.00
Location: Galveston County
CEPRA Share: $35,000.00
Project Description: The project is to obtain an USACE permit for the City of Jamaica Beach that authorizes beach nourishment and identifies both upland and submerged sand sources.

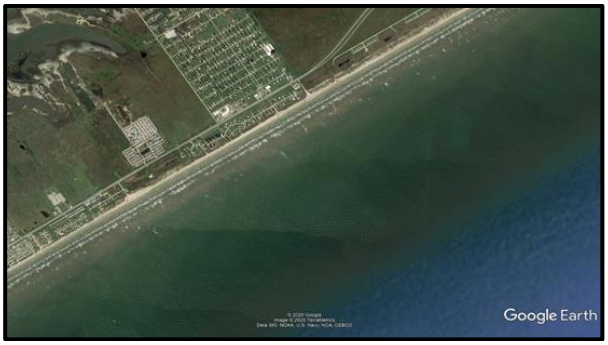

Figure 17. Jamaica Beach Project Location

1690 Bolivar Peninsula Beach & Dune Restoration Design & Engineering

Partner(s): Galveston County
Phase: E&D
Budget: $300,000.00
Location: Galveston County
CEPRA Share: $180,000.00
Project Description: The project consists of seeking engineering and design specifications that could be used in a USACE permit for approximately 21,100 linear feet of bolivar peninsula. The limits of the project are the Galveston-Chambers county line and extend westward towards Gilchrist.

Figure 18. Bolivar Peninsula Beach and Dune Project Location

1692 West Galveston Seawall to 8 Mile Road Engineering and Design

Partner(s): City of Galveston Park Board of Trustees
Phase: E&D
Budget: $600,000.00
Location: Galveston County
CEPRA Share: $360,000.00
Project Description: The project is to engineer and design approximately 4,500 to 6,500 linear feet of beach and dune nourishment. Using the existing USACE permit and the results of the engineering and design of the project will open future projects to construction for beach and dune nourishment.

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Figure 19. West Galveston Seawall to 8 Mile Road Project Location

1700 SH 316 Shoreline Protection (Ocean Drive Living Shoreline)

Partner(s): Texas Department of Transportation
Phase: Construction
Budget: $3,905,000.00
Location: Calhoun County
CEPRA Share: $5,000.00
GOMESA Share: $2,661,000.00
Project Description: The project is to design, permit and construct shoreline stabilization along State Highway 316. The shoreline stabilization will restore the diminishing beach, protect wetland habitat, and protect State Highway 316.


Figure 20. SH 316 Shoreline Protection Project

1704 Texas Point Beach Nourishment

Partner(s): U.S. Fish and Wildlife Service
Phase: Construction
Budget: $22,005,000.00
Location: Jefferson County
CEPRA Share: $5,000.00
Project Description: The project is to restore 6 miles of shoreline along the Texas Point National Wildlife Refuge. Project entails data collection, alternatives analysis, preliminary design, permitting, final design, solicitation, and construction. Project outcome entails 31,680 linear feet of beach nourishment and dune restoration with a goal of 40 yd3/ln ft of beach-quality sand.

Figure 21. Texas Point Project Location

SHORELINE PROTECTION PROJECTS

1650 Adolph Thomae Park Shoreline Protection Phases III- IV

Partner(s): Cameron County Parks & Recreation Department
Phase: E&D
Budget: $2,000,000.00
Location: Cameron County
CEPRA Share: $1,200,000.00r
Project Description: The project will construct the Phases 3 and 4 shoreline protection segments for Adolph Thomae park. The final outcome of design and construction is to stabilize approximately 1,640 linear feet of the eroding Arroyo Colorado cut-off channel shoreline adjacent to the park in two areas, one at the east and the other at the west end of the park, thereby protecting public park infrastructure.

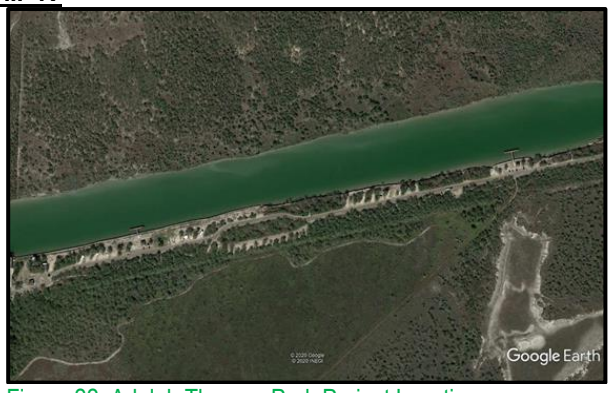

Figure 22. Adolph Thomae Park Project Location

1675 Oyster Lake Habitat Protection and Restoration Phase III

Partner(s): Galveston Bay Foundation
Phase: E&D
Budget: $4,600,000.00
Location: Brazoria County
CEPRA Share: $60,000.00
GOMESA Share: $4,500,000.00
Project Description: The project will reduce wave action affecting the Oyster Lake shoreline and restore marsh vegetation along the shoreline. Phase III will extend the existing shoreline protection for approximately 11,000 feet; including, approximately 6,000 feet north and 5,000 feet south.

Figure 23. Oyster Lake Phase III Project Location

1676 Gordy Marsh Shoreline Protection
Partner(s): Galveston Bay Foundation
Phase: E&D
Budget: $4,500,000.00
Location: Chambers County
CEPRA Share: $115,000.00
GOMESA Share: $4,380,000.00
Project Description: The project will construct up to 9,000 linear feet of breakwater along the shoreline; in addition, approximately up to 40 acres of intertidal wetlands will be restored behind the breakwater structure.

Figure 24. Gordy Marsh Project Location

1679 Magnolia Beach Shoreline Protection Phase I
Partner(s): Calhoun County
Phase: Alternative Analysis
Budget: $175,000.00
Location: Calhoun County
CEPRA Share: $105,000.00
Project Description: The project Phase I goal is to perform an alternative analysis to identify the preferred alternative for mitigating erosion along approximately 5,700 feet of eroding shoreline, develop a preliminary engineering design of the preferred alternative and obtain a USACE permit.

Figure 25. Magnolia Beach Project Location

1680 Boggy Nature Park Phase I
Partner(s): Calhoun County
Phase: Alternative Analysis
Budget: $67,938.00
Location: Calhoun County
CEPRA Share: $40,762.80
Project Description: The project is to perform an engineering analysis and develop feasible alternative shoreline protections for Boggy Nature Park. A coastal engineering analysis is to be conducted along with topographic and bathymetric surveys. All information gathered will be used in the development and analysis of shoreline protection alternatives.

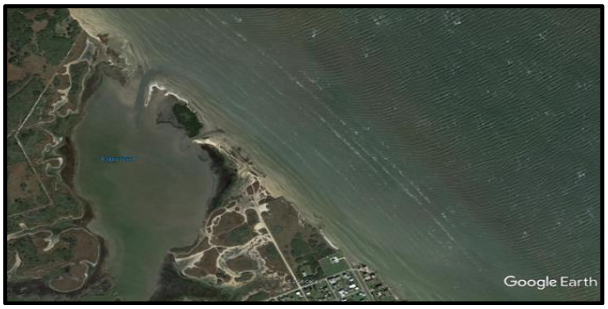

Figure 26. Boggy Nature Park Project Location

1681 Anahuac National Wildlife Refuge Shoreline Protection
Partner(s): Ducks Unlimited
Phase: E&D
Budget: $7,416,667.00
Location: Chambers County
CEPRA Share: $5,000.00
GOMESA Share: $4,445,000.00
Project Description: The project will provide 6.7 miles of shoreline stabilization via installation of a rock breakwater along 7 segments of the Gulf Intracoastal Waterway, from High Island, Texas to the east end of East Bay, and along a portion of the East Bay shoreline. All breakwater segments will border the shoreline of the Anahuac National Wildlife Refuge.

Figure 27. Anahuac National Wildlife Refuge Project Location

1682 Oliver Point/Oliver Point Reef Restoration
Partner(s): Matagorda Bay Foundation
Phase: E&D
Budget: $262,500.00
Location: Matagorda County
CEPRA Share: $187,500.00
Project Description: The project will include a study, design, and permitting leading into construction. Approximately 6,500 feet of living shoreline is to be designed along with about 5,200 linear feet of oyster reef. Additionally, BUDM from the Palacios Channel is to be used in the creation/design of the living shoreline.

Figure 28. Oliver Point Project Location

1684 Children's Beach Phase I
Partner(s): Cameron County Parks & Recreation Department
Phase: Permitting
Budget: $225,000.00
Location: Cameron County
CEPRA Share: $135,000.00
Project Description: The project is to collect data, perform an alternative analysis of shoreline protection, submit and obtain a USACE permit, and perform a preliminary engineering design of the preferred alternative.

Figure 29. Children's Beach Project Location

1685 Causeway Rookery Island Phase 2

Partner(s): Coastal Bend Bays and Estuaries Program
Phase: Final E&D, Construction
Budget: $2740,000.00
Location: Nueces County
CEPRA Share: $42,000.00
GOMESA Share: $2,670,000.00
Project Description: The project entails 3,400 linear feet of shoreline protection in the form of breakwaters around a bird rookery island. The system will include 9 breakwater segments of various lengths between 175 to 1,050 feet in length.

Figure 30. Causeway Rookery Island Project Location

1686 Triangle Tree Rookery Island Shoreline Protection Phase II

Partner(s): Coastal Bend Bays and Estuaries Program
Phase: Construction
Budget: $1,620,000.00
Location: Kleberg County
CEPRA Share: $36,000.00
GOMESA Share: $1,560,000.00
Project Description: The project entails the construction of approximately 1,200 linear feet of near-shore rock breakwater to protect the north, east, and west sides of the rookery island, where erosion is the most severe.

Figure 31. Triangle Tree Rookery Island Project Location

1687 Matagorda Island West Marsh Protection

Partner(s): Coastal Bend Bays and Estuaries Program
Phase: E&D
Budget: $3,500,000.00
Location: Calhoun County
CEPRA Share: $2,000,000.00
Project Description: The project will consist of levee and water control structure repair to Matagorda Island and the restoration of West Marsh to pre-Harvey conditions. In addition to CEPRA funds CBBEP has entered into a cooperative agreement with USFWS for the water control repairs.

Figure 32. Matagorda Island West Marsh Protection Project Location

1694 Jones Bay Oystercatcher Habitat Restoration
Partner(s): Galveston Bay Foundation
Phase: E&D
Budget: $1,270,000.00
Location: Galveston County
CEPRA Share: $5,000.00
GOMESA Share: $1,150,000.00
Project Description: The project will restore up to 4 remnant islands frequented for nesting and foraging by Oystercatchers in Jones Bay, with additional nearshore oyster reef enhancement to promote ecosystem services and wave attenuation.

Figure 33. Jones Bay Oystercatcher Project Location

****1696 Dickinson Bayou Habitat Restoration**
Partner(s): Texas Parks and Wildlife Department
Phase: Construction
Budget: $60,000.00
Location: Galveston County
CEPRA Share: $60,000.00
Project Description: This project will involve planting of a previous CEPRA project that created two marsh berms in Dickinson Bayou. This previous project was affected by Hurricane Harvey, requiring additional fill to the berms and subsequent planting.

Figure 34. Dickinson Bayou Project Location

1698 Nueces Bay Rookery Island Shoreline Protection
Partner(s): CBBEP, PCCA, NFWF
Phase: Post Construction
Budget: $4,645,553.75
Location: Nueces County
CEPRA Share: $500,000.00
GOMESA Share: $773,110.00
Engineer: Scheibe Consulting, LLC
Project Description: In 2002 CBBEP worked in partnership with the GLO to install geotextile tubes to protect the Nueces Bay Rookery Islands. Upon inspection in 2015 it was observed that most of the geotextile tubes had failed. The project constructed additional erosion protection reduction structures around the islands and placed fill to restore habitat. The islands provide much needed nesting and loafing habitat for colonial waterbirds in addition to protecting nearby critical foraging areas.

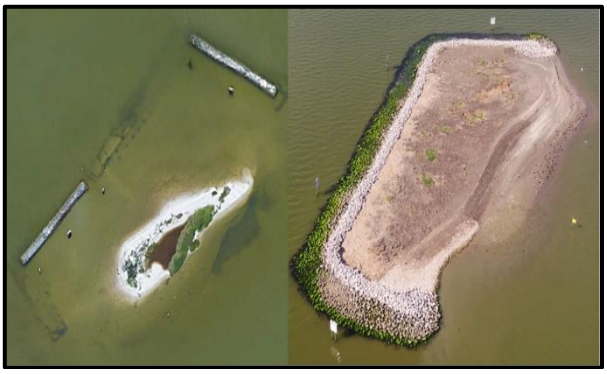
Figure 35. Nueces Bay Rookery Island Shoreline Protection Project Location

1699 Willow Lake Shoreline Stabilization and Star Lake Water Control Structure
Partner(s): Ducks Unlimited, Inc.
Phase: E&D
Budget: $5,655,000.00
Location: Jefferson County
CEPRA Share: $5,000.00
GOMESA Share: $2,150,000.00
Project Description: The project will consist of approximately 3.5 miles of rock breakwater along the northern and southern shorelines of the Gulf Intercoastal Waterway protecting Willow Lake and Star Lake. In addition, the water control structures at Star Lake are to be replaced with more efficient and up to date structures.

Figure 36. Willow Lake and Star Lake Project Location

1708 Powderhorn Lake and WMA Shoreline Protection Project
Partner(s): TPWD, Calhoun Port Authority
Phase: E&D
Budget: $1,060,000
Location: Calhoun County
CEPRA Share: $500,000
Project Description: The project will include Engineering and Design of a living shoreline or shoreline protection structures from the mouth of Powder Horn Lake southeast to Boggy Bayou to protect and preserve critical habitats and marshes from high energy wave action. The project is funded by the Gulf Environmental Benefits Fund (GEBF) via an agreement between NFWF and the GLO, and by CEPRA funding via a cooperation agreement between TPWD and the GLO.


Figure 37. Powderhorn Lake and WMA Project Location

STUDIES AND DEMONSTRATIONS

The yearly release of GOMESA funds through the CEPRA and CMP programs facilitated an increase in funding for internal surveys dedicated to studying sediment inventory and management. Identified as a critical need in the Master Plan, the GLO's Coastal Protection Division is spearheading a Texas Sediment Management Plan. During Cycle 11, CEPRA began sediment studies and surveys to compliment these efforts to better facilitate coastal restoration projects. Internal studies to monitor beaches and assess the cost-benefit of the CEPRA Program were also completed.

1602 Beach Monitoring and Maintenance Plan **(BMMP)Surveys**
Internal Study
Location: Coastwide
Budget: $4,170,210.00
CEPRA Share: $4,170,210.00
Project Description: The GLO established the BMMP in 2010 following guidance issued by FEMA requiring a BMMP as a prerequisite for funding eligibility under the Public Assistance (PA) program for the mitigation of damages to engineered beaches impacted by federally declared disasters. BMMP surveys are conducted yearly at 12 engineered beaches during each CEPRA Cycle to measure sand loss/gain at each site.

Figure 38. BMMP Project Survey Areas

1703 Longshore Transport Modeling
Internal Study
Location: Region 1 and Region 4
CEPRA Share: $1,863,977.20
Project Description: The intent of the Longshore Transport Modeling project is to inform the development of sediment budgets for Regions 1 and 4 as identified in the Master Plan. The desired outcome for this project is the development of a regional sand transport model and sediment budget for Regions 1 and 4 that can be used by the GLO and coastal communities for preliminary planning of future coastal restoration projects.

Figure 39. Regions identified within the Master Plan

1705 Region 1 Sediment Mapping Surveys
Internal Study
Partner(s): Bureau of Ocean Energy Management
Location: Region 1; GLO Offshore submerged and OCS
Budget: $3,027,917.00
CEPRA Share: $69,048.00
GOMESA Share: $1,977,917.01
Project Description: Utilizing BOEM funding and the Marine Minerals Information Systems (MMIS) the GLO aims to assist in building the National Offshore Sand Inventory and MMIS to help reduce response time in disaster recovery and facilitate long-term planning to strengthen the resilience of Texas coastal communities and infrastructure.

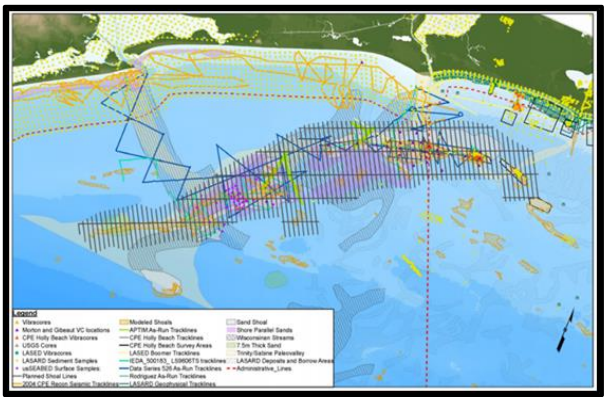
Figure 40. Region 1 Sediment Mapping Survey Project

1706 Trinity River Valley Paleochannel Investigation

Internal Study

Partner(s): Bureau of Ocean Energy Management

Location: Region 1

Budget: $1,371,030.00

GOMESA Share: $1,371,030.00

Project Description: Utilizing GOMESA funds the GLO is investigating an offshore sand source within state-owned submerged waters located in the Trinity River Valley Paleochannel. The identification of offshore sand sources assists with disaster recovery time and strengthens coastal community resiliency planning.

Figure 41. Trinity River Paleochannels

1707 Economic Cost-Benefit Report for the CEPRA Program

Internal Study

Location: Coastwide

Budget: $120,259.00

CEPRA Share: $120,259.00

Project Description: Natural Resources code dictates the CEPRA Program supply the Texas Legislature with an assessment of the efficacy of CEPRA program. Recently completed CEPRA projects are assessed to determine what amount of return is made on every dollar spent on CEPRA projects.

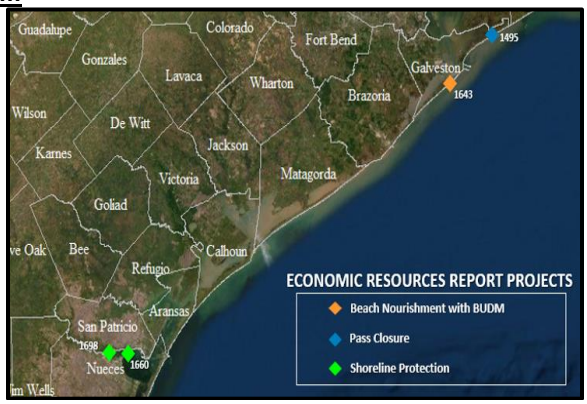

Figure 42. Economic Report Project Areas

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