TEXAS COASTAL RESILIENCY MASTER PLAN
UPDATE

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87TH Legislature
George P. Bush, Commissioner, Texas General Land Office

A Long-Term Coastal Plan for Texas

The 2019 Texas Coastal Resiliency Master Plan (Master Plan), presented by the Texas General Land Office (GLO), is the second installment of the statewide plan to protect and promote a vibrant and resilient Texas coast. Since the 2019 Master Plan was released, the GLO has been focused on implementing the plan. This includes:

- Helping project partners find funds to construct coastal resiliency projects.
- Improving the models used to analyze coastal vulnerabilities.
- Creating project design guides to educate and assist coastal managers.
- Pursuing new opportunities to further the reach and versatility of the Master Plan.

The Master Plan will continue to be used by the GLO to guide long-term coastal management in Texas by assisting with identifying funding priorities. As the GLO advances toward issuing the next iteration of the Master Plan in 2023, the agency continues to leverage multiple ongoing funding streams at the state and federal level.

The Coast's Value to Our State & Nation

The coastal region of Texas supports a thriving port industry, energy production and exploration endeavors, and tourism opportunities that drive both the state and national economies.

- The Texas coast is the main trade hub for the rest of the state and the leading energy producer for the nation, generating more than one-fifth of the energy produced in the U.S.[1]
- Port activities have generated $368 billion in economic value to the state – roughly 23 percent of the total state gross domestic product – and handled 23 percent of all U.S. port tonnage annually since 2017.[2,3,4]
- In total, the Texas coastal region accounts for roughly 24 percent of the state's population, 23.5 percent of the state's businesses, 26 percent of the state's workforce, and brings in 29 percent of the state's total annual average wages.[5,6]

The value of the Texas coast at the state and national level cannot be understated; it is an economic powerhouse that is expected to grow in the coming years as industries are expanded and the population increases. All Texans, in every reach of our vast state, depend on the coast for goods and services, recreation, and quality of life that a vibrant and prosperous coastal environment provides.
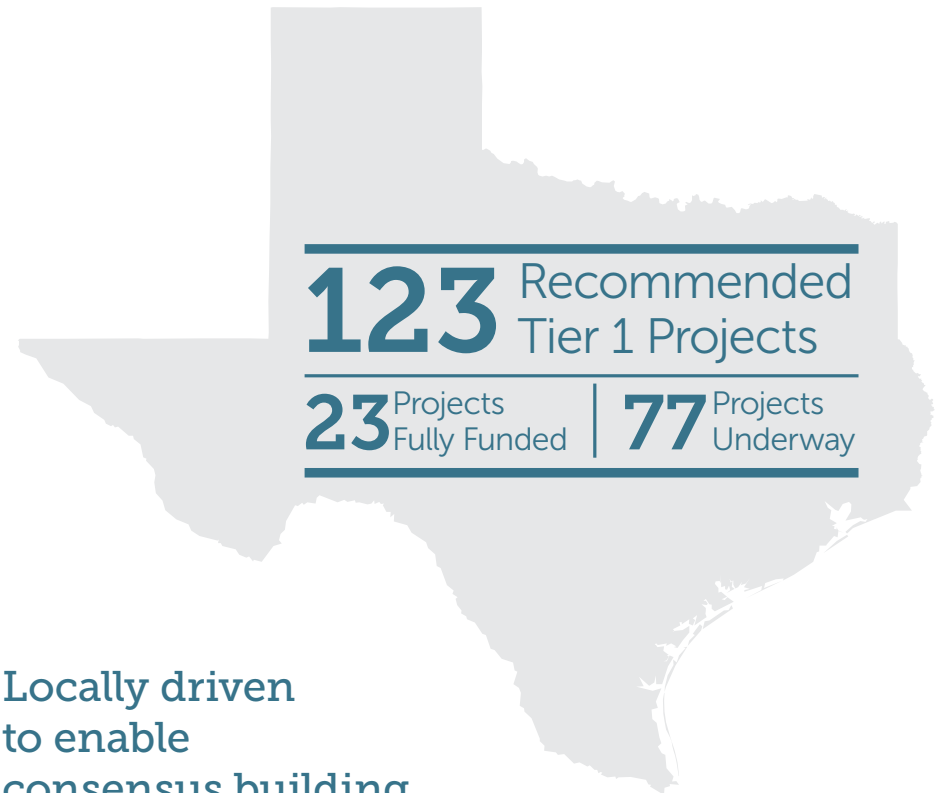

Photo: GLO

Photo: GLO

Photo: GLO

2019 MASTER PLAN OVERVIEW

The 2019 Master Plan, completed in March of 2019, identified 123 Tier 1 coastal resiliency projects recommended to protect the coast from current and future coastal hazards, and alleviate issues of concern. The total cost of these projects is estimated to be $5.4 billion. Of the 123 recommended projects, 77 projects are underway, and 23 of these are fully funded.

123 Recommended Tier 1 Projects

23 Projects Fully Funded | **77** Projects Underway

Locally driven to enable consensus building

The Texas Coastal Resiliency Master Plan serves as a coastal forum to drive consensus building for Texas coastal resiliency initiatives. The Master Plan brings together more than 200 coastal scientists, engineers, planners, and professionals on an annual basis to share local and technical expertise in a collaborative setting through its Technical Advisory Committee, or TAC. The TAC identifies coastal needs, opportunities, and assists the GLO with project prioritization. Most recently, the TAC met in June 2020 to discuss and offer valuable insights on the current efforts and pursuits of the GLO planning team.

State & federal agencies
Universities
Local governments
Non-profits
Engineering firms
Port representatives
Regional trusts, foundations & partnerships

Technical Advisory Committee (TAC)

Protecting the coast for generations to come: Relative Sea Level Rise, Extreme Events, and Flood Resilience

Through the Master Plan, the State of Texas remains at the forefront of coastal resilience nationally, serving as a beacon of innovation to other coastal states looking to balance coastal development with risk mitigation.

- **Sea Level Rise** – The 2019 Master Plan included the first state-level guidance for sea level rise planning projections for the Texas coast. These values have since been adopted by the Texas Department of Transportation in the newly added Coastal Chapter of the Hydraulic Design Manual, recognizing the coastal leadership of the GLO.

- **Hurricanes and Extreme Events** – The Master Plan identifies areas along the coast that are most vulnerable to hurricanes and prioritizes necessary projects to protect infrastructure, safeguard ecosystems, and support communities against future catastrophic events before they happen.

- **Flooding** – The Master Plan assists communities with planning for flooding scenarios, particularly by identifying areas where flooding may worsen in the future due to sea level rise.

The Need for the Texas Coastal Resiliency Master Plan

The GLO Coastal Division is involved in many programs and studies dedicated to meeting coastwide needs. These efforts have produced many successes in recent years, contributing to the overall goal of restoring, protecting, and enhancing the Texas coastal area.
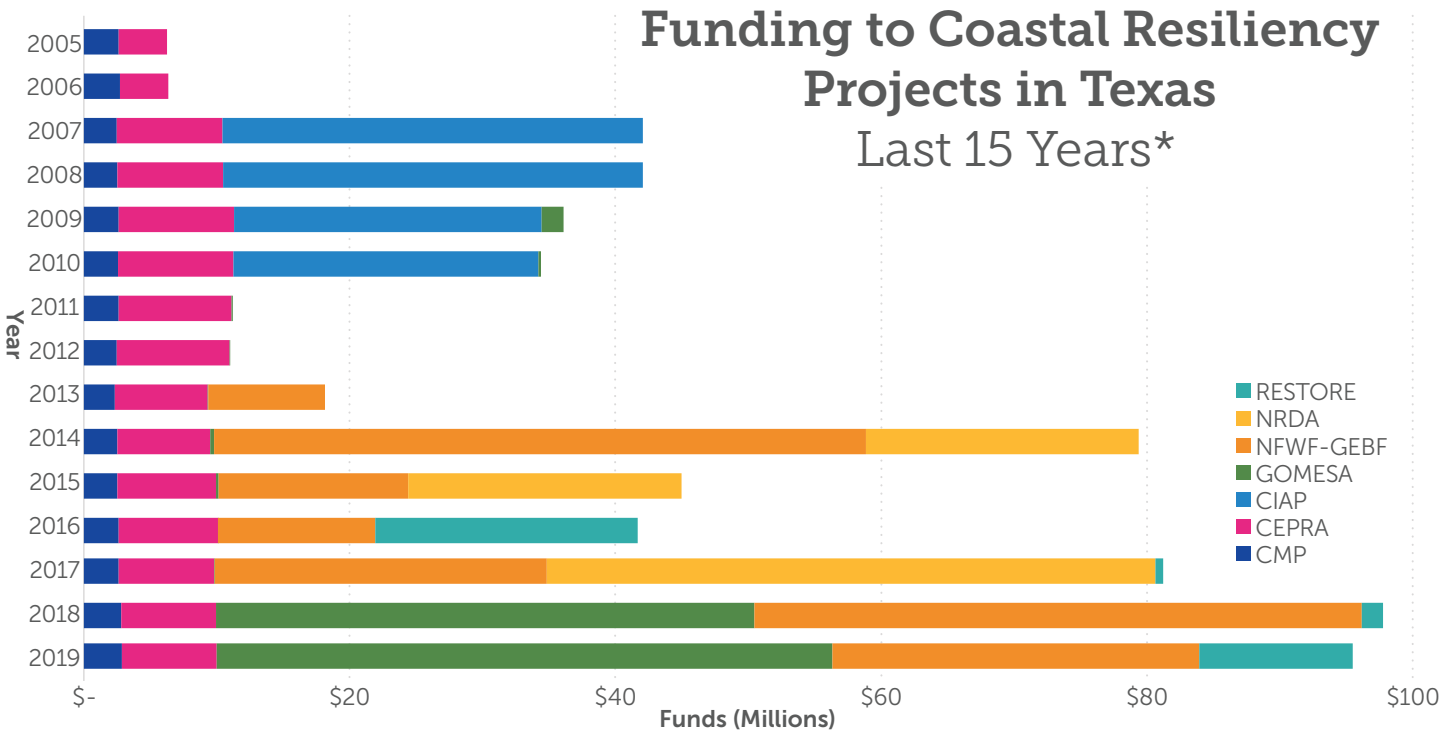
Funding

Funding for coastal resiliency projects in Texas has been increasing in recent years (see chart below), spurred in part by the increase in hurricanes and tropical storm activity in the Gulf of Mexico. This recent increase in funding sources has provided an opportunity for the GLO to leverage the work of the Master Plan to more effectively prioritize coastal projects using federal and local funding.

- **GLO Coastal Programs** – There are several federal and state grant funding programs that the GLO administers supporting coastal projects in Texas. These include the Coastal Erosion Planning and Response Act (CEPRA), the Gulf of Mexico Energy Security Act (GOMESA), which pays out royalties from oil and gas exploration in the Gulf of Mexico, and the Coastal Management Program (CMP), funded by NOAA, among others.

- **Hotel Occupancy Tax** – The Hotel Occupancy Tax (HOT) House Bill No. 6 (HB 6) was passed during the 2019 Texas Legislative Session and included dedicating 2% of HOT revenues in coastal counties to the GLO's CEPRA program to boost the state's capabilities to address coastal erosion and ensure money spent on the Texas coast stays on the Texas coast.

- **Integration with CDBG - MIT** – The GLO is administering nearly $4.3 billion in Community Development Block Grant-Mitigation (CDBG-MIT) grants through its Community Development and Revitalization (CDR) Division. Of these funds, the Coastal Resiliency Program is set to receive $100 million for coastal resiliency projects. CDR is identifying eligible Tier 1 projects from the Master Plan and is working alongside stakeholders to progress these projects.

- **Coastal Texas Study** – Led by the U.S. Army Corps of Engineers, this is a multi-year study to examine ways to reduce risk faced by coastal communities and industries to coastal storms. The GLO is partnering with the Army Corps as the non-federal sponsor of this study, sharing 50% of study costs with the federal government.

- **Deepwater Horizon** - Funds collected from civil and criminal penalties from the Deepwater Horizon oil spill are administered through three funding streams: National Fish and Wildlife Foundation-Gulf Environmental Benefit Fund (NFWF-GEBF), Natural Resource Damage Assessment (NRDA), and the RESTORE Act. The 2019 Master Plan has been referenced as a representation of regional priorities for the allocation of funding under these sources.

Funding to Coastal Resiliency Projects in Texas
Last 15 Years*

Legend: RESTORE, NRDA, NFWF-GEBF, GOMESA, CIAP, CEPRA, CMP

X-axis: Funds (Millions) — $-, $20, $40, $60, $80, $100
Y-axis: Year — 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019

*CEPRA is funded on a two-year cycle. Those funds are shown distributed equally across both years in the biennium.

LEGISLATIVE DISTRICT OVERVIEW

Table 1. House District Summary

Region	House District	Number of Projects*	Cost of Projects	Percent Funded
1	21	14	$2.8 billion	5%
	22	3	$883 million	0%
	23	19	$513 million	26%
	24	4	$71.5 million	26%
1, 2	25	22	$1.1 billion	3%
2, 3	30	18	$89.1 million	56%
3, 4	31	3	$29.2 million	17%
3	32	8	$24.1 million	44%
	34	4	$10.9 million	69%
4	37	11	$139 million	15%
3	43	8	$17.6 million	65%
1	128	1	$10 million	0%
	129	2	$45.3 million	78%
1 - 4	Statewide	15	$26.4 million	35%

Master Plan Tier 1 Project Types per Region

- Shoreline Stabilization
- Beach Nourishment
- Dune Restoration
- Habitat Creation and Restoration
- Hydrologic Connectivity
- Land Acquisition
- Community Infrastructure
- Flood Risk Reduction
- Public Access and Improvements
- Structure/Debris Removal
- Study, Policy, Plan or Program

REGION 1

REGION 2

REGION 3

REGION 4

Table 2. Senate District Summary

Region	Senate District	Number of Projects*	Cost of Projects	Percent Funded
1	3	5	$2.4 billion	0%
	4	24	$1.5 billion	5%
	6	1	$10 million	0%
	11	18	$380 million	22%
1, 2	17	4	$767 million	0%
2, 3	18	34	$209 million	24%
3	20	7	$17.8 million	42%
	21	5	$12.8 million	68%
3, 4	27	16	$148 million	16%
1 - 4	Statewide	15	$26.4 million	35%

*Projects falling within multiple districts are double counted in the above tables to reflect total possible projects and cost in each district.
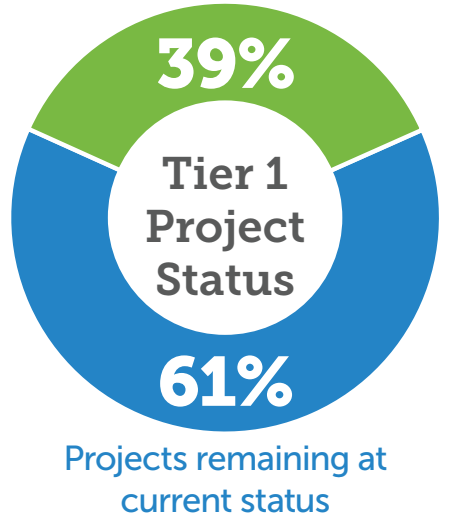
Ongoing Projects

The GLO's Coastal Division has been working with project stakeholders to move projects from the 2019 Master Plan into action. Of the 123 Tier 1 projects identified in the Plan, 77 are currently ongoing and 21 have progressed since the 2019 Master Plan (projects are double counted in the tables shown if they fall into more than one district).
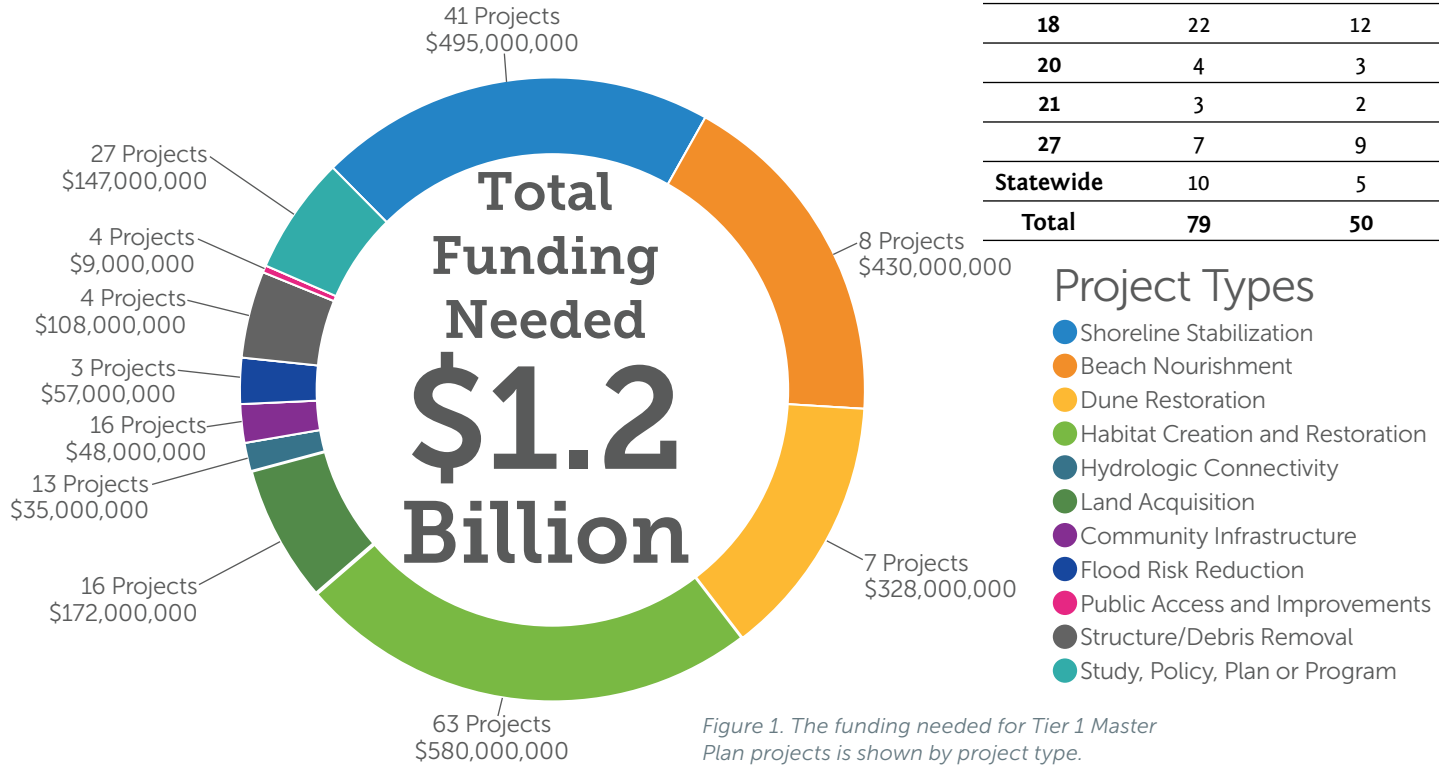
In addition to the Tier 1 Master Plan projects, several major coastal infrastructure projects are proposed for Texas in the coming years (see page 6).

Projects that have progressed since January 2019

39%

Tier 1 Project Status

61%

Projects remaining at current status

House District	Projects Not Progressed	Projects Progressed since 2019
21	9	5
22	3	-
23	10	9
24	2	2
25	16	6
30	11	7
31	1	2
32	5	3
34	2	2
37	6	5
43	3	5
128	1	-
129	1	1
Statewide	10	5
Total	**80**	**52**

Leveraging Funds for Texas Coastal Resiliency

By paying part of the cost of Texas coastal resiliency projects, the State has been able to leverage other federal funds that are not administered by the GLO's Coastal Program, as well as local match funds from partnering communities. While there is still considerable funding needed to complete all the Tier 1 projects (Figure 1), the Master Plan's locally-driven process has seen considerable success in bringing additional funding for projects to better protect the Texas coastal area (Figure 2, next page).

Senate District	Projects Not Progressed	Projects Progressed since 2019
3	5	-
4	14	10
6	1	-
11	9	9
17	4	-
18	22	12
20	4	3
21	3	2
27	7	9
Statewide	10	5
Total	**79**	**50**

27 Projects
$147,000,000

4 Projects
$9,000,000

4 Projects
$108,000,000

3 Projects
$57,000,000

16 Projects
$48,000,000

13 Projects
$35,000,000

16 Projects
$172,000,000

63 Projects
$580,000,000

41 Projects
$495,000,000

Total Funding Needed $1.2 Billion

8 Projects
$430,000,000

7 Projects
$328,000,000

Project Types
- Shoreline Stabilization
- Beach Nourishment
- Dune Restoration
- Habitat Creation and Restoration
- Hydrologic Connectivity
- Land Acquisition
- Community Infrastructure
- Flood Risk Reduction
- Public Access and Improvements
- Structure/Debris Removal
- Study, Policy, Plan or Program

Figure 1. The funding needed for Tier 1 Master Plan projects is shown by project type.

Leveraged Funding to Tier 1 Projects

■ GLO Funding   ■ Leveraged Funding

2017 Plan

2019 Plan

Current (leading up to 2023 Plan)

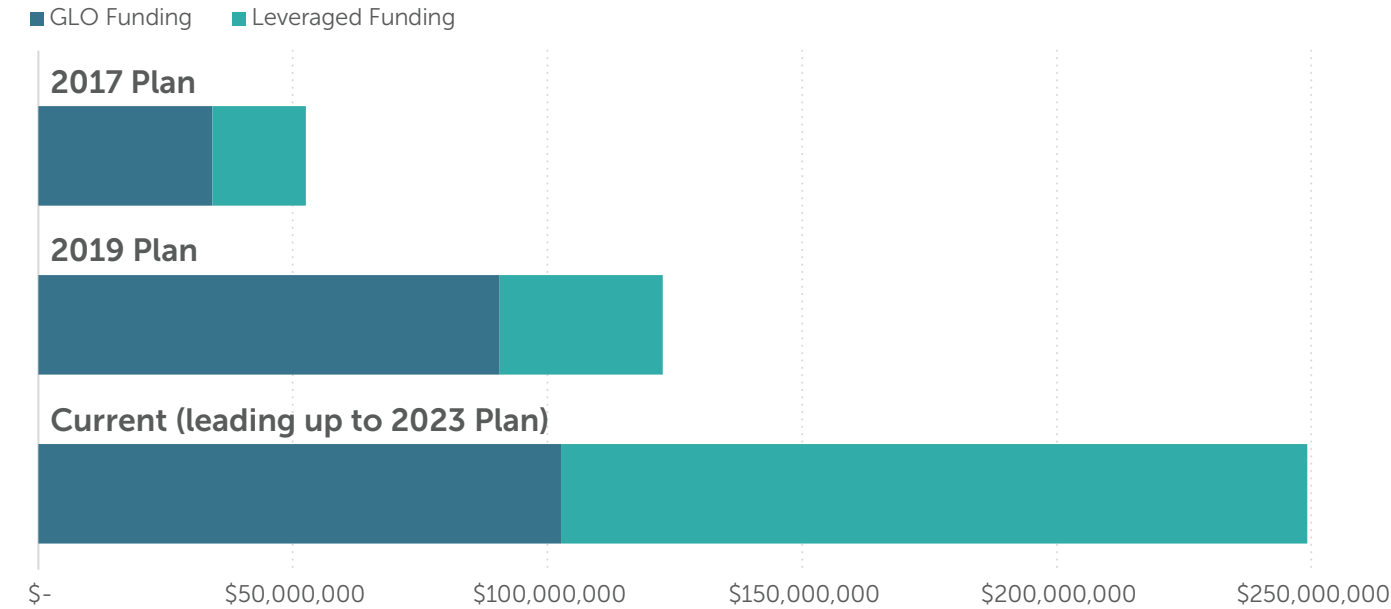$- $50,000,000 $100,000,000 $150,000,000 $200,000,000 $250,000,000

Figure 2. Leveraged funding to Tier 1 Master Plan projects has increased from $18,314,326 to nearly $147,000,000 since the first iteration of the Master Plan.

Anticipated Major Texas Coastal Infrastructure

- **Brazos River Floodgates and Colorado River Locks** – The U.S. Army Corps-led study to redesign the Brazos River floodgates and Colorado River locks is on the docket for funding in the 2020 Water Resources Development Act, or WRDA. Once authorized, the project would improve long-term navigation, inflow, and erosion issues associated with the two river systems.
- **Port Arthur, Orange, and Freeport Hurricane Flood Protection Systems** – In coordination with the U.S. Army Corps of Engineers, engineering and design phases are in progress for three hurricane flood protection systems to manage storm risk on the upper Texas coast. These three systems are part of the federally led Sabine Pass to Galveston Bay Study and will improve coastal protection against flooding and storm surge. Recent damage along the Texas coast from the 2020 hurricane season can be seen in Figure 3.
- **Galveston Island and South Padre Island Storm Management** – The federally-partnered Coastal Texas Study (see page 3) proposes to increase resiliency along the Texas coast through the combination of coastal storm risk management and ecosystem restoration alternatives, with major improvements planned for Galveston Island and South Padre Island. The final report is anticipated to be complete in 2021 and submitted to the U.S. Congress for authorization.

Photo: Aransas County   Photo: GLO   Photo: GLO

Figure 3. Fulton Beach Road after Hurricane Hanna; Dune loss at Quintana Beach by Hurricane Laura; Dune damage by Hurricane Laura at Quintana Beach.

IMPROVEMENTS FOR THE 2023 MASTER PLAN

New Data & Modeling

Looking toward the 2023 Texas Coastal Resiliency Master Plan, the GLO is working to improve the coastal modeling suite by refining input data and producing new map products to share with communities.

- **Improved Model Inputs** – Updates to and development of geospatial data will add to our current knowledge of the state of the Texas coast, including its topography, geoenvironments, infrastructure, human use, and socio-economic settings. This will further enhance our understanding of how to increase resiliency through the Master Plan.
- **Additional Storm and Sea Level Rise Scenarios** — GLO is expanding the capabilities of future change modeling using ensembles of synthetic storms and additional sea level rise scenarios developed by the National Oceanic and Atmospheric Administration to better gauge the human and natural vulnerability of the coastal zone.
- **Geohazards Mapping** — New maps will present geospatial data showing current condition, past changes, and predicted future changes in the coupled natural-human system of the Texas coastal plain. The results will show how communities are embedded in the coastal landscape to better understand which communities and environments are most vulnerable to changes along the Texas coast. These maps will help identify which areas are most in need of resiliency enhancements.

Enhancements to the Planning Process

- **Sediment Volume Calculations** - The GLO is investigating the long-term sediment needs along the Texas Gulf shoreline based on historic erosion trends and future projected relative sea level rise. This will help the GLO in scheduling renourishment activities and in regional sediment management planning efforts.
- **Resilient Project Design Guides** - The GLO is developing a set of Design Guides for stakeholders, project managers, and city planners along the Texas coast. The guides will help end users understand how to design more resilient projects in the coastal landscape.
- **Ecosystem Services** - The GLO created an Ecosystem Services Technical Working Group to use the latest academic data as it is developed to calculate the benefits of ecosystem services from coastal resiliency projects to more accurately capture cost-benefits.

Ecosystem services are benefits to humans provided by healthy ecosystems. These include, among others, production of food and water, recreational benefits, flood and storm protection, and water and nutrient cycling. These benefits are not always straightforward and can be difficult to quantify.
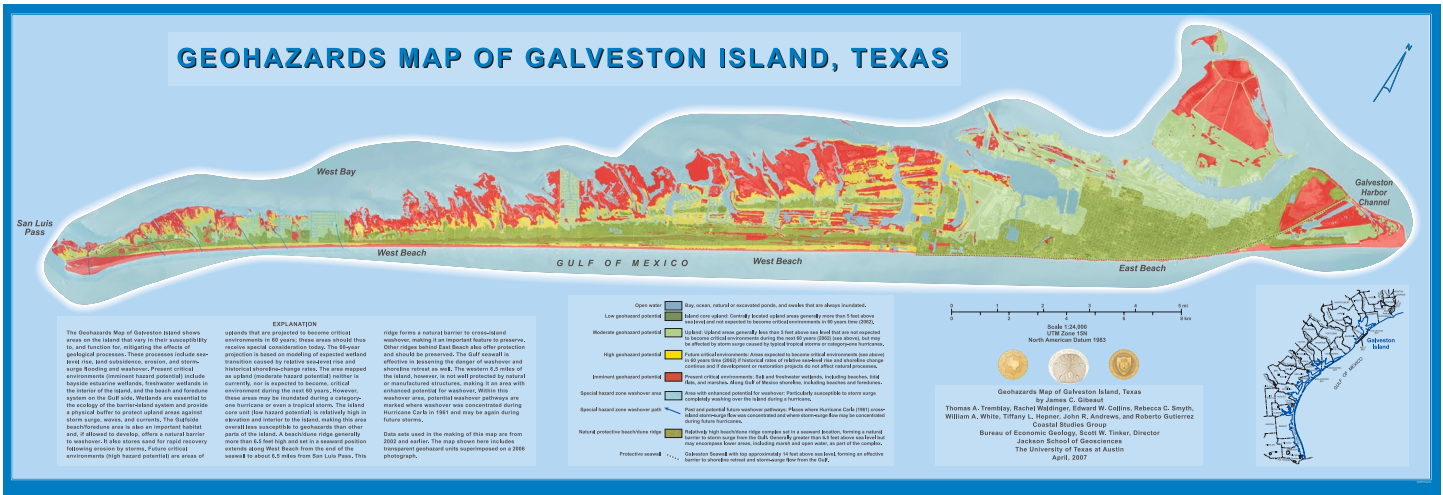

GEOHAZARDS MAP OF GALVESTON ISLAND, TEXAS

Figure 4. Example geohazards map of Galveston Island, Texas, where green areas indicate less susceptibility to specific hazards, and red indicates greater susceptibility (Gibeaut et. al., The University of Texas at Austin Bureau of Economic Geology, 2007).

HOW COASTAL RESILIENCE WORKS FOR TEXAS

Case Study: Hurricane Harvey
Beaches and Dunes

When Hurricane Harvey made landfall north of Port Aransas on August 25, 2017 as a Category 4 hurricane, it unleashed its full force of impact on San Jose Island, an uninhabited barrier island in the Gulf of Mexico. The beaches and dunes on San Jose Island are healthy and robust and, as a result, absorbed a significant amount of the storm surge produced by the hurricane – absorbing enough energy from storm surge and wave action to displace nearly 7.5 million cubic yards of sand, or more than half a million dump truck loads of sand.[7]

The natural barrier provided by the beaches and dunes mitigated storm surge damage to communities throughout Aransas County along the inhabited mainland. Most of the damage in Aransas County was due to the hurricane-strength winds and bayside flooding, rather than typically devastating Gulf-side storm surge. Natural infrastructure, such as our state's system of barrier islands, beaches, and dunes, are a key component to the resilience concepts presented in the Master Plan.

Living Shoreline Initiatives

GLO Living Shoreline Workshops

In September 2020, the GLO held a series of workshops to highlight the benefits of incorporating living shorelines into coastal projects. Living shorelines are typically used as erosion reduction features that incorporate both natural components, like vegetation, and structural components, like stone, to enhance resiliency of the property they are protecting. As part of the workshops, GLO developed *A Guide to Living Shorelines in Texas*, a guidebook for project managers with best practices for installing living shorelines. These are techniques that can be applied by individual homeowners or at a regional level, making them relevant for much of the population living on the coast.

Case Study: Refugio County

The Driscoll Rooke Covenant Park in Copano Bay was losing a significant portion of its shoreline to erosion from waves and recreational boat traffic, endangering the park and surrounding communities and habitats. Working with local partners, such as the Copano Bay Soil and Water Conservation District and the Coastal Bend Bays and Estuaries Program, the GLO installed a breakwater structure along the shoreline of the park to reduce the extreme erosion. Other elements, such as establishing a marsh between the land and the breakwater, were incorporated to strengthen the overall effect of the breakwater. The resulting living shoreline, constructed in 2004, created new habitat and provided protection from wave action. When Hurricane Harvey hit 13 years later, many areas in Copano Bay were heavily damaged, but the park shoreline behind the natural buffer remained largely intact (Figure 5).

Photo: Coastal Bend Bays and Estuaries Program (CBBEP)

Photo: CBBEP

Photo: CBBEP

Figure 5. The photos show the progression over time of the living shoreline at the Driscoll Rooke Covenant Park, including post-construction conditions in 2003 (top), the expansion of Spartina alterniflora in 2010 (middle), and the shoreline after Hurricane Harvey in 2019 (bottom).

References
1. https://www.eia.gov/state/print.php?sid=TX
2. http://ftp.dot.state.tx.us/pub/txdot-info/tpp/giww/mission-plan-86.pdf
3. https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/2972
4. https://www.texasports.org/
5. U.S. Bureau of the Census. 2017. Total Population, 2013-2017 American Community Survey 5-Year Estimates.
6. https://data.bls.gov/cew/apps/table_maker/v4/table_maker.htm#type=1&year=2017&qtr=A&own=5&ind=10&supp=0
7. FEMA Region VI Assessment Branch. 2018. Hurricane Harvey: Coastal Erosion Hot Spot Analysis. Report prepared by Compass PTS JV, led by AECOM.