GLO Contract No. 16-108-000-9359
Coastal management Program—Cycle 18
Project Deliverables- Task 1

I. Final summary report on inventory of data sources in geodatabase, including new data layers developed or incorporated into the RMC viewer. Interim updates to be provided upon request.

II. Final recommendation for proceeding with ongoing data collection for GLO planning initiative, including data maintenance, identified data gaps, and data quality.

DATA SOURCES AND LAYERS

DATA SOURCES

Please see the 2014 RMC report for an inventory of data sources in the RMC database. During the 2012-2014 RMC update process, some data gaps were identified (Table 1). In 2015-2016, two datasets were created address some of the gaps identified (highlighted below), and one dataset was updated.

Table 1. Data gaps identified during the 2012-2014 RMC update process.

Title	Comments
Contaminated Areas	Could not identify dataset(s) to use for the 2014 RMC update.
Mitigation Sites	Could not obtain dataset(s) for the 2014 RMC update. A single GIS dataset needs to be developed from multiple sources and formats.
Restoration Areas	The Texas GLO was initially interested in seeing this dataset developed.
Bay Nearshore Areas	HRI is capable of developing this dataset.
Gulf Nearshore Areas	HRI is capable of developing this dataset.
State Species of Concern Habitats	Could not obtain dataset(s) from TPWD's Texas Natural Diversity Database for the 2014 RMC update possibly due to the sensitive nature of the data.
Updated Estuarine Bathymetry	Currently using NOAA's Estuarine Bathymetry datasets published in 1998, but primarily based on surveys performed in the early 1960's and likely do not accurately represent bathymetry for major bays in recent years. A more recent bathymetric acquisition for major bays is needed.
THC's MJ/MK RMCs transferred to 2014 Sub OLTS	The process of joining THC's MJ/MK RMCs to Sub OLTS 2014 is an inaccurate process due to attribute (tract ID) and geometry (shoreline) differences between the Sub OLTS layer the Texas Historical Commission uses and the Sub OLTS 2014 layer used for the 2014 RMC update.
FEMA Special Flood Hazard Areas: Refugio County	An updated SFHA dataset for Refugio County was still being debated during 2014 RMC update and therefore was not included in the 2014 RMC update.

UPDATES

New datasets created:

- Bay Nearshore Areas; based on percent sand sediment distribution layers derived from historic Texas BEG sediment samples in Texas submerged lands
- Gulf Nearshore Areas; based on 2012 LIDAR and USACE depth of closure datasets

Resource Management Codes updated:

- DA (Dredge)
- OA and OH (Oil and Gas)

FUTURE RECOMMENDATIONS

RECOMMENDATIONS

- Remove ‘priority protection areas’ dataset from sensitive areas compilation then re-update RMCs DA, MB, ME, MG, OA, Oh.
- Replace current ‘bridges and causeways’ (manually derived) dataset with Federal Highway Administration’s National Bridge Inventory (point) dataset which is actively being developed and curated.

GAPS

- Restoration areas dataset to map RMC “MR”
- State endangered species data to map RMC “MN”

GLO Contract No. 16-108-000-9359
Coastal management Program—Cycle 18
Project Deliverables- Task 2

I. Written evaluation methodology and criteria for projects and issues of concern identification.

II. Online IOC and project gap evaluation. Draft report on TAC results. Socio-economic and ecosystem services analysis report of benefits for priority projects.

EVALUATION METHODOLOGY AND CRITERIA FOR PROJECTS AND ISSUES OF CONCERN

INTRODUCTION

This work builds on work started in 2012 to identify Issues of Concern and evaluate projects that adequately address the issues identified in the Texas coastal zone. Information and data developed in 2012, and lessons learned, were incorporated into this work and often served as a starting point for the 2016 Texas Coastal Resiliency Master Planning effort.

ASSESSMENT FRAMEWORK

Through a series of meeting and conversations with the GLO and project partners, an assessment framework was developed (Figure 1). This framework recognized the iterative nature of resiliency planning, and focused on identifying issues of concern as they relate to coastal resiliency and potential responses to identified issues. Starting with a current understanding of pressures exerted on the coastal system stemming from social, economic, and natural drivers, specific Issues of Concern (IOCs) were developed. The status or level of concern for each IOC in discrete portions of the Texas coast were evaluated to gain an understanding of the current condition of the coast, specifically in terms of ecological, economic, and community resiliency. Solutions, in the form of specific projects or groups of projects, were then evaluated in terms of whether they addressed the Issues of Concern identified, as well as feasibility and whether they were considered a priority for resiliency in their area. In future phases of this work, the implementation of projects or groups of projects can be evaluated in terms of how they alleviate local Issues of Concern and increase coastal resiliency. The Texas Coastal Resiliency Master Plan is intended to be a living document, and as conditions and Issues of Concern change, potential responses can be augmented to best address them.

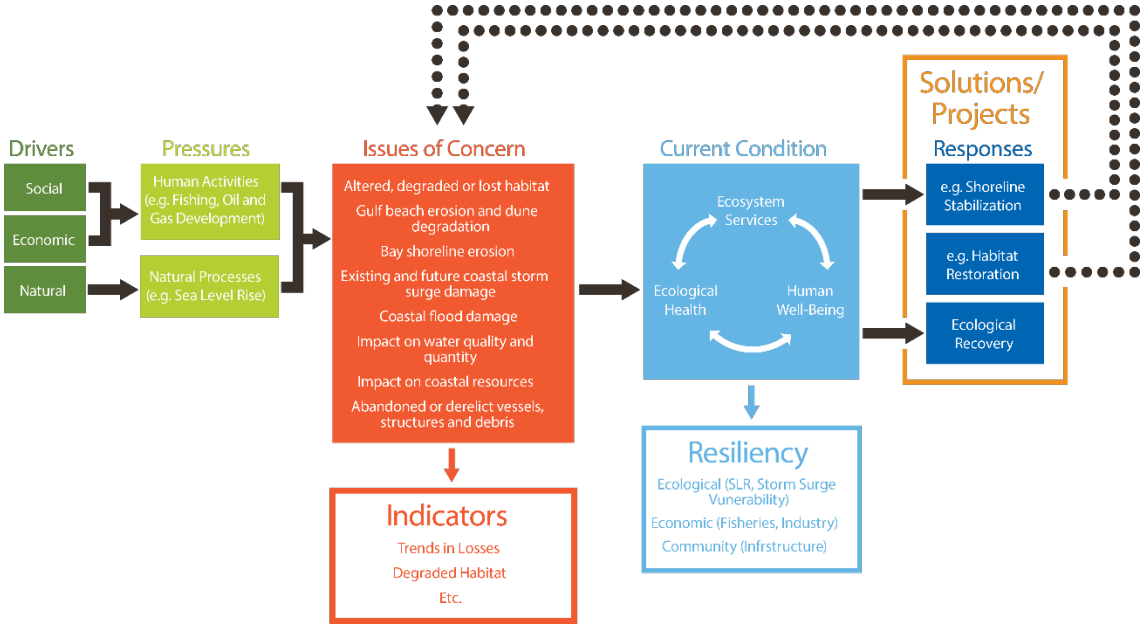


Figure 1. Assessment framework for resiliency planning for the Texas coast. Modified from A New Framework for the Gulf of Mexico EcoHealth Metrics, Harwell, Gentile, McKinney, Tunnell, Dennison, and Kelsey.

WORKFLOW

One of the most significant features of the Texas Coastal Resiliency Master Planning process is the utilization of expert elicitation. A Technical Advisory Committee (TAC) was created, composed of researchers in many fields of coastal science; local, state, and federal natural resource agency personnel; non-governmental organizations in the field of coastal management, and engineering experts who had worked closely with the GLO on various coastal projects in the past. The 2016 TAC was composed of members from the 2012 planning effort as well as new members.

Input from the TAC was elicited at several points in the Master Planning process (Figure 2), and comprises one of the most important datasets used. First, HRI subdivided the Texas coastal zone into regions and subregions. Then, Issues of Concern were developed, starting from the IOCs developed in 2012 and focusing more specific on concepts of coastal resiliency. The TAC was asked to evaluate their level of concern for each IOC within each subregion via an online survey. Then, potential projects or solutions to those issues were developed by AECOM, working from the previous list of projects developed as well as a wide range of other sources. Then, at four regional meetings, the TAC was asked to assess those potential projects in terms of how they addressed the Issues of Concern identified for the subregions where the projects were located. The results from those meetings were used to group potential projects in tiers, and selected projects were further evaluated. The top tier of projects were grouped into "strategies," which will soon be presented to the TAC as a first-cut for inclusion into the Phase I Texas Coastal Resiliency Master Plan.

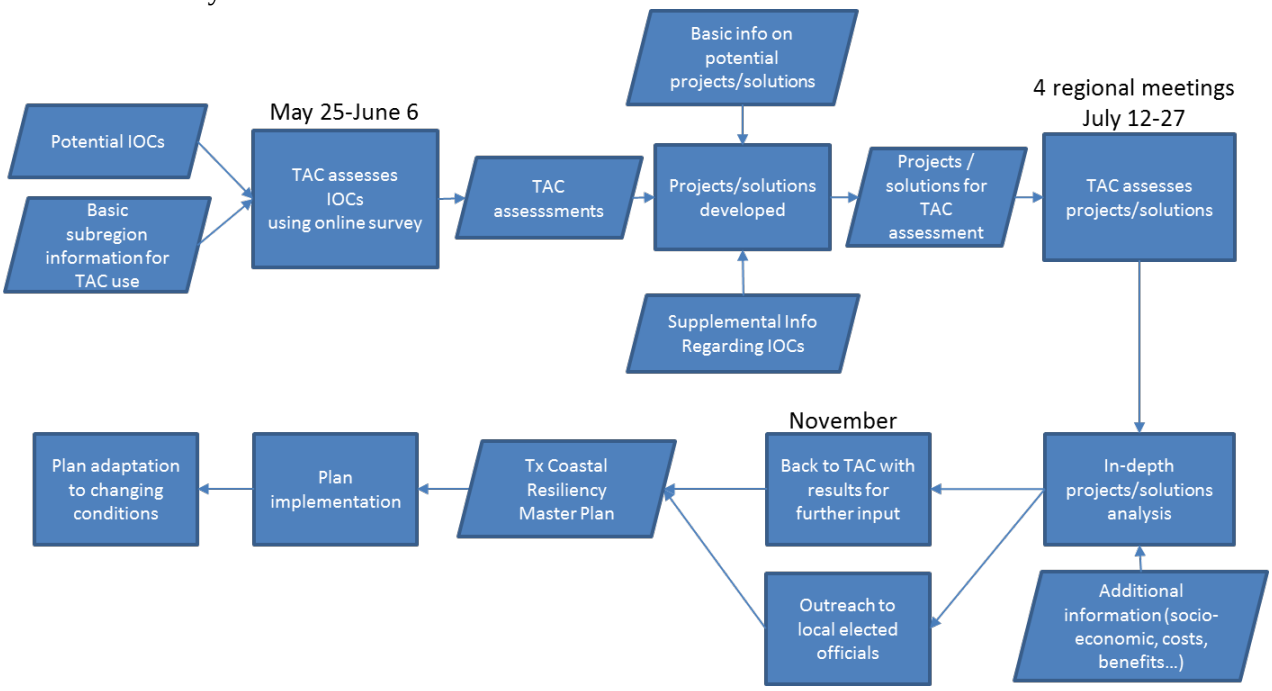


Figure 2. Workflow for Phase I of the Texas Coastal Resiliency Master Planning process.

IDENTIFYING COASTAL SUBREGIONS

The 2012 coastal planning effort began with the delineation of coastal regions and subregions based on the spatial distribution of the projects that would be evaluated by the TAC and the location of geographic features such as water bodies, land masses, and population centers. One of the lessons learned

from the 2012 effort was that subregions should be based on a standard dataset that could be utilized along the entire Texas coast. Several different datasets were considered for use in developing subregion boundaries, including TCEQ service regions; Texas Water Development Board Groundwater Management Areas and Regional Water Planning Areas; Texas Parks and Wildlife Department Gould Ecoregions, Natural Subregions, Omernik Level IV Ecoregions, and River Basins datasets; and several different levels of Hydrologic Unit Codes (HUC) developed by the U.S. Geological Survey. The 2016 subregions were ultimately delineated according to USGS HUC10 watershed units, and bounded landward by the GLO Coastal Zone Boundary. The HUC10 watershed units were chosen because they made sense ecologically, coincided neatly with the bay systems, and were small enough to provide for local-level analysis yet could be combined in meaningful ways to make larger units for landscape-level analysis. Using the watershed dataset also allowed for contiguous coverage across the Texas coast, an enhancement from the 2012 effort (Figure 3).

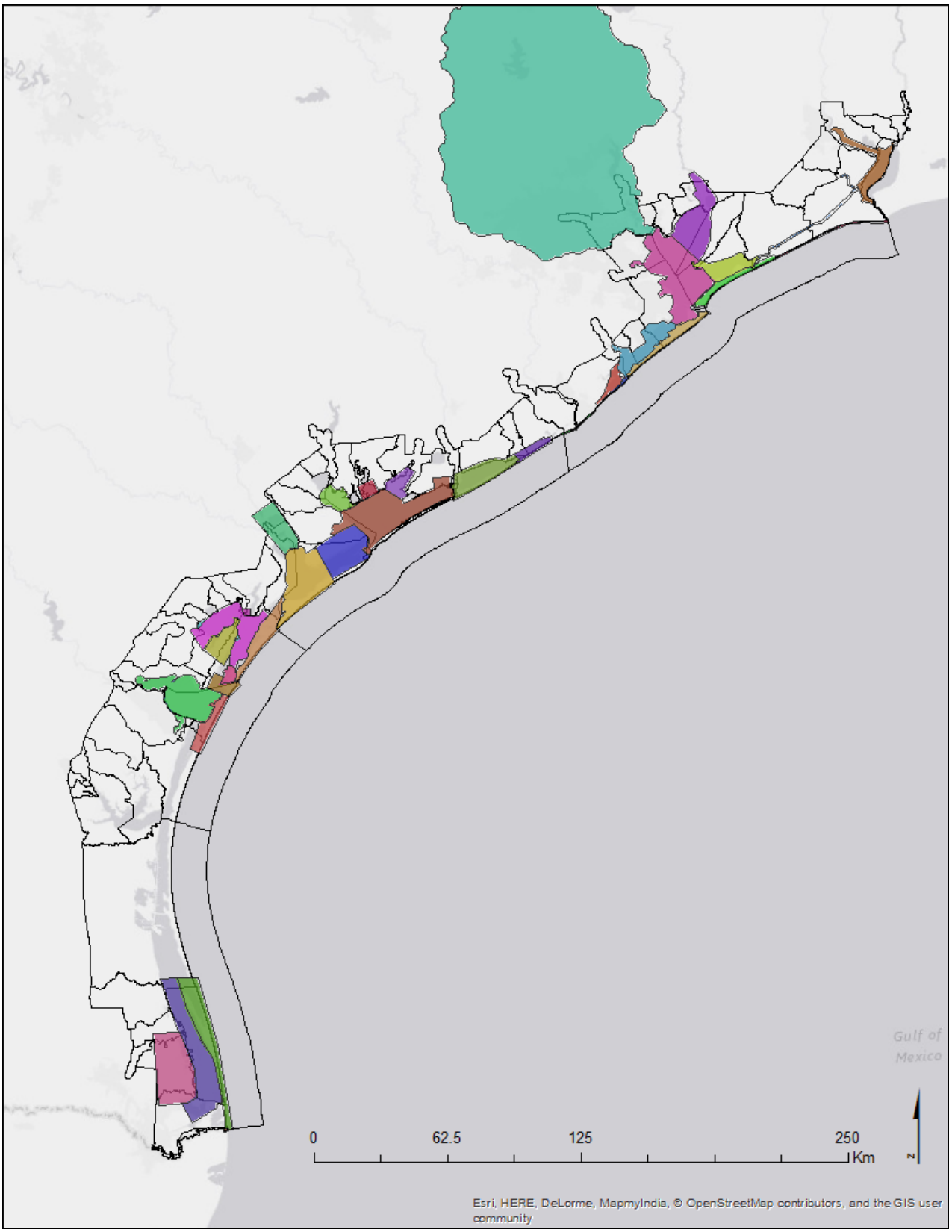


Figure 3. Texas coastal subregions, 2012 (color) and 2016 (hollow). The 2012 subregions were based on geographic distribution of projects, while the 2016 subregions were based on USGS HUC10 watershed units.

ISSUES OF CONCERN (IOCS)

IOCs developed in 2012

At the 2012 TAC meetings, participants were asked to assess their level of concern for each issue within each subregion on a scale of zero to four, zero being "not at all concerned," and four being "extremely concerned." The values were then averaged for each IOC within each subregion, resulting in a single value (IOC score) for each Issue of Concern within each subregion.

2012 Issues of Concern

Wetlands and Habitat Loss
Gulf Beach Erosion and Dune Degradation
Bay Shoreline Erosion
Flooding and Storm Surge
Water Quality and Quantity
Public Access: Gulf and Bay
Impacts to Fish and Wildlife
Impacts to Marine Resources
Navigation: Commercial and Recreation
Marine Debris
Public Health and Safety
Land Subsidence
Invasive Species
Lack of Information and Data
Community Resilience
Tourism and Local Economy
Other

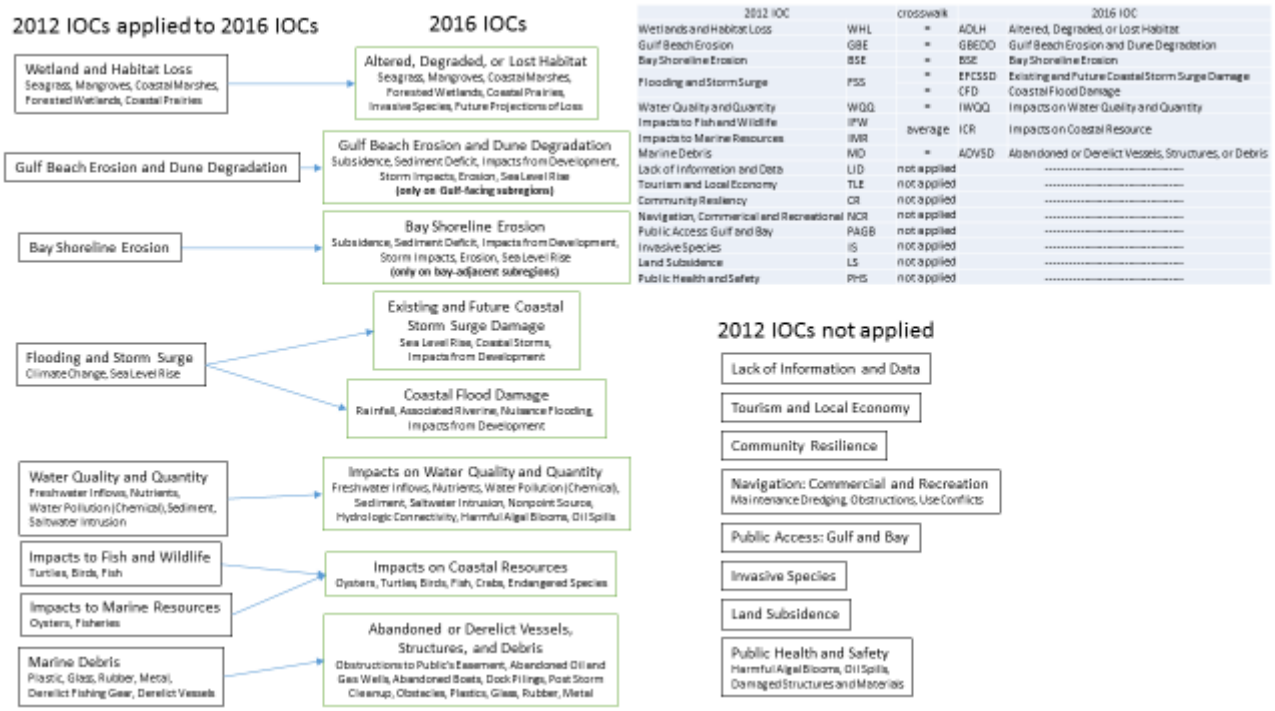
IOCs developed in 2016

Potential issues of concern for the 2016 Texas Coastal Resiliency Master Plan process were developed in conjunction with the GLO to be more explicitly related to the concept of coastal resiliency, using the IOCs developed in 2012 as a starting point.

2016 Issues of Concern

Altered, Degraded, or Lost Habitat
Gulf Beach Erosion and Dune Degradation
Bay Shoreline Erosion
Existing and Future Coastal Storm Surge Damage
Coastal Flood Damage
Impacts on Water Quality and Quantity
Impacts on Coastal Resources
Abandoned or Derelict Vessels, Structures, or Debris

A crosswalk was developed to re-map 2012 IOCs to 2016 IOCs (Figure 4).This crosswalk served as a starting point for applying the top Issues of Concern identified for each subregion in 2012 to the new 2016 subregions. This was achieved by performing a spatial join (ArcGIS) between the subregions developed in 2016 and the subregions and IOC scores developed in 2012.



2012 IOC		crosswalk		2016 IOC
Wetlands and Habitat Loss	WHL	*	AOLH	Altered, Degraded, or Lost Habitat
Gulf Beach Erosion	GBE	*	GBEDD	Gulf Beach Erosion and Dune Degradation
Bay Shoreline Erosion	BSE	*	BSE	Bay Shoreline Erosion
Flooding and Storm Surge	FSS	*	EFCSSD	Existing and Future Coastal Storm Surge Damage
		*	CFD	Coastal Flood Damage
Water Quality and Quantity	WQQ	*	IWQQ	Impacts on Water Quality and Quantity
Impacts to Fish and Wildlife	IFW	average	ICR	Impacts on Coastal Resource
Impacts to Marine Resources	IMR			
Marine Debris	MD	*	AOVSD	Abandoned or Derelict Vessels, Structures, or Debris
Lack of Information and Data	LID	not applied		----------
Tourism and Local Economy	TLE	not applied		----------
Community Resiliency	CR	not applied		----------
Navigation, Commerical and Recreational	NCR	not applied		----------
Public Access Gulf and Bay	PAGB	not applied		----------
Invasive Species	IS	not applied		----------
Land Subsidence	LS	not applied		----------
Public Health and Safety	PHS	not applied		----------

Figure 4. 2012 IOCs crosswalked to 2016 IOCs.

In the common case where more than one 2012 subregion intersected a 2016 subregion, the IOC scores from all 2012 subregions intersecting the 2016 subregion were averaged to obtain a mean IOC score for each issues in each region (Figure 5).

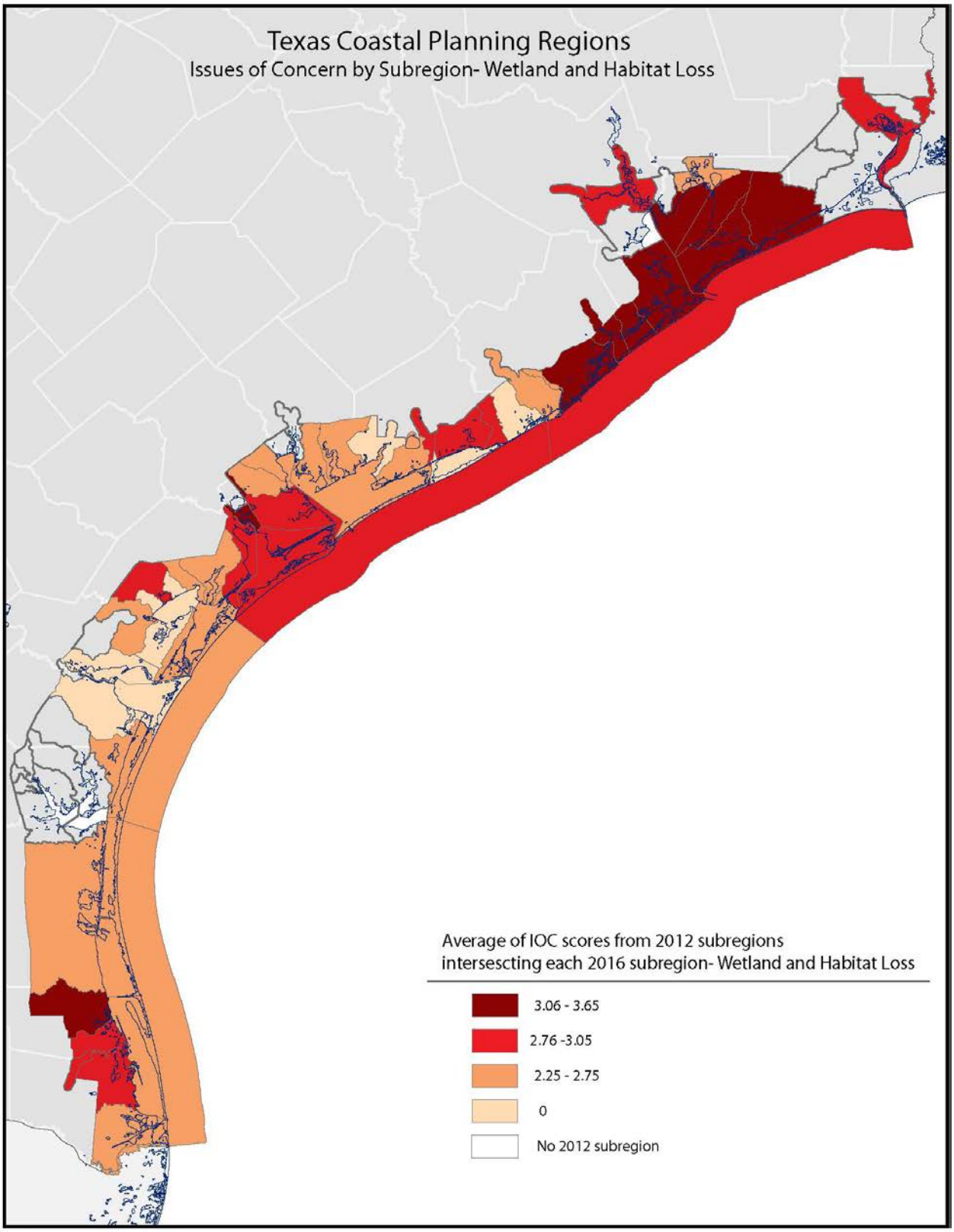


Figure 5. To develop IOC scores for 2016 subregions, IOC scores for the 2012 subregions were averaged together where more than one 2012 subregion intersected a 2016 subregion.

Once the 2012 IOCs were applied to the 2016 subregions (where there was overlap), an online survey was created using the Qualtrics software program. This survey was introduced to the TAC via a WebEx webinar. The TAC was asked to complete the survey, assigning a level of concern for all potential IOCs within each subregion, and were given the option to agree to the previously identified IOC scores for subregions that had been scored in 2012. To assist the TAC in their evaluation, maps and figures were included depicting shoreline change rates, storm surge inundation, spatial distribution of major marine, estuarine, palustrine, and upland environments including oyster reefs and seagrass beds, wetland loss and upland development, and data describing ocean-related economics for each region. The TAC was also asked to provide any additional information they had to support the assessment of Issues of Concern in each subregion, such as additional datasets or any specific knowledge of issues not reflected in the data. An FAQ document was also produced to provide supplemental information on the IOC survey, underlying data for the maps and figures, and information on the overall Texas Coastal Resiliency Master Planning effort.

PROJECT EVALUATION

One of the goals of the 2016 Texas Coastal Resiliency Master Planning effort was to expand the list of projects that came out of the 2012 effort. At that time, out of over 100 projects, about 40 projects were selected as "top projects." These project were selected through an expert elicitation method where the TAC was asked to score each project based on how well each project aligned with the Issues of Concern in its local subregion, its likelihood of reducing the identified IOCs, project feasibility, and potential social, economic, or ecologic loss if the project did not occur. These scores were compiled using a "best average" method and grouped into quartiles (please see the report from the 2012 effort for an explanation of the "best average" method). Projects falling into the first quartile for each subregion were chosen as "top projects."

One of the first tasks in the 2016 effort was to expand the list of "top projects" from the 2012 effort. The "best average" scores were still used, but instead of taking the top quartile of projects from each region, a natural breaks method was used to cluster the projects into non-overlapping groups or classes. Natural breaks (jenks) seeks to reduce the variance within classes and maximize the variance among classes. This method represents an enhancement from the previously used method of selecting the top quartile of "best average" scores, as it includes all projects with similar scores, minimizing the risk of unintentionally excluding similarly scored project because they fall outside the top quartile. The top 3 clusters of projects were chosen as selected projects, which roughly corresponded to the top half of "best average" scores in each subregion, resulting in a list of 80 projects instead of the previously identified 42.

This list was joined with an exhaustive literature search undertaken by AECOM to develop a list of over 700 potential projects to be evaluated. AECOM filtered this list down to around 200 for evaluation by the TAC.

Potential projects were evaluated for inclusion in the Texas Coastal Resiliency Master Plan at four in-person meetings along the Texas coast (one meeting per region). TAC members were asked to evaluate each project in terms of how it addressed each Issue of Concern (with emphasis given to those identified as high priority by the TAC in the online survey) within the subregion or area it was located, as well as the feasibility of the project, and whether it should be considered a priority for coastal resiliency. Discussion was facilitated by means of an interactive live polling system where TAC members were asked to indicate projects' attributes and results were displayed on a screen. This encouraged interaction among TAC members and catered to a well-rounded discussion facilitating consideration of many different perspectives on resiliency. TAC members were asked to mark their final evaluations in a

workbook and workbooks were collected at the end of each meeting and returned to HRI for analysis.

Workbook results for all TAC members were manually input into a spreadsheet for each region. IOC, feasibility, and priority scores were recorded for all projects, and the spreadsheet was also attributed for subregion and project type(s). A final project score was developed. First, for each project, an average IOC score was calculated for each of eight Issues of Concern. Then, each average IOC score was multiplied by the IOC score for that region for each issue, resulting in eight "weighted IOC scores"- one for each Issue of Concern. These weighted IOC scores were then added together, to obtain a weighted sum for each project. This method gives extra weight to projects that score highly in Issues of Concern that are of high concern within their subregion, and de-emphasizes project that may be good projects but don't directly address the most urgent issues. Within each region, the weighted sums for each project were grouped according to natural breaks. Depending on the final number of projects desired, one or more of these groups can be pulled out as "Tier 1" projects for further consideration.

ONLINE IOC AND PROJECT GAP EVALUATION

Please see report for Task 3 and attached documents

TAC RESULTS

Issues of Concern

Sixty-one Technical Advisory Committee members took part in the online Issues of Concern survey, assessing IOCs for an average 24 out of 68 subregions. In general, the TAC assessed highest levels of concern for most potential IOCs in Region1 and lowest levels of concern in Region 4, with moderate levels of concern in Regions 2 and 3. Coastwide, Abandoned or Derelict Vessels, Structures, and Debris ranked lowest.

Region 1

Altered, Degraded, or Lost Habitat was the issue of highest concern in almost every subregion in Region 1. Existing and Future Coastal Storm Surge Damage, Coastal Flood Damage, and Impacts to Water Quality and Quantity were also of high concern. Subregions 1.14 and 1.15- Buffalo Bayou-San Jacinto River and Clear Creek-Frontal Galveston Bay- had the highest overall levels of concern across the entire Texas coast. Issues of highest concern in these subregions include Altered, Degraded, or Lost Habitat, Existing and Future Coastal Storm Surge Damage, Coastal Flood Damage, Impacts to Water Quality and Quantity, and Impacts to Coastal Resources.

Region 2

In Region 2, only one subregion had an Issue of Concern that was identified as "highest concern." In subregion 2.17- San Antonio Bay-Espiritu Santo Bay- Altered, Degraded, or Lost Habitat was identified as an issue of highest concern. Throughout the rest of the region, moderately high levels of concern were identified for most Issues of Concern besides Abandoned or Derelict Vessels, Structures, and Debris. Subregions 2.11 and 2.12- Cox Creek and Keller Branch-Lavaca River- had the lowest levels of concern within the region.

Texas Coastal Ecosystem Services Analysis by Geo-environment

Ecosystems along the Texas coast provide many benefits to communities called ecosystem services. Ecosystem services are generally defined as the benefits provided by the environment that support, sustain, and enrich human life (Yoskowitz et al. 2010). Below is a description of different ecosystem services provided by oyster reefs, beaches and dunes, rookery islands, and coastal wetlands along the Texas coast.

1. Oyster Reefs

Oysters are traditionally viewed as solely a source of food. In 2014, Texas harvested 4.1 million pounds of oysters worth $19 million. Texas has continuously been second in commercial oyster landings among all U.S. states, after Louisiana (NOAA NMFS, 2014). However, in addition to being a commercial fishery commodity, oysters provide many benefits to people including contributing to clearer and cleaner water, removing pollutants and sediment from the water, providing habitat for numerous animals, and recreational opportunities to people.

a. Habitat

Oysters provide an important three-dimensional biogenic habitat for recreationally and commercially valuable species. With their dense assemblages, oysters harbor polychaetes, crustaceans, and other invertebrates which are consumed by juvenile fish and crustaceans, which on the hand use oyster reefs for foraging and as a refuge from predators (Grabowski et al 2012). In fact, a previous study in the Gulf of Mexico found that every $10m^2$ of restored oyster reef habitat creates an additional 2.6 kilograms of fish and crustacean production every year. Using these productivity rates and the market price of the expected landings, the provision of habitat by oysters was valued at $3,780/ha/year (USD 2012) (Grabowski et al 2012). Given the provision of this service, oysters also provide recreational opportunities to many fishermen who are looking for places to fish. Recreation provided by oyster reefs has been previously valued in Louisiana at $6.02/ha/year (USD 2012) (NOAA, 2004).

b. Water quality

Oysters lead clearer and cleaner water. They filter suspended materials from the water and remove phytoplankton and sediments from bay waters via filter feeding activities, a process they use to grow (Newell and Jordan 1983). Oysters then deposit the materials filtered on the sediment surface as feces and/or pseudofeces (Grabowski et al 2012, Kellogg et al 2013). They can also help neutralize the increased anthropogenic concentrations of nitrogen in estuaries via denitrification and the absorption of nutrients into their tissue and shells. These filtering activities lead to improved water quality and support neighboring ecosystems, such as seagrass, by reducing water turbidity and depositing nutrients in the bottom of the water column (Grabowski et al., 2012). One studied quantified the rates of nutrient removal and found that oysters have an hourly rate during the day of 236 micromoles of nitrogen removed per square meter (m2). Using the price of $28.23 per kg of nitrogen removed, which is the current average trading price for nitrogen removal in estuarine ecosystems in the North Carolina nutrient offset Credit program, the value of nitrogen removal by oysters can be valued at $4,130/ha/year (Grabowski et al., 2012).

c. Erosion control

Oyster reefs are natural structures that interact with tidal and wave energy. They slow waves down and increase sedimentation rates. As a result, oyster reefs can serve as natural protection against shoreline erosion and property damage and loss along many estuarine shorelines (Grabowski et al., 2012). Traditionally, the standard practice for inshore shoreline protection is the use of man-made shoreline stabilization structures such as breakwaters, bulkheads, or jetties. However, because oysters can grow vertically faster than expected rising sea levels, one can argue that oysters are more resilient to sea level rise than fixed man-made structures, and consequently have a higher value as shoreline stabilizers. One study used the cost of building man-made structures as the proxy for the value of oyster reefs in protecting the shoreline. The authors valued oyster reefs at $5,900/ha/year (USD 2012) (Grabowski et al., 2012) in locations where homeowners demanded shoreline protection services and oyster reefs worked as perfect substitute for man-made structures. Since this economic valuation method is driven by demand of the service, the value of oyster reef restoration in shoreline stabilization will be positively affected by the proximity to property that people want to protect from erosion.

d. Carbon sequestration

Another important service provided by oysters is their ability to sequester carbon from the water, including phytoplankton, zooplankton, and detritus, as they filter the water and form and grow their shells. All the carbon that is sequestered is not completely removed from the system and part of it is recycled in organic and inorganic form through the process of respiration, feces, and pseudofeces. Particulate carbon is deposited as feces and pseudofeces at the sediment-water interface, where it can be re-suspended in the water column. The part that is not re-suspended is either buried to deep, inactive sediments and isolated from the water column, or respired and returned to the water column in the form of carbon dioxide. As such, oysters can become important players in alleviating the increasing amounts of carbon dioxide in the ocean, especially as global warming may affect the amount of carbon absorbed by the ocean. One study estimated that oysters filtered 164 tons of carbon per year (tC/year) from the water column, of which 15.2 tons were buried to deep sediments and 13 tons were buried in the form of shell (Cerco, 2014). Another study estimated that oyster aquaculture was responsible for 0.83tC/ha/year (hectare = ha). If we use the social cost of carbon to monetize this sequestration rate, then the value of oysters in sequestering carbon is $122/ha/year.

Table 1: Potential ecosystem services value provided by oyster reef restoration and conservation

Ecosystem Service	Value (2012 USD)	Value (2012 USD)
Habitat	$3,780/ha/year[1]	$1,530/acre/year
Recreation	$6.02/ha/year[2]	$2/acre/year
Water quality/nutrient regulation	$4,130/ha/year[3]	$1,671/acre/year
Erosion Control	$5,900/ha/year[4]	$2,388/ha/year
Carbon sequestration	$32.37/ha/year[5]	$13/acre/year

2. Beaches and Dunes

Sandy shores combine both marine and terrestrial components and vary, depending on sand supply, in the extent to which the beach and dune dominates. Due to their unique position between ocean and land, coastal beaches and dunes have provided many benefits to people including the provision of raw materials and ornamental resources, protection against storms, erosion control, water catchment and purification, maintenance of wildlife, carbon sequestration, tourism and recreation, science and education opportunities, and aesthetic views.

a. Raw materials

Beaches and dunes provide raw materials in the form of sand that has been mined for centuries for multiple uses, including extraction of minerals such silica and feldspar for glass and ceramic production, infill for development, amendments for agriculture, and base material for construction products. Although sand is a valuable resource, its extraction through mining can have obvious negative effects, especially on coastal protection and aquifers

b. Storm protection

Coastal protection is arguably one of the most valuable services provided by sand shore ecosystems especially in the face of extreme storms, hurricanes, and sea level rise. As waves reach the shoreline, they are attenuated by the beach slope and, at high tide, also by the dunes. Beaches vary in their ability to attenuate waves depending on their extent and width. Dunes' ability to attenuate waves also varies depending on the dunes' height and width, which is determined by the presence of vegetation and sand supply from the beach (Hesp 1989; Hacker et al., 2012). In South Carolina, storm protection by beaches

[1] Grabowski, J.H., Brumbaugh, R.D., Conrad, R.F., Keeler, A.G., Opaluch, J.J., Peterson, C.H., Piehler, M.F., Powers, S.P., Smyth, A.R., 2012. Economic Valuation of Ecosystem Services Provided by Oyster Reefs. BioScience 62, 900–909.

[2] NOAA, L.D.O.W.A.F. 2004. Louisiana's Oyster Shell Recovery Pilot Project. Socioeconomics Research and Development Section and Marine Fisheries Division, 1-432.

[3] Grabowski, J.H., Brumbaugh, R.D., Conrad, R.F., Keeler, A.G., Opaluch, J.J., Peterson, C.H., Piehler, M.F., Powers, S.P., Smyth, A.R., 2012. Economic Valuation of Ecosystem Services Provided by Oyster Reefs. BioScience 62, 900–909.

[4] Grabowski, J.H., Brumbaugh, R.D., Conrad, R.F., Keeler, A.G., Opaluch, J.J., Peterson, C.H., Piehler, M.F., Powers, S.P., Smyth, A.R., 2012. Economic Valuation of Ecosystem Services Provided by Oyster Reefs. BioScience 62, 900–909.

[5] Cerco, C.F., 2014. Calculation of Oyster Benefits with a Bioenergetics Model of the Virginia Oyster. DTIC Document.

has been valued at $271/per foot and in New Jersey at $81,900/ha/year or $33,144/acre/year (2012 USD) (Pompe and Rinehart, 1999; Liu et al., 2010).

c. Erosion Control

Beaches and sand dunes provide sediment stabilization and soil retention in vegetation root structure, thus controlling coastal erosion and protecting recreational beaches, tourist-related businesses, ocean front properties, land for aquaculture and agriculture, and wildlife habitat. Although this service has not been valued directly, there has been a growing number of studies that value the benefits gained from erosion control programs that either preserve or "nourish" existing beaches and dunes (Landry et al. 2003, Kriesel and Landry 2004, Huang et al. 2007, Whitehead et al. 2008, Morgan and Hamilton 2010). Such programs are often an alternative to property owners building their own erosion protection structures, such as seawalls and groins, which can inadvertently accelerate the degradation of the coastal environment (Landry et al. 2003, Kriesel and Landry 2004). In New Hampshire and Maine, a coastal erosion program that preserves five miles of beach is estimated to have net benefits of $4.45/household, adjusted for the costs associated with disturbance to wildlife habitat, deterioration of water quality, and the risk of injury to swimmers from the program measures (Huang et al. 2007). Landry et al. (2003) found that a one meter increase in beach width, or equivalently, the prevention of one meter of beach erosion, increased oceanfront and inlet-front property values by $233 on Tybee Island in the U.S. state of Georgia. Lastly, a study in California valued erosion control by beaches at $83,000/ha/year or $33,589/acre/year (2012 USD) (Raheem et al., 2012).

d. Provision of Habitat

Coastal dunes and beaches provide important habitat for fish, shellfish, birds, and rodents, which have been an important source of food to many communities.

e. Carbon Sequestration

Dunes that encourage vegetation growth and productivity will also be responsible for carbon sequestration, although this process varies with the type of vegetation, sediment deposition and subsidence, and coastal geomorphology.

f. Recreation and Tourism

Beaches and dunes provide important recreational benefits. Boating, fishing, swimming, scuba diving, walking, beachcombing, and sunbathing are among the numerous recreational and scenic opportunities that are provided by beach and dune access. In the USA alone, 70% of the population visits the beach on vacation, and 85% of total tourism dollars come from beach visits. An analysis of North Carolina beaches shows that implementation of a beach replenishment policy to improve beach width by an average of 100 feet would increase the average number of trips by visitors in the subsequent year from 11 to 14, with beach-goers willing to pay $166/trip or $1574 per visiting household per year. In Texas, recreation provided by beaches has been previously valued at $153-$401/visit, $97.20/trip, $36.7/person/year, and $4,911/person/year (Freeman III, A. M. 1995; Parsons and Kang, 2007).

Table 2: The potential ecosystem services values provided by beach and dunes restoration and conservation

Ecosystem Service	Value (2012 USD)	Value (2012 USD)
Storm Protection	$81,900/ha/year[6]	$33,144/acre/year[6]
Erosion Control	$83,000/ha/year[7]	$33,589/acre/year[7]
Recreation	$153/visit[8] $401/visit[8] $4,811/person/year[8] $36.7/person/trip[9] $97.2/trip[9]	

3. Rookery Islands

Rookery islands are communal nesting ground for birds including herons, egrets, and cormorants. Historically, Texas has supported many colonial water bird nesting islands, however changes in the bays such as relative sea level rise and sediment management practices have resulted in fewer nesting areas for waterbirds (Texas Parks and Wildlife Department, 2015; Stanzel, 2015). Some of these islands were created as a consequence of navigation channels construction and are made of dredge materials, while others were created naturally, like in the case of natural oyster reef islands (other materials include coquina reef rock and cobble, shell, and sand) (Texas Parks and Wildlife Department, 2015).

Rookery islands are threatened by land loss associated with tides, winds, vessel traffic, storms, and predicted sea level rise. It is important to restore rookery islands to make sure they are able to respond to such threats and continue to exist. Some of the benefits rookery islands provide include protecting the shoreline and navigation channels from erosion and providing important habitat for waterfowl and water birds, two of the most commonly watched birds by Texan bird watchers. Bird tourism or avitourism is also an important industry and source of revenue to the state of Texas, which means the restoration of rookery islands can have significant economic impacts to the local and state economies.

In 2011, there were a total of 2,238,000 birders[10] in Texas, of which 95% were state residents, who spend approximately 132 days a year birding (Carver, 2013). Two of the most commonly watched birds were waterfowl, such as ducks and geese, and other water birds such as herons and shorebirds. Rookery islands provide important habitat to these birds and their preservation becomes increasingly important as changes in the bays have resulted in fewer nesting areas for waterbirds. Several studies conducted in the Galveston Bay estuary have found a link between water bird populations and wetland areas; as the latter decreases so do water bird populations.

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[7] Raheem, N., Colt, S., Fleishman, E., Talberth, J., Swedeen, P., Boyle, K.J., Rudd, M., Lopez, R.D., Crocker, D., Bohan, D., O'Higgins, T., Willer, C., Boumans, R.M., 2012. Application of non-market valuation to California's coastal policy decisions. Marine Policy 36, 1166–1171.

[8] Freeman III, A. M. 1995. The benefits of water quality improvements for marine recreation: a review of the empirical evidence. Marine Resource Economics, 10(4), 385–406.

[9] Parsons, G. R., Kang, A. 2007. Valuing Beach Closures on the Padre Island National Seashore. Retrieved from http://pubpages.unh.edu/~jell/parsonsrevisedfall2007/parsons.pdf

[10] A birder, or birdwatcher, according to the National Survey, is any individual that has either taken a trip one mile or more from home for the main purpose of observing birds and/or closely observed or tried to identify birds around the home (https://www.fws.gov/southeast/economicimpact/pdf/2011-birdingreport--final.pdf).

Birders spend money on a variety goods and services for their trip-related and equipment-related purchases. In 2011, approximately 47 million of birders in the U.S. spent an estimated $15 billion on their trips[11] and $26 billion on equipment[12]. If we consider that of the 47 million of birders in the U.S., 4.7% or 2.2 million are Texans or visit Texas for their trips, one can also assume that 4.7% of the $41 billion spent in 2011, *i.e.* $1.9 billion, was spent in Texas in 2011 by birders (Carver, 2013). Thus, bird tourism in Texas has a significant economic impact in local and state economies and can beneficiate from the conservation and restoration of prime bird habitat provided by rookery islands.

4. Coastal Wetlands

Wetlands are lands in between terrestrial and aquatic systems where the water table is frequently at or near the surface or the land is covered by shallow water (Cowardin et al. 1979). They are one of the most productive ecosystems and are responsible for a series of benefits to people such as clean water, recreational opportunities, harvestable fish, and protection against storms (Barbier et al., 2011).

a. **Coastal Marsh** (salt, brackish, and freshwater)

Coastal marshes are a common feature of temperate estuaries throughout the world. Besides being one of the most productive plant communities in the world, coastal marshes are important elements of estuarine ecosystems that provide a food source to numerous estuarine and coastal consumers, serve as habitat for large numbers of juvenile and adult organisms, and play an important role in estuarine chemical cycles (Day et al. 1989). According to the outputs of the first Gulf of Mexico Ecosystem Services Workshop (Yoskowitz et al. 2010), the most important ecosystem services provided for marshes are storm protection, recreation, aesthetics, nutrient cycling, soil retention, and water quality. These services are discussed below.

i. <u>Habitat</u>

Marshes act as a refugium, nursery, and spawning ground for resident and migratory species, including many different species of insects, crustaceans, plants, reptiles, mammals, birds, and fish. These wetlands help maintain fisheries by increasing the production of economically and ecologically important species such as clams, shrimp, oysters, and fish. As an example, salt marshes are thought to account for 25% of the blue crab and 66% of the shrimp production in the Gulf of Mexico (Barbier et al 2011). Due to their closely packed plant structure, they offer habitat that is mostly inaccessible to large fish, thus providing shelter and protection for young fish, shrimp, and shellfish (Barbier et al 2011). Many birds also use marshes as feeding and resting habitat during migrations, as well as for foraging and breeding (Bird Observations 2012). Other animals that use coastal marshes include alligators that are known residents of freshwater marshes and act as large predators on birds and mammals (Weller, 1994) and blue crabs, which are an important commercial species in Texas and use marsh as nursery habitat. Given the variety of species that use wetlands, the provision of this service is vital not only for those animals, but also for the provision of other services such recreational fishing, birding, and hunting. In 2011, a total of 2.2 million people observed birds in Texas and there was a total of $1.8 billion in wildlife-watching related expenditures showing that

[11] Trip-related expenditures include food, lodging, transportation, and other incidental expenses. For trip expenditures, 52 percent was food and lodging, 34 percent was transportation, and 14 percent was other costs such as guide fees, user fees, and equipment rental.

[12] Equipment-related expenditures consist of binoculars, cameras, camping equipment, and other costs. Equipment expenditures were relatively evenly distributed among wildlife watching equipment (29 percent), special equipment (37 percent), and other items (30 percent).

the provision of this service can have a significant economic impact (Carver, 2013; U.S. Fish and Wildlife Service, 2011). In Texas, habitat provided by marshes has been previously valued at $7,910/ha/year (2012 USD) (Feagin et al., 2010).

ii. Storm Protection

Marshes protect coastal populations from damaging extreme weather events such as floods, droughts, or hurricanes, due to their water-storage capacity and vertical structure. They act as buffers by collecting floodwaters, slow their courses, and reduce their peak water levels (Zedler and Elliot 2006). Consequently, these habitats reduce flood-danger and damage to infrastructure resulting from winds and water surge. In addition, as sea level rises, the risk for flooding increases and marshes become crucial factors in dampening those risks. In Texas, the storm protection service of marshes has been previously valued at $7,370/ha/year (2012 USD) (Feagin et al., 2010).

iii. Water Quality

Marshes contribute to improved water quality by removing and breaking down nutrient and non-nutrient compounds and materials (Farber et al., 2006). Organic wastes are frequently introduced into coastal and marine ecosystems and marshes can help filter and decompose those materials (Millennium Ecosystem Assessment, 2005). An indicator of this service is the maximum amount of chemicals that can be recycled or halted on a sustainable basis by ecosystems (de Groot et al. 2009). In Galveston Bay, the ability of marshes to filter non-nutrient compounds has been previously valued at $418/ha/year (USD 2012) (Ko, J.-Y., Johnston, S.R., 2007).

The ability of marshes to store, process, and acquire nutrients, such as nitrogen and phosphorus, is an component that leads to improved water quality. Balanced levels of nutrients are directly related to things important to communities, such as water quality and clarity, food production, and the presence of fish. Contrarily, alterations to nutrient levels resulting in nutrient surplus, cause eutrophication of soils and water bodies and nutrient deficit cause soil exhaustion and loss of fertility (Lavelle and Berhe, 2005). Unsustainable agricultural practices, such as soil fertilization, release excessive levels of nutrients in aquatic systems leading to eutrophication, the depletion of oxygen in the water, and consequently in the reduction of fish populations and degradation of water quality (Lavelle and Berhe 2005). Healthy ecosystems are dependent upon efficient cycling and availability of nutrients and marshes are important players in cycling nutrients and maintaining healthy nutrient levels in aquatic systems.

iv. Recreation

Marshes provide opportunities for recreational activities such as fishing, birding, and hunting. Wildlife-related recreational activities play a significant role in Texas economy. In 2011, there were approximately 6.3 million people in Texas who participated in wildlife-associated recreational activities (including fishing, hunting, and wildlife watching), spending roughly $6.2 billion in wildlife-associated expenditures. Texas was the fourth State with the highest wildlife-associated expenditures, after New York, Florida, and California, with $9.16, $9.12, and $7.65 billion, respectively. Texas is also the State with more hunters (a total of 1.147 million of residents and non-residents) and the second with more anglers (2.25 million of residents and non-residents) in the nation (U.S. Fish and Wildlife Service, 2011). These numbers show how a large portion of recreational expenditures depends upon healthy ecosystems. For this reason, it is in the stakeholders' best interest to protect the well-being and function of these habitats not only from

human stressors such as pollution, but also from climate stressors such as sea level rise. In Texas, recreation provided by marshes has been previously valued at $5,170/ha/year (2012 USD) (Feagin et al., 2010).

v. Food

Food production is a portion of primary production that can be extractable as food. In the case of marshes, the presence of edible plants and animals, like fish and crustaceans, makes these habitats indirect providers of food for humans.

vi. Aesthetics

Aesthetics is the appreciation of natural scenery, other than through recreational activities (de Groot et al. 2009). For marshes, the aesthetic quality of the ecosystem would be based on elements such as structural diversity, quality of the water, "greenness", and tranquility. An example of how people appreciate a certain habitat is by looking at the number of houses that border that habitat or the amount of users of scenic routes. A way of valuing this service is by using hedonic price, a method that analyzes variations in house prices that reflect the home owner's willingness to pay to live close to natural areas (Harte Research Institute, 2012). Barrier Islands are a good example of this; despite higher house prices, insurance costs, and probability of being hit by a hurricane, people still want to own a house close to the coast.

vii. Soil retention

Coastal erosion is a serious hazard not only for people living near the coast, but also for organisms living along the coasts in bays, estuaries, and shallow water (Stewart 2009). Marshes play an important role in controlling coastal erosion by preventing soil loss by wind and runoff and avoiding buildup of silt (Farber et al. 2006). Marsh vegetation is crucial in retaining the soil and consequently it is frequently used as a shoreline erosion control measure (Broome et al. 1992). This service is directly linked to human well-being since it influences elements such as water quality, water clarity, fisheries, and recreational opportunities. Even if very important to coastal populations, this service is still not frequently valued in the ecosystem services valuation literature (Harte Research Institute, 2012).

viii. Carbon Sequestration

Marshes are able to regulating the chemical composition of the atmosphere and oceans by sequestering carbon. Marshes sequester and store millions of tons of carbon every year by burying it and thereby contributing to alleviate the effects of increasing atmospheric carbon dioxide (Cebrian 2002; Feagin et al 2010). In Texas, carbon sequestration by salt marshes has been previously valued at $1,335/ha/year (2012 USD) (Feagin et al., 2010).

Table 3: *Potential ecosystem services values provided by marsh restoration and conservation*

Ecosystem Services	US$ 2012
Habitat	$7,910/ha/year[13]
Storm protection	$7,370/ha/year[13]
Water purification	$418/ha/year[14]
Recreation	$5,170/ha/year[13]
Carbon sequestration	$1,335/ha/year[13]

b. Mangroves

Mangroves are dominated by trees adapted to seawater and changing tides that help maintain water quality by removing pollutants carried to the Gulf from rivers and land runoff. They are also home to many protected bird species such as egrets, herons, and the roseate spoonbill. They provide many benefits to people including carbon sequestration water purification, recreational opportunities, water supply, and erosion control. These benefits are explained below.

a. Carbon Sequestration

Mangroves regulate the chemical composition of the atmosphere and oceans by sequestering carbon from the water and air and deposit it in their biomass and in the soil. Mangrove are among the largest stores of organic carbon, containing on average 1,023Mg carbon per hectare (or approximately 414Mg C per acre) (Alongi, 2002; Donato et al, 2011). This important role in alleviating greenhouse gas emissions is an important argument in favor of mangrove conservation and restoration. In Texas, carbon sequestration by mangroves has been valued at $384/ha/year (USD 2014) (Harte Research Institute, 2014).

b. Habitat

Mangroves are a prime nursery habitat to many animals including different species of insects, plants, reptiles, mammals, birds, finfish, and shellfish. Some of the finfish and shellfish with commercial and/or recreational value that use mangroves include white shrimp, brown shrimp, blue crab, speckled sea trout, white sea trout, and flounder. Due to their roots and branches, mangroves offer habitat that is mostly inaccessible to large fish, thus providing shelter and protection for young fish, shrimp, and shellfish (Heck et al 2003; Minello et al 2003; Barbier et al 2011). In South Florida, mangroves are thought to account for 75% percent of the game fish and 90% of the commercial species (Asokan 2012). There is no equivalent study in Texas. In Mexico, the contribution of mangroves to shrimp harvest has been previously valued at $2,450/ha/year or $991/acre/year (2012 USD) (Barbier and Stand, 1998).

c. Water Purification

Mangroves contribute to improved water quality by removing nutrients and pollutants from the water. This leads to clearer and cleaner water and to improved aesthetic and recreational opportunities, as more people will visit places with clean water versus polluted and murky water. Mangroves retain, remove, and cycle pollutants and nutrients from land-based sources before they reach neighboring habitats such as

[13] Feagin, R. A, M. L Martinez, G. Mendoza-Gonzalez, and Robert Costanza. (2010). "Salt Marsh Zonal Migration and Ecosystem Service Change in Response to Global Sea Level Rise: A Case Study from an Urban Region." (Appendix) Ecology and Society 15, no. 4: 14.

[14] Ko, J.-Y., Johnston, S.R., 2007. The Economic Value of Ecosystem Services Provided by the Galveston Bay/Estuary System. Texas A&M University at Galveston, Department of Marine Sciences & Center for Texas Beaches and Shores.

submerged aquatic vegetation and coral reefs. Their root system slows the water flow enabling the deposition of sediment on the bottom; toxins and nutrients are moved to sediment particles and then removed during sediment deposition (Saenger 2002). This service has not been valued in Texas or the United States, but in Mexico it has been valued at $1,680/ha/year or $679.87/acre/year (USD 2012) (Cabrera et al., 1998).

d. Recreation

Recreational activities in mangroves is associated with fishing, boating, kayaking, swimming, birding, and hunting. Given the variety of animals that live or visit mangroves, it is no surprise people seek this habitat for their recreational activity. This service has not been previously valued in Texas or in the United States; in Mexico however, recreation provided by mangroves has been valued at $177/ha/year or $72/acre/year (USD 2012) (Mendoza-González et al., 2012).

e. Storm protection

Storm protection is the role mangroves play in reducing the effects of extreme weather events such as storms and hurricanes by slowing wave energy and fast moving waters. Mangroves with its water-storage capacity and strong roots that trap sediment, protect humans from flood damages and act as a buffer by collecting floodwaters, slowing their courses, and reducing their peak water levels (Zedler and Elliot 2006). This service has not been valued in Texas or the United States. In Mexico, it has been valued at $3,690/ha/year or $1,493/acre/year (USD 2012) (Valdez et al., 2013).

f. Erosion control

The ability of mangroves to stabilize sediment and retain soil in their roots helps reduce shoreline erosion and damage. Despite the importance of this service to coastal communities and infrastructure, this service has not been previously valued in Texas or the United States. Most valuation studies took place in Asian countries where mangroves are more prominent.

Table 4: *Potential ecosystem services values provided by mangroves restoration and conservation*

Ecosystem Services	**US$ 2012**	**US$ 2012**
Carbon Sequestration	$384/ha/year[15] (2014 US$) $373/ha/year (2012 US$)	$155/acre/year (2014 US$) $150/acre/year (2012 US$)
Habitat	$2,450/ha/year[16]	$991/acre/year
Water purification	$1,680/ha/year[17]	$679.87/acre/year
Recreation	$177/ha/year[18]	$72/acre/year
Storm Protection	$3,690/ha/year[19]	$1,493/acre/year

[15] Harte Research Institute, 2014. GecoView: Gulf of Mexico Ecosystem Services Viewer. A Story Map about the benefits of our coastal habitats. Harte Research Institute. Available at: http://www.gecoview.org.

[16] Barbier, E. B., Strand, I. E. (1998). Valuing Mangrove-Fishery Linkages - A Case Study of Campeche, Mexico. SSRN eLibrary. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=868667

[17] Cabrera, M. A., Seijo, J., Euan, J., & Perez, E. (1998). Economic Values of Ecological Services from a Mangrove Ecosystem. Intercoast Network, 32, 1-2.

[18] Mendoza-González, G., Martínez, M.L., Lithgow, D., Pérez-Maqueo, O., Simonin, P., 2012. Land use change and its effects on the value of ecosystem services along the coast of the Gulf of Mexico. Ecological Economics 82, 23–32.

[19] Valdez, V.C., Ruiz-Luna, A., Ghermandi, A., Nunes, P.A.L.D. 2013. Valuation of Ecosystem Services provided by coastal wetlands in northwest Mexico. Ocean & Coastal Management.

c. Coastal prairies Wetlands

Coastal prairies along the Texas Gulf Coast provide a variety of ecosystem services including gas regulation, water quality, and bird habitat. Once covering over 6.5 million acres of Texas land, prairies now occupy less than 1% of these lands or only 65,000 acres (Baldwin et al, 2007).

i. Gas Regulation

Prairies have extensive root systems that can go as deep as 15 feet underground. With these systems, they are able to store carbon both in their roots and in the soil, as they grow and form new soil (Hale et al., 2014). Studies have shown that natural prairie and grassland ecosystems hold much more carbon in their soils than agricultural lands. On the other hand, the stored carbon can be released in the air if prairies are degraded or converted into agricultural land. One study estimated that in the United States, 5000 million metric tons of carbon have been released into the air from the conversion of natural land to agricultural land (Hale et al., 2014). A previous study by Potter et al. (1999) found that restored grasslands could sequester 428lbs of C per acre per year, or 0.48 t C/ha/year. Using the social cost of carbon which puts a value of $40 per ton of carbon dioxide sequestered, this translates into $70/ha/year or $28.5/acre/year (2014 US$). Another study by Sims and Bradford (2001) found that native prairie grass could sequester on average 623lbs C per acre per year, which translates to $103/ha/year or $41.48/acre/year (2014 US$) using the same method.

ii. Habitat

Prairies provide habitat to a variety of animals, including birds such as sparrows and flycatchers. The presence of vegetation provides nesting cover for these grassland birds. A study by Rudolph et al. (2014) conducted winter bird surveys to assess the link between restored prairies and bird population. They found over 30 different species of grassland birds and particularly grassland sparrow populations increased dramatically post-restoration. For this reason, coastal prairies attract birders from all over the country to view their unique assemblage of species. Additionally, they provide appealing, aesthetic views and their bird populations keep insect populations under control in the surrounding area.

iii. Water Quality

Prairies contribute to improved water quality by filtering and storing nutrients. Coastal prairies wetlands are significant sinks for nutrients such as inorganic nitrogen and phosphorus, and by capturing and controlling the release of these nutrients, coastal prairies wetlands help regulate and improve water quality. A study by Forbes et al. (2012) found that prairies retained 7.36 lbs./acre/year of incoming nitrogen and filtered a total of 0.54lbs./acre/year of phosphorus. It is important to consider these important prairie wetlands because without them, significantly higher levels of nutrients would reach the bays and affect recreational and commercial activities that depend on healthy bay ecosystems (Enwright et al., 2011). Prairie tallgrass can also store and cycle nutrients in plant biomass and in the soil. A study by Risser et al.

(1982) found that prairie grasses could remove 22lbs./acre/year of nitrogen through the shoot and root system of the prairie grass and then transfer it to the soil.

Table 5: *Potential ecosystem services values provided by prairie wetlands restoration and conservation*

Ecosystem Services	**US$ 2012**	**US$ 2012**
Carbon Sequestration	$70 - $103/ha/year (2014 US$)[20,21,22] $68 - $100/ha/year (2012 $)	$28.5 -$41.49/acre/year (US$ 2014) $27.6 - $40.2/acre/year (2012 $)

d. Hardwood bottomland forest wetlands

Texas bottomland hardwood forests are vast areas of riparian and coastal forests along the central coast of Texas that provide important benefits to coastal populations, despite being under continuous threat due to fragmentation, agricultural development, and urban expansion. Bottomlands went from 700,000 acres to about 150,000 acres from 1997 to 20013 (U.S. Fish and Wildlife Service, 1997; Carver, 2013). This unique system is composed of freshwater flow from the upstream rivers, bayous, sloughs, wetlands, banks, floodplains, and diverse hardwood forest. Some of the ecosystem services provided by these forests include provision of raw materials and water supply, protection against storms, water quality, carbon sequestration, recreational and aesthetic opportunities, and provision of habitat.

i. Storm protection

Hardwood forests have the ability to retain significant amounts of water, which in a severe storm surge flooding event can be very beneficial as these forests are able to buffer and mitigate storm surge that would otherwise flood neighboring areas and create significant damage. Hardwood forests are also found along rivers and their floodplains, which makes them an important resource in absorbing flood waters and overbank flow from rivers. This ability of retaining water for long periods of time and then slowly releasing it into the Gulf is also responsible for maintaining balanced estuaries, salt water marshes, and other wetlands that also provide storm protection services (Hale et al., 2014).

ii. Water Quality

Harwood forests are able to retain and filter nutrients such as nitrogen and phosphorous and other pollutants that when in excess, degrade the water quality. Thus, by keeping the levels of nutrients and non-nutrient compounds balanced, forested wetlands provide an important service essential for the wellbeing of all living things in any ecosystem. One study on riparian forests in Georgia found denitrification rates that ranged between 1.2lbs. N /acre/year, 27.6 lbs. N/acre/year and 263 lbs. N/acre/year, depending on nitrate

[20] Potter, K. N., Torbert H. A., Johnson, H. B., & Tischler, C. R. (1999). Carbon Storage After Long-¬Term Grass Establishment on Degraded Soils. Soil Science, Vol 164, No 10, 718 -725.

[21] Sims, P. L., & Bradford, J. A. (2001). Carbon dioxide fluxes in a southern plains prairie. Agricultural and Forest Meteorology, Vol 109, 117-¬134.

[22] Using the Social Cost of Carbon: Interagency Working Group on Social Cost of Carbon, 2015. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government.

and carbon loads in the area. The difference in rates showed that riparian forests exposed to higher levels of nutrient pollution will have a higher retention rate than those subject to lower loads (Hale et al., 2014).

iii. Carbon Sequestration

The tree composition of the bottomlands in Texas is very unique and there is a lack of carbon data for this type of forest (Sugarberry, American elm, and Green ash). Nonetheless, bottomland forests store large amounts of carbon in their trees and soils and sequester high rates of carbon each year through vegetation growth and soil formation. A study estimated that bottomlands can accumulate carbon at a rate of 2,086lbs. C/acre/year, or 1.04 tons C/acre/year (Hale et al., 2014).

iv. Habitat and Recreational Opportunities

Every year, neotropical songbirds migrate from Central and South America to North America. Bottomlands provide food, shelter, water, and a resting place for millions of these birds (Hale et al., 2014). As a consequence, these forests attract thousands of wildlife viewers and birders. In addition to migrating birds, these forest are also home to many resident birds that spend all year in this habitat. Waterfowl are also residents and some areas of the bottomlands are open to duck hunting, providing important economic and recreational opportunities (Hale et al., 2014). In 2011, birding generated 666,000 jobs and $31 million in employment income and $6 billion in State tax revenue, showing that bottomland forests can have significant economic impact in the state (Carver, 2013).

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Project Alternatives Economic Impact Analysis

The economic impact analysis of different project alternatives was conducted and is presented below. This analysis was performed using IMPLAN© (Impact Analysis for PLANning), a software program that traces spending by a project or program through the economy in a given time period. The cumulative effects of the specific projects are estimated monetarily.

Results show *direct effects*, *indirect effects*, and *induced effects*. Direct effects represent the impacts for the expenditures specified as direct final demand changes. Indirect effects are the impacts caused by industries purchasing from industries as a result of the direct final demand changes. Induced effects include all the impacts on all local industries caused by the expenditures of new household income generated by the direct and indirect effects of direct final demand changes. Value-added, as seen in some of the tables below, include employee compensation, proprietary income (payments received by self-employed individuals as income), other property type income (payments to individuals in the form of rents, royalties, dividends), and indirect business taxes. Lastly, the total output is provided in dollars and represents the value of an industry's total production.

The five different project alternatives include:

1. Barrier Island Restoration
2. Beach Nourishment and Dune Restoration
3. Marsh Restoration and Shoreline Protection
4. Oyster Reef Restoration
5. Rookery Island Restoration

1. Barrier Island Restoration

Project #320- GIWW Barrier Island Restoration, Old River and Hickory Cove

Project type: Habitat Creation and Shoreline Stabilization
Description: This measure would restore islands that once protected the GIWW at the northern end of Sabine Lake in front of Old River Cove and Hickory Cove.
Region: 1
County: Orange
Cost of the project: $8,373,374
Multiplier effect in the county: 1.33
Total multiplier effect in the whole State: 1.73

IMPLAN Analysis Summary

The completion of project #320 generates a total output of $8.47 million to Orange County (Table 1). For every dollar spent on this project in Orange County, $1.33 are generated in the county's economy. However, since not all materials and services necessary to complete this project can or will be purchased in the county, we have analyzed the impact the project can have in other parts of the state. Thus, in addition to the $8.47 million generated in Orange County, an added $2.59 million are generated in the state (Table 3), which adds up to a total of $11.2 million (Table 5). This means that overall, for every dollar spent on project #320, $1.73 are generated in the state (Orange County included). There are also approximately 76 jobs (full- and part-time jobs) created and/or supported (Table 5). The top ten industries impacted by project #320 can be found in tables 2 and 4.

Table 6: Economic Impact to Orange County

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	44.1	$2,207,711	$2,756,769	$6,377,208
Indirect Effect	10.9	$413,368	$671,333	$1,159,635
Induced Effect	7.9	$241,886	$551,409	$935,713
Total Effect	63	$2,862,964	$3,979,510	$8,472,556

Table 7: Top Ten Industries impacted in Orange County

Sector	Description	Employment	Labor Income	Value Added	Output
58	Construction of other new nonresidential structures	23.8	$1,454,055	$1,809,601	$4,293,615
449	Architectural, engineering, and related services	7.5	$425,201	$361,922	$819,711
395	Wholesale trade	2.6	$144,500	$369,251	$569,021
62	Maintenance and repair construction of nonresidential structures	1.8	$108,009	$132,286	$343,419

414	Scenic and sightseeing transportation and support activities for transportation	3.4	$25,608	$66,666	$330,279
462	Office administrative services	7.2	$160,490	$182,639	$329,508
441	Owner-occupied dwellings	0	$0	$172,515	$243,428
433	Monetary authorities and depository credit intermediation	0.6	$29,058	$60,005	$109,095
440	Real estate	0.8	$4,670	$76,012	$108,654
445	Commercial and industrial machinery and equipment rental and leasing	0.2	$27,657	$62,423	$80,385

Table 8: Economic Impact to the State (in addition to Orange County)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	8.2	$565,543	$950,895	$1,899,849
Induced Effect	4.5	$225,411	$384,029	$690,991
Total Effect	12.7	$790,954	$1,334,924	$2,590,839

Table 9: Top Ten Industries Impacted in the State (in addition to Orange County)

Sector	Description	Employment	Labor Income	Value Added	Output
395	Wholesale trade	1.1	$101,034	$193,043	$273,342
156	Petroleum refineries	0	$8,427	$52,523	$222,530
20	Extraction of natural gas and crude petroleum	0.1	$30,383	$74,459	$96,991
449	Architectural, engineering, and related services	0.5	$49,149	$44,824	$76,280
411	Truck transportation	0.4	$24,330	$27,253	$62,006
440	Real estate	0.4	$9,663	$45,109	$61,506
441	Owner-occupied dwellings	0	$0	$42,001	$59,266
454	Management consulting services	0.4	$31,812	$32,272	$52,076
427	Wired telecommunications carriers	0.1	$8,438	$23,404	$44,872
49	Electric power transmission and distribution	0	$5,780	$11,738	$44,498

Table 10: Total Economic Impact of project #320 to the State of Texas

Impact Type	Employment	Labor Income	Value Added	Total Output
Direct Effect	44.1	$2,207,711	$2,756,769	$6,377,208
Indirect Effect	19.1	$978,911	$1,622,228	$3,059,484
Induced Effect	12.4	$467,297	$935,438	$1,626,704
Total Effect	75.7	$3,653,918	$5,314,434	$11,063,395

2. Beach Nourishment and Dune Restoration

Project #145 - Town of South Padre Island Gulf Shoreline

Project type: Beach Nourishment and Dune Restoration.
Description: This project would provide approximately 8.15 miles of beach nourishment and dune restoration for the Town of South Padre Island's Gulf shoreline.
Region: 4
County: Cameron
Cost of the project: $7,211,719
Multiplier effect in the county: 1.58
Total multiplier effect in the whole State: 1.98

IMPLAN Analysis Summary

The completion of project #145 generates a total output of approximately $11.4 million in Cameron County (Table 6). For every dollar spent on this project in the county, $1.58 are generated in the county's economy. In addition, since not all materials and services will be purchased in the county, we have analyzed the impact the project can have everywhere else in the state. Thus, in addition to the $11.4 million generated in Orange County, an added $2.87 million are generated in the state (Table 8), which adds up to a total of $14.25 million (Table 10). This means that overall, for every dollar spent on project #145, $1.98 are generated in the state's economy. There are also approximately 104 jobs (full- and part-time jobs) created and/or supported (Table 10). The top ten industries impacted by project #145 can be found in tables 7 and 9.

Table 11: Economic Impact to Cameron County

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	53.5	$1,672,936	$2,305,232	$7,208,811
Indirect Effect	23	$608,251	$1,343,713	$2,530,958
Induced Effect	14.9	$466,908	$904,611	$1,633,535
Total Effect	91.3	$2,748,094	$4,553,556	$11,373,305

Table 12: Top Ten Industries Impacted in Cameron County

Sector	Description	Employment	Labor Income	Value Added	Output
58	Construction of other new nonresidential structures	40.2	$1,238,427	$1,838,738	$6,013,402
395	Wholesale trade	2.5	$99,944	$313,761	$505,142
449	Architectural, engineering, and related services	4.9	$201,105	$159,571	$459,404
414	Scenic and sightseeing transportation and support activities for transportation	2.8	$78,214	$112,437	$333,216
62	Maintenance and repair construction of nonresidential structures	2	$65,309	$91,245	$316,014

462	Office administrative services	5.5	$157,164	$174,053	$286,443
441	Owner-occupied dwellings	0	$0	$161,723	$228,201
440	Real estate	1.7	$13,023	$159,916	$227,202
407	Retail – Non-store retailers	2.2	$17,822	$96,931	$197,073
403	Retail - Clothing and clothing accessories stores	2.1	$31,387	$86,918	$154,580

Table 13: Economic Impact to the State (in addition to Cameron County)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	7.7	$593,495	$1,013,011	$2,128,941
Induced Effect	4.8	$242,507	$416,690	$745,161
Total Effect	12.5	$836,003	$1,429,701	$2,874,102

Table 14: Top Ten Industries Impacted in the State (in addition to Cameron County)

Sector	Description	Employment	Labor Income	Value Added	Output
156	Petroleum refineries	0	$16,721	$104,213	$441,531
20	Extraction of natural gas and crude petroleum	0.2	$58,725	$143,816	$187,324
395	Wholesale trade	0.6	$59,444	$113,375	$160,435
449	Architectural, engineering, and related services	1.1	$102,920	$93,872	$159,673
454	Management consulting services	0.4	$39,784	$40,358	$65,084
441	Owner-occupied dwellings	0	$0	$44,364	$62,600
440	Real estate	0.4	$8,599	$39,968	$54,480
209	Other concrete product manufacturing	0.2	$11,589	$16,509	$45,845
464	Employment services	0.8	$28,793	$36,020	$43,874
437	Insurance carriers	0.1	$10,381	$18,342	$40,625

Table 15: Total Economic Impact of project #145 to the State

Impact Type	Employment	Labor Income	Value Added	Total Output
Direct Effect	53.5	$1,672,936	$2,305,232	$7,208,811
Indirect Effect	30.7	$1,201,746	$2,356,724	$4,659,899
Induced Effect	19.7	$709,415	$1,321,301	$2,378,696
Total Effect	103.8	$3,584,097	$5,983,257	$14,247,407

3. Marsh Restoration and Shoreline Protection

Project #380- Gordy Marsh Restoration & Shoreline Protection - Phase 1

Project type: Habitat creation and restoration
Description: This project will provide shoreline protection and marsh restoration on Gordy Marsh, a 1,700 acre coastal wetland and prairie habitat that borders Trinity Bay. Gordy Marsh is located within an area rated as a high conservation priority by Chambers County and the Galveston Bay Foundation.
Region: 1
County: Chambers
Cost of the project: $24,826,773
Multiplier effect in the county: 1.20
Total multiplier effect in the whole State: 1.61

IMPLAN Analysis Summary

The completion of project #380 generates a total output of approximately $28.66 million in Chambers County (Table 11). For every dollar spent on this project in the county, $1.20 are generated in the county's economy. In addition, we have analyzed the impact the project can have anywhere else in the state. Thus, in addition to the $28.66 million generated in Chambers County, an added $9.7 million are generated in the state (Table 13), which adds up to a total project impact of $38.8 million (Table 15). This means that overall, for every dollar spent on project #380, $1.61 are generated in the state's economy. There are also approximately 202 jobs (full- and part-time jobs) created and/or supported (Table 15). The top ten industries impacted by project #380 can be found in tables 12 and 14.

Table 16: Economic Impacts to Chambers County

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	120.8	$11,016,676	$12,471,802	$23,837,512
Indirect Effect	15.8	$780,038	$1,404,206	$2,294,761
Induced Effect	15.9	$544,121	$1,569,267	$2,525,471
Total Effect	152.5	$12,340,835	$15,445,275	$28,657,744

Table 17: Top 10 Industries Impacted in Chambers County

Sector	Description	Employment	Labor Income	Value Added	Output
58	Construction of other new nonresidential structures	96.2	$9,194,310	$10,631,160	$20,722,551
449	Architectural, engineering, and related services	10.6	$951,961	$862,362	$1,513,438
62	Maintenance and repair construction of nonresidential structures	4.4	$389,137	$447,592	$958,039
441	Owner-occupied dwellings	0	$0	$665,978	$939,734

462	Office administrative services	11.4	$648,783	$683,726	$919,981
440	Real estate	3.3	$136,044	$420,152	$552,761
395	Wholesale trade	2.3	$156,898	$355,761	$531,491
445	Commercial and industrial machinery and equipment rental and leasing	0.8	$58,072	$185,023	$249,936
411	Truck transportation	1.2	$47,262	$55,998	$160,010
502	Limited-service restaurants	2.3	$39,691	$72,456	$122,413

Table 18: Economic Impact to the State (in addition to Chambers County)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	31.9	$2,154,931	$3,634,234	$7,186,827
Induced Effect	17.4	$850,667	$1,439,102	$2,559,853
Total Effect	49.3	$3,005,598	$5,073,336	$9,746,680

Table 19: Top 10 Industries Impacted in the State (in addition to Chambers County)

Sector	Description	Employment	Labor Income	Value Added	Output
395	Wholesale trade	3.9	$367,472	$702,238	$994,404
156	Petroleum refineries	0.1	$36,785	$229,269	$971,366
20	Extraction of natural gas and crude petroleum	0.5	$129,412	$317,106	$413,063
449	Architectural, engineering, and related services	2	$195,524	$178,305	$303,531
411	Truck transportation	1.5	$96,216	$107,774	$245,159
441	Owner-occupied dwellings	0	$0	$159,628	$225,244
440	Real estate	1.5	$34,679	$162,165	$221,135
209	Other concrete product manufacturing	1	$47,589	$67,820	$188,454
464	Employment services	3.2	$108,065	$135,332	$164,956
454	Management consulting services	1.1	$95,565	$96,948	$156,472

Table 20: Total Economic Impact of Project #380 to the State of Texas

Impact Type	Employment	Labor Income	Value Added	Total Output
Direct Effect	120.8	$11,016,676	$12,471,802	$23,837,512
Indirect Effect	47.7	$2,934,969	$5,038,440	$9,481,588
Induced Effect	33.3	$1,394,788	$3,008,369	$5,085,324
Total Effect	201.8	$15,346,433	$20,518,611	$38,404,424

4. Oyster Reef Restoration and Shoreline Stabilization

Project #19- East Galveston Bay Ecosystem Oyster Reefs

Project type: Habitat creation and restoration and shoreline stabilization
Description: The goal of the project is to restore Galveston Bay oyster reef habitats in response to large-scale impacts from Hurricane Ike and increased harvest pressures due to Deepwater Horizon and population growth. The project will also restore a 130 acre oyster reef in East Galveston Bay and collect side scan sonar data to create new GIS maps detailing the locations and aerial extents of restored and natural oyster reefs.
Region: 1
County: Galveston
Cost of the project: $15,043,640
Multiplier effect in the county: 1.50
Total multiplier effect in the whole State: 1.97

IMPLAN Analysis Summary

The completion of project #19 generates a total output of approximately $14.7 million in Galveston County (Table 16). For every dollar spent on this project in the county, $1.50 are generated in the local economy. In addition, we have analyzed the impact the project can have anywhere else in the state and found that besides the $28.66 million generated in Galveston County, an added $4.6 million is generated in the state (Table 18), which adds up to a total project impact of $19.3 million (Table 20). This means that overall, for every dollar spent on project #19, $1.97 are generated in the state's economy. There are also approximately 123 jobs (full- and part-time jobs) created and/or supported (Table 20). The top ten industries impacted by project #19 can be found in tables 17 and 19.

Table 21: Economic Impact to Galveston County

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	60.5	$3,773,865	$4,701,307	$9,808,866
Indirect Effect	19.9	$728,894	$1,349,264	$2,520,723
Induced Effect	19.2	$626,790	$1,347,677	$2,391,059
Total Effect	99.7	$5,129,549	$7,398,248	$14,720,647

Table 22: Top 10 Industries Impacted in Galveston County

Sector	Description	Employment	Labor Income	Value Added	Output
58	Construction of other new nonresidential structures	32.2	$2,162,207	$2,642,813	$6,003,687
395	Wholesale trade	5.6	$397,833	$875,510	$1,296,879
449	Architectural, engineering, and related services	10.5	$629,747	$540,913	$1,183,844
414	Scenic and sightseeing transportation and support activities for transportation	5.6	$180,401	$247,776	$682,95

62	Maintenance and repair construction of nonresidential structures	2.9	$202,569	$241,664	$582,135
462	Office administrative services	7.3	$405,693	$428,060	$579,183
441	Owner-occupied dwellings	0	$0	$310,138	$437,623
440	Real estate	2.9	$20,253	$276,153	$393,316
156	Petroleum refineries	0	$7,121	$79,161	$357,323
437	Insurance carriers	0.7	$48,463	$87,998	$198,537

Table 23: Economic Impact to the State (in addition to Galveston County)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	14.1	$976,733	$1,615,215	$3,105,219
Induced Effect	9.4	$492,972	$841,022	$1,496,746
Total Effect	23.5	$1,469,705	$2,456,238	$4,601,964

Table 24: Top 10 Industries Impacted in the State (in addition to Galveston County)

Sector	Description	Employment	Labor Income	Value Added	Output
395	Wholesale trade	1.8	$169,806	$324,374	$459,267
20	Extraction of natural gas and crude petroleum	0.4	$102,637	$251,166	$327,124
411	Truck transportation	0.9	$57,647	$64,558	$146,713
441	Owner-occupied dwellings	0	$0	$77,648	$109,566
440	Real estate	0.7	$16,476	$76,446	$104,190
438	Insurance agencies, brokerages, and related activities	0.5	$32,943	$42,186	$92,174
156	Petroleum refineries	0	$3,687	$21,555	$90,424
62	Maintenance and repair construction of nonresidential structures	0.4	$30,086	$35,348	$81,219
449	Architectural, engineering, and related services	0.5	$48,060	$43,841	$74,524
427	Wired telecommunications carriers	0.1	$13,924	$38,602	$74,002

Table 25: Total Economic Impact of Project #19 to the State of Texas

Impact Type	Employment	Labor Income	Value Added	Total Output
Direct Effect	60.5	$3,773,865	$4,701,307	$9,808,866
Indirect Effect	34	$1,705,627	$2,964,479	$5,625,942
Induced Effect	28.6	$1,119,762	$2,188,699	$3,887,805

Total Effect	123.2	$6,599,254	$9,854,486	$19,322,611

5. Rookery Island Restoration and Shoreline Stabilization

Project #72- Long Reef Shoreline Stabilization and Habitat Protection

Project type: Habitat creation and restoration and shoreline stabilization
Description: The project involves placement of USACE dredged material on the Western tip of the rookery island to raise its elevation and installation of geotubes to be used as breakwaters and sediment retention structures.
Region: 3
County: Aransas
Cost of the project: $1,915,228
Multiplier effect in the county: 1.42
Total multiplier effect in the whole State: 1.88

IMPLAN Analysis Summary

The completion of project #72 generates a total output of approximately $2.7 million to Aransas County (Table 21). For every dollar spent in the county on this project, $1.42 are generated in the local economy. In addition, we have analyzed the impact the project can have anywhere else in the state and found that an additional $881,689 is generated (Table 23), adding up to a total project impact of $3.6 million (Table 25). This means that overall, for every dollar spent on project #72, $1.88 are generated in the state's economy. There are also approximately 24 jobs (full- and part-time jobs) created and/or supported (Table 25). The top ten industries impacted by project #72 can be found in tables 22 and 24.

Table 26: Economic Impacts to Aransas County

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	13	$545,498	$691,080	$1,894,875
Indirect Effect	4.6	$132,524	$265,409	$493,719
Induced Effect	2.6	$71,389	$174,348	$300,710
Total Effect	20.2	$749,411	$1,130,837	$2,689,305

Table 27: Top 10 Industries Impacted in Aransas County

Sector	Description	Employment	Labor Income	Value Added	Output
58	Construction of other new nonresidential structures	9.6	$387,844	$531,104	$1,528,826
449	Architectural, engineering, and related services	2	$75,158	$57,939	$182,176
395	Wholesale trade	0.6	$16,802	$67,535	$113,189
414	Scenic and sightseeing transportation and support activities for transportation	0.6	$32,778	$40,467	$90,355
62	Maintenance and repair construction of nonresidential structures	0.5	$19,972	$26,061	$78,910

440	Real estate	0.6	$5,954	$54,724	$77,100
462	Office administrative services	0.8	$53,137	$55,615	$72,446
441	Owner-occupied dwellings	0	$0	$43,260	$61,042
407	Retail – Non-store retailers	0.4	$3,621	$19,041	$38,557
411	Truck transportation	0.3	$5,359	$7,809	$37,058

Table 28: Economic Impact to the State (in addition to Aransas County)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	2.7	$183,924	$328,005	$662,678
Induced Effect	1.4	$70,820	$122,042	$219,011
Total Effect	4.2	$254,744	$450,047	$881,689

Table 29: Top Ten Industries Impacted in the State (in addition to Aransas County)

Sector	Description	Employment	Labor Income	Value Added	Output
156	Petroleum refineries	0	$4,024	$25,079	$106,256
395	Wholesale trade	0.2	$18,978	$36,264	$51,351
20	Extraction of natural gas and crude petroleum	0.1	$14,157	$34,697	$45,198
445	Commercial and industrial machinery and equipment rental and leasing	0.1	$9,052	$23,216	$30,500
449	Architectural, engineering, and related services	0.2	$16,020	$14,609	$24,866
209	Other concrete product manufacturing	0.1	$4,915	$7,004	$19,463
441	Owner-occupied dwellings	0	$0	$13,531	$19,093
49	Electric power transmission and distribution	0	$2,464	$5,005	$18,977
440	Real estate	0.1	$2,871	$13,405	$18,278
437	Insurance carriers	0.1	$4,659	$8,232	$18,237

Table 30: Total Economic Impact of Project #72 to the State of Texas

Impact Type	Employment	Labor Income	Value Added	Total Output
Direct Effect	13	$545,498	$691,080	$1,894,875
Indirect Effect	7.3	$316,448	$593,414	$1,156,397
Induced Effect	4	$142,209	$296,390	$519,721
Total Effect	24.4	$1,004,155	$1,580,884	$3,570,994

GLO Contract No. 16-108-000-9359
Coastal management Program—Cycle 18
Project Deliverables- Task 3

I. Documents, maps, or resources provided, if any, to GLO to assist in TAC and stakeholder outreach.

QUALTRICS SURVEYS

ISSUES OF CONCERN SURVEY

A survey was developed to elicit information from the Technical Advisory Committee (TAC) regarding the level of concern for each IOC in each of 68 subregions along the Texas coast. Maps and information were included in the survey to provide context for TAC evaluations. Along with a short paragraph characterizing each subregion, the following maps and figures were produced for every subregion:

- Map 1, Shorelines
- Map 2, Storm Surge and Human Development
- Map 3, Land cover and Habitats
- Graph, Land Cover Change
- Table, Regional Ocean Economy Data

A FAQ document was also created to accompany the IOC survey

GAP PROJECTS SURVEY

At four regional in-person meetings, the TAC was asked to evaluate projects based on how well they addressed local issues of concern, the projects' feasibility, and which projects would be considered a priority for coastal resiliency. TAC members were also asked to submit information for potential projects that would fill any gaps where issues may exist that were not currently being addressed by any of the projects included for evaluation. The 60 submitted gap projects were then compiled and included in another online survey. The online survey was designed to replicate the information provided and questions asked in the face-to-face meetings as closely as possible. For each project, a short project description was included, and an interactive table was provided to TAC members to indicate the level of benefit each project would achieve for each IOC, as well as the feasibility of the project and whether the project should be considered a priority for coastal resiliency. TAC members were also asked to provide any additional information or any other comments on the project if appropriate.

MEETING MATERIALS DEVELOPED

INTERACTIVE MAP

For each regional face-to-face meeting, an interactive ArcGIS map was developed for live exploration to facilitate discussion and provide more information during the meetings. The map document incorporated over 30 underlying datasets including the following:

- Gulf and bay shoreline change rates
- Shoreline types
- Wetland types and rates of change
- Locations of seagrass beds, oyster reefs, and rookery islands
- Endangered species critical habitat
- Navigation channels
- Gulf and bay access points
- Dredge placement areas and identified offshore sand sources
- Artificial reef locations
- Category 1 and 3 storm surge inundation extents
- Developed lands
- Census information

LARGE-SCALE MAPS

For each regional meeting, a set of large maps were designed and printed for display around the meeting room. Some maps were intended to provide context and additional information during the meeting, and some maps were intended for TAC members to mark up, indicating the locations of potential gap projects to be submitted. Maps provided included:

- Regional overview
- Shoreline and wetlands change rates
- Sections of each region for TAC members to indicate gap project locations

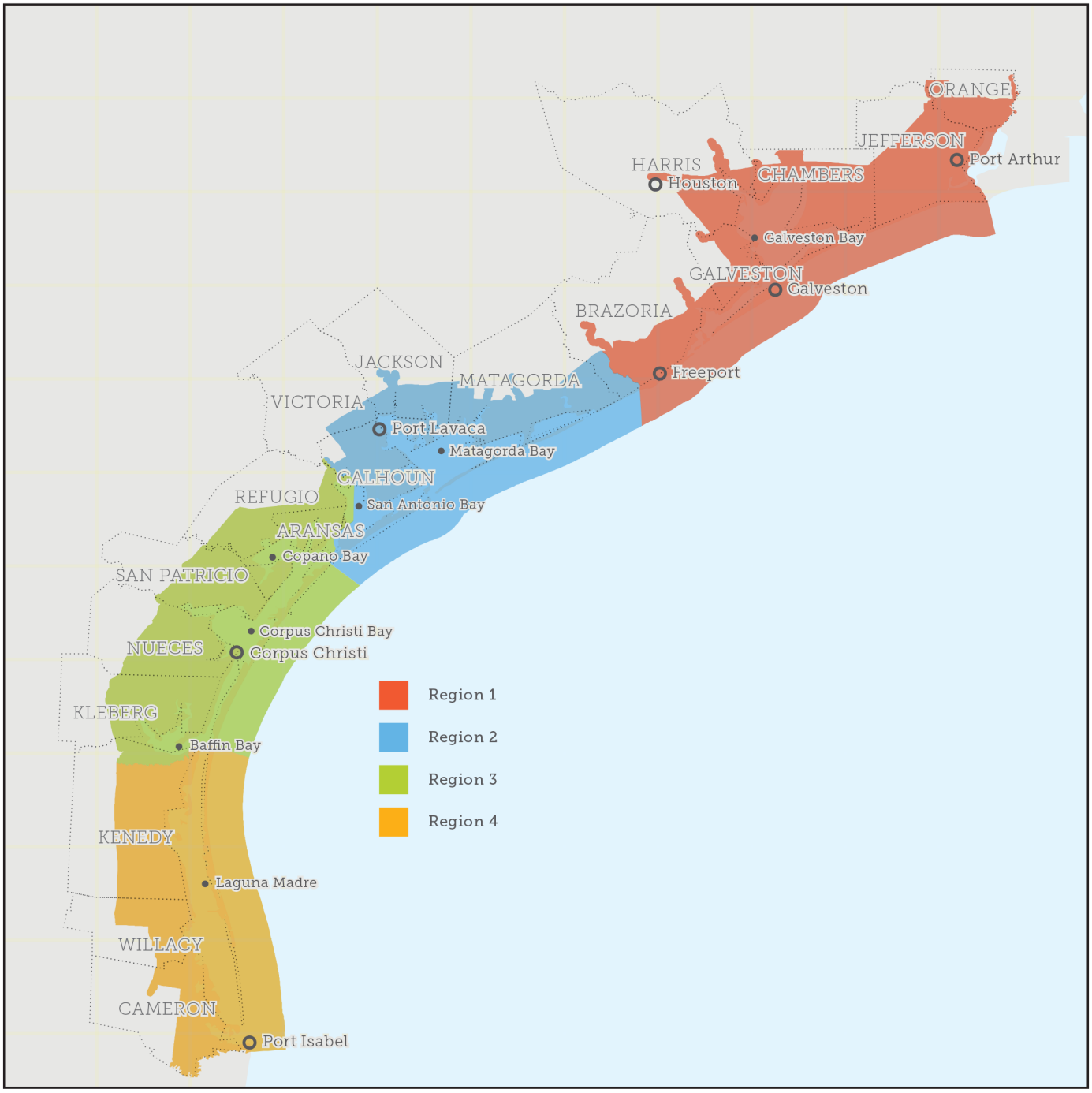
INFO PACKET MAP

A shoreline change rate map was produced for inclusion in each regional information packet. This need was identified after the Region 3 meeting, so no shoreline change rate map was included in the Region 3 packet.

Cover Page

Texas General Land Office

Technical Advisory Committee Project Gap Submissions



The purpose of this survey is to collect feedback on potential projects for inclusion in the Texas Coastal Resiliency Master Planning effort. The projects included in this survey comprise all gap projects submitted to the GLO during and after the face-to-face Technical Advisory Committee (TAC) meetings via the Project Gap Submission form or any other means. This survey has been designed to replicate, as much as possible, the materials available at the four TAC meetings held in July.

Please refer to the Gap projects information packet for maps of project locations, explanation of terms, and project types and subtypes. Use of Google Maps and any other external information is

also encouraged to help you evaluate projects. A PDF copy of the workbook can be downloaded using the following link: Gap projects workbook

This survey is organized by region (Region 1, Region 2, Region 3, Region 4, and Regionwide). Each region comprises a single page. You may provide feedback on as many or as few projects in as many or as few regions as you wish. If you do not feel comfortable providing feedback for a region or project, simply skip that region or those projects.

You may use the forward and back arrows at the bottom of the page to move forward through the survey. **You may close and then return to the survey at any time until you submit your responses, as long as your cookies are enabled and you access the survey link from the same computer and web browser each time. You must use the arrows at the bottom of the page to "lock in" your answers before you close your browser.** If you complete the survey and submit your responses but would like to provide additional input on any of the projects, you may start the survey again but you will be unable to review previous responses. You can use the original link to re-access the survey. During analysis, we will only consider your most recent response for each project.

Note: This survey is not anonymous. You will be required to enter your contact information below. You may be contacted via this email address for further clarification of your responses.

Please contact Luz Lumb at the Harte Research Institute (luz.lumb@tamucc.edu) for any issues regarding the use of this survey software or issues with links, and Elizabeth Vargas at the Texas General Land Office (Elizabeth.Vargas@GLO.Texas.gov) with any other questions.

Please enter your contact information (required):

Name

Organization

Email address

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Technical Advisory Committee Workbook - Project Gap Submissions
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Region 1

Study Area #1: Gulf Facing Beaches and Dunes

Subregion 1.01
Gulf Facing Beaches and Dunes

Region 1
Study Area #1: Gulf Facing Beaches and Dunes
Subregion 1.01

Project ID: 9026

Project Name: Shoreline Stabilization from Galveston Seawall to 8 Mile Road

Project Subtype (Type):


Mis. Wave Break (Shoreline Stabilization)


Gulf (Beach Nourishment)

Project Description:

The project proposes to provide shoreline stabilization along the Gulf beach of Galveston's West End and the creation of a feeder beach to passively nourish the shoreline from the Galveston Seawall to 8 Mile Road through natural transport.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degredation	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #2: Sabine Lake Area

Subregion 1.04
Cow Bayou

Region 1
Study Area #2: Sabine Lake Area
Subregion 1.04

Project ID: 9018
Project Name: Hydrologic Restoration of Upper Cow Bayou

Project Subtype (Type):

 Wetlands/ Forested Wetlands (Habitat Creation & Restoration)

 Hydrologic Restoration (Environmental)

 Studies (Studies, Policies & Programs)

Project Description:

The goal of the proposed project is to return Upper Cow Bayou, a tributary to Sabine River, to its natural hydrologic state by restoring meanders and reducing saltwater intrusion. This will in turn protect the existing Cypress-Tupelo habitat. A study may be required to determine the best methodology to restore the hydrology and protect the wetlands.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 1.05
Tenmile Creek - Neches River

Region 1
Study Area #2: Sabine Lake Area
Subregion 1.05

Project ID: 9019
Project Name: Rose City Marsh Restoration

Project Subtype (Type):

 Marsh (Habitat Creation & Restoration)

Project Description:
The project involves the beneficial use of dredged materials to restore substrate for marsh and forested wetlands in former Cypress-Tupelo swamp.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 1
Study Area #2: Sabine Lake Area
Subregion 1.05

Project ID: 9025
Project Name: Bessie Heights Marsh Restoration

Project Subtype (Type):

 Marsh (Habitat Creation & Restoration)

Project Description:
The proposed project would restore a historical marsh complex at Bessie Heights Marsh in the Lower Neches WMA that has been lost to subsidence. The marsh restoration methodology will be Beneficial Use of Dredge Material (BUDM) cells with sacrificial containment berms.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○

Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #3: West Sabine Lake Area

Subregion 1.06
Salt Bayou

Region 1
Study Area #3: West Sabine Lake Area

Subregion 1.06

Project ID: 9047
Project Name: Sabine Ranch Habitat Protection

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
Sabine Ranch is a critical, 12,100-acre component of the largest remaining contiguous coastal freshwater marsh system in Texas. Protection of the Sabine Ranch, almost entirely within the McFaddin NWR boundary, is the U.S. Fish and Wildlife Service's (USFWS) top conservation priority for the upper Texas coast. Sabine Ranch's central position within 100,000+ acres of federal and state protected beach and marshland make the permanent protection of this coastal habitat critical to the entire complex. Conserving and restoring these lands will avert further losses of marshland and biological diversity. Sabine Ranch's coastal marshes, prairies and woodlots provide important habitat for 35 of the 48 avian species that are USFWS Species of Conservation Concern in the Gulf Prairies Bird Conservation Region.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #5: Trinity Bay Area

Subregion 1.12
Old River - Trinity River

Region 1
Study Area #5: Trinity Bay Area
Subregion 1.12

Project ID: 9024
Project Name: Maintain Freshwater Inflows to Trinity River Delta

Project Subtype (Type):

 Fisheries (Wildlife)

 Fresh Water Inflow (Environmental)

 Studies (Studies, Policies & Programs)

Project Description:

The project proposes to maintain freshwater inflows and sediment transport to the Trinity River Delta, thereby maintaining habitat for Vallisneria and brackish water clams. A study may be required to determine the best methods for maintaining freshwater inflows.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #8: Galveston Bay Area

Subregion 1.17
Dickinson Bayou

Region 1
Study Area #8: Galveston Bay Area
Subregion 1.17

Project ID: 9016
Project Name: Swan Lake Marsh Restoration

Project Subtype (Type):

 Marsh (Habitat Creation & Restoration)

Project Description:
The project proposes the beneficial use of dredged material for restoring salt marshes and associated channels in Swan Lake in lower Galveston Bay.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 1
Study Area #8: Galveston Bay Area
Subregion 1.17

Project ID: 9022
Project Name: Jones Bay Oyster Restoration

Project Subtype (Type):

 Oyster Reef (Habitat Creation & Restoration)

 Studies (Studies, Policies & Programs)

Project Description:
The proposed project would restore and/or create oyster reef habitat within the Jones Bay system. Included in the project is a study of the Bay to determine locations with favorable conditions for oyster reef habitat.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4

Altered, Degraded, or Lost Habitat						
Bay Shoreline Erosion						
Existing or Future Coastal Storm Surge Damage						
Coastal Flood Damage						
Impacts to Water Quality and Quantity						
Impacts to Coastal Resources						

Would you consider this project a priority for coastal resiliency?

Yes | No | I don't know

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 1

Study Area #8: Galveston Bay Area

Subregion 1.17

Project ID: 9061
Project Name: Galveston Island Bayside Flood Protection Feasibility Study

Project Subtype (Type):


Studies (Studies, Policies & Programs)

Project Description:
The Galveston Flood Defense Committee is concerned with preventing flooding occurring from water rapidly moving south from Galveston Bay onto Galveston Island during storm events. Bayside flood protection for the City of Galveston is an essential part of any option for reducing storm surge impacts on Galveston Island. This project would look at existing research for a Galveston Island bayside levee and supplement it as necessary with a detailed feasibility and engineering study in order to provide a body of information for various community stakeholders to use to arrive at a consensus for projects.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #10: Freeport Bay Area

Subregion 1.22
Lower San Bernard River

Region 1
Study Area #10: Freeport Bay Area
Subregion 1.22

Project ID: 9046
Project Name: Follets Island Conservation Initiative

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:

The Follets Island Conservation Initiative is a partnership effort to acquire and protect an additional 1,300 acres on the island and transfer title to the Texas Parks and Wildlife Department. Critically important wildlife habitats on the island include tall grass prairies, salt and fresh water marshes, sea grass meadows, oyster reefs, mud flats, sand dunes, and Gulf beaches. The island is important for Kemp's Ridley sea turtles, piping plovers, waterfowl, wading birds and shorebirds. Follets Island helps protect the entire estuary system, including Drum and Christmas Bays, from degradation from storms and allows the natural movement and restoration of habitats after storm events.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 1
Study Area #10: Freeport Bay Area
Subregion 1.22

Project ID: 9056
Project Name: Restoration of the San Bernard River Deltaic Process

Project Subtype (Type):


Studies (Studies, Policies & Programs)


Hydrologic Restoration (Environmental)

Project Description:
The San Bernard River mouth has closed numerous times. Restoration of a functional river mouth would alleviate navigation issues at the Brazos River lock/gate, enhance sediment movement towards Sargent, and improve water quality conditions in the San Bernard River. The addition of a

gate west of the San Bernard River would provide a means to maintain the river mouth. This would require a concerted effort at operating the locks/gates to ensure that flow conditions maintain the river mouth. A study is proposed to determine the best means and methods for the restoration.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 2

Region 2

Study Area #2: East Matagorda Bay Area

Subregion 2.02
East Matagorda Bay

Region 2
Study Area #2: East Matagorda Bay Area
Subregion 2.02

Project ID: 9030
Project Name: Matagorda Peninsula and East Matagorda Bay State Scientific Area

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

 Acquisitions (Land Acquisition)

Project Description:
The project proposes the acquisitions of the East Matagorda Peninsula Barrier Island (from bay shoreline to Gulf dunes) and the Matagorda Peninsula to establish a state scientific area. The

adjacent bays are a refuge for sea turtles, critical fish habitat, and support oyster and sea grass habitats. The recent establishment of a Texas Parks and Wildlife Department Ecosystem Resources Program Habitat Team provides staff for monitoring and ecosystem studies.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 2
Study Area #2: East Matagorda Bay Area
Subregion 2.02

Project ID: 9050
Project Name: Sargent Ranch Addition to San Bernard NWR

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
Sargent Ranch consists of approximately 8,000 acres of habitat surrounded by the San Bernard National Wildlife Refuge. The U.S. Fish and Wildlife Service would like to purchase the ranch. The ranch stretches from the Gulf inland and includes beaches, dunes, prairies, extensive salt and fresh water wetlands, and Columbia Bottomland forests dominated by large old live oaks. The acquisition of the ranch would connect large portions of the refuge and make it possible to protect important coastal dune and beach habitat for nesting sea turtles, piping plovers and a great diversity of waterfowl and water birds. The protection of the beach dunes would also improve the resiliency of this portion of the coast to storms and sea level rise and allow the natural migration of marshes and wetlands and other habitats over time.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 2.03
Water Hole Creek - Caney Creek

Region 2
Study Area #2: East Matagorda Bay Area
Subregion 2.03

Project ID: 9048
Project Name: Baer Ranch Addition to San Bernard NWR

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
The Baer Ranch proposed addition to San Bernard National Wildlife Refuge consists of approximately 10,000 acres and is adjacent to East Matagorda Bay. It has several miles of frontage on the bay and contains tidal bayous and marshes, transitional habitats, bottomland habitats, coastal prairies and pothole wetlands. East Matagorda Bay is one of the most intact Texas bay systems remaining, and there is at present an opportunity to preserve much of the associated shoreline and watershed to ensure the health of the bay for fish, wildlife and future generations.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○

Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 2.04
Peyton Creek - Live Oak Bayou

Region 2
Study Area #2: East Matagorda Bay Area
Subregion 2.04

Project ID: 9049
Project Name: Lake Austin Shoreline Addition to Big Boggy NWR

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
This is a proposed addition to Big Boggy National Wildlife Refuge of 757 acres of prime wetlands and salty prairie, which encompasses approximately 1/4 of the shoreline of Lake Austin. The addition will provide important habitat for a diverse bird population including large numbers of waterfowl, wading birds and shorebirds. The conservation of this land will improve resilience by: preventing further development in a floodplain subject to Gulf storms, allowing the natural movement and restoration of habitats after storms, and providing protection to the inland fields and wildlife habitat adjacent to the lake. The addition will allow the U.S. Fish and Wildlife Service to expand public use programs on the refuge, including waterfowl hunting, fishing, canoe and kayak access and environmental education.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #5: Matagorda Bay Area

Subregion 2.07
Matagorda Bay

Region 2
Study Area #5: Matagorda Bay Area
Subregion 2.07

Project ID: 9028
Project Name: Schicke Point Living Shoreline and Marsh Protection

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:

The project proposes shoreline protection to prevent further recedence of intertidal marsh from Schicke Point on the Matagorda Bay shoreline to the east. Potential protection method includes construction of a living shoreline combined with sediment addition.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 2
Study Area #5: Matagorda Bay Area
Subregion 2.07

Project ID: 9034
Project Name: Matagorda Bay Freshwater Inflows from the Colorado River

Project Subtype (Type):

 Fresh Water Inflow (Environmental)

Project Description:
This project involves purchasing an ongoing right to have water delivered to the estuary from new storage facilities that are planned for imminent development. Although purchasing the right to get water from a new storage facility will result in a relatively high per-unit cost for the water, the availability of storage will allow for water to be captured during periods of very low inflows, thereby managing a limited quantity of water to maximize environmental benefits. The project will procure up to 15,000 acre-feet per year of freshwater inflows that can be delivered when most needed.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 2
Study Area #5: Matagorda Bay Area
Subregion 2.07

Project ID: 9035
Project Name: Matagorda Bay Estuary System Freshwater Inflows from Tributary Streams

Project Subtype (Type):

 Fresh Water Inflow (Environmental)

Project Description:
This project involves purchasing one or more existing water-use permits from willing sellers on other streams that flow directly into the Matagorda Bay estuary system. By limiting water withdrawals on one or more streams that reach the bay at a key location, this project will help moderate salinity levels during dry periods and provide a refuge from which organisms can emerge to help revitalize the overall bay when water conditions return. Reduced withdrawals will also improve bay productivity during more normal rainfall conditions. The project will procure up to 10,000 acre-feet per year of water that would otherwise be withdrawn, and will establish downstream delivery points to protect the flows all the way to the estuary.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○

Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #6: San Antonio Bay Area

Subregion 2.15

Black Bayou - Green Lake

Region 2
Study Area #6: San Antonio Bay Area
Subregion 2.15

Project ID: 9029
Project Name: Guadalupe Bay - Victoria Barge Canal Cuts

Project Subtype (Type):


Misc. Wave Break (Shoreline Stabilization)


Hydrologic Restoration (Environmental)

Project Description:
The land between Guadalupe Bay (GB) and Victoria Barge Canal (VBC) has eroded cuts resulting from barge traffic. These cuts allow water to flow down the VBC instead of going to GB, which robs GB of natural flows and increases sedimentation in the VBC. Most of the eroded cuts are shallow, but one is deep. Geotubes have been used previously with some success; additional shoreline stabilization is recommended to preserve the original hydrology.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○

Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 2.17

San Antonio Bay - Espiritu Santo Bay

Region 2
Study Area #6: San Antonio Bay Area
Subregion 2.17

Project ID: 9027

Project Name: San Antonio Bay Rookery Island Restoration

Project Subtype (Type):

 Rookery Islands (Habitat Creation & Restoration)

Project Description:

San Antonio Bay bird rookery islands have significantly declined due to erosion. An inventory of rookery islands within San Antonio Bay shows only two marginally functioning islands where there had been 10. The loss of suitable nesting habitat has led to a decline in herons, egrets, black skimmers and brown pelicans. An initial site assessment of San Antonio Bay identified five locations of previously functioning islands that are suitable for reconstruction. This project proposes restoration of a historical rookery island utilizing one or more of these locations. BUDM would be used from the adjacent channels, if possible.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3

Region 3

Study Area #2: Aransas Bay Area

Subregion 3.02
Hynes Bayou - San Antonio Bay

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.02

Project ID: 9031

Project Name: Traylor Cut (Mission Lake - Guadalupe River)

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

 Hydrologic Restoration (Environmental)

Project Description:

In the 1930s, the Guadalupe River was partially rerouted into Mission Lake through Traylor's Cut. Today, the Guadalupe Delta is eroding and sinking, at least in some measure due to lack of sediment deposition. Closing Traylor's Cut and reestablishing flows in the lower river could increase over banking onto the delta. A study is proposed to determine possible effects of closing the cut.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.02

Project ID: 9032
Project Name: Aransas NWR San Antonio Bay Shoreline Protection

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

Project Description:
The Ingleside Barrier Island strand plain upland is eroding and large live oaks are falling into San Antonio Bay. A wave-break of some type could prevent or slow down loss of this important habitat.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.02

Project ID: 9033
Project Name: San Antonio Bay Freshwater Inflows

Project Subtype (Type):

 Fresh Water Inflow (Environmental)

Project Description:
This project involves the delivery of water to the San Antonio Bay estuary by purchasing existing water-use permits from willing sellers or paying owners of water-use permits to enter into longterm commitments to not withdraw that water upstream. Downstream delivery points will be established to ensure the water reaches the estuary and, where feasible, storage facilities will be used to help deliver the purchased water to the estuary at times when it provides the greatest ecological benefit. The project will provide up to 40,000 acre-feet per year of reliable inflows to the San Antonio Bay system as compared to future conditions without the project.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○

Existing or Future Coastal Storm Surge Damage						
Coastal Flood Damage						
Impacts to Water Quality and Quantity						
Impacts to Coastal Resources						

Would you consider this project a priority for coastal resiliency?

Yes | No | I don't know

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 3.03
Saint Charles Bay

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.03

Project ID: 9004
Project Name: Lamar Beach Road Protection

Project Subtype (Type):

 Breakwater (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:
This project proposes approximately 1 mile of breakwaters along Lamar Beach Road from Main Street to 12th Street in Aransas County. The project also includes regrading and filling along the shoreline along with marsh planting to establish a living shoreline system. Lamar Beach Road was recently damaged in 2015/2016 with high winds and above-average tides. The current shoreline hardening is non-engineered rubble and concrete riprap, which is deteriorating and threatens the road infrastructure and access for public and private users. This road provides water access for St. Charles Bay and popular kayak launching for the public. The living shoreline solution would also address extensive marsh / estuarine habitat loss along this shoreline.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○

Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 3.05
Aransas Bay

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.05

Project ID: 9006
Project Name: Dagger Island Shoreline Protection

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:

The project proposes to eliminate or drastically reduce the rate of shoreline erosion and island migration by protecting the shoreline of Dagger Island, which is due west of Ingleside, on the southern edge of Redfish Bay just north of Corpus Christi Bay. The shoreline is eroding due to natural and human causes, and the project will address both the current and future need for shoreline stabilization. The project focuses on protecting shallow aquatic habitat, submerged aquatic vegetation, intertidal habitat, oyster reefs, emergent marsh, mangrove marsh, mangroves, tidal flats, benthic life and associated uplands important for the health of the entire bay ecosystem. In addition, this project will create low and high marsh habitats and enhance seagrass beds.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal	○	○	○	○	○	○

Resources

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #2: Aransas Bay Area
Subregion 3.05

Project ID: 9059
Project Name: Little Bay Restoration Initiative

Project Subtype (Type):

 Rookery Island & Marsh (Habitat Creation & Restoration)

 Hydrologic Restoration (Environmental)

 Birds (Wildlife)

Project Description:

The initiative will restore Little Bay, a shallow, enclosed bay with approximately 420 acres of surface area, to a natural, vegetated state, making it better able to sustain and enrich an ecosystem that provides habitat for submerged seagrasses as well as local water fowl, migratory birds, fish, crustaceans, and other aquatic fauna. Scientists have identified polluted stormwater runoff, inadequate water circulation and diminished water exchange with Aransas Bay as principal causes of the declining water quality and loss of wildlife habitat. Four tasks will address these issues: dredge Little Bay to a depth of nine feet to restore historical conditions; beneficially use dredge material to restore two rookery islands and create a marsh platform along the western shoreline; plant four acres of new vegetative marsh habitat and create nesting habitat for black skimmers; and widen, realign, and extend Blevins Channel, one of the two outlets connecting Little Bay with Aransas Bay.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal						

Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #3: Copano Bay Area

Subregion 3.04
Copano Creek

Region 3
Study Area #3: Copano Bay Area
Subregion 3.04

Project ID: 9003

Project Name: Coastal Prairie Estuarine Wetland and Mima Mound Complex Habitat Protection at Shell Point Ranch

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:

The project proposes the acquisition of approximately 400 acres of coastal habitats that support coastal prairie, freshwater, and estuary wetlands and the southernmost extents of Mima mounds at Shell Point Ranch in Texas. This mosaic of habitats supports Mottled Duck and whooping cranes, in addition to other wildlife.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #4: Corpus Christi Bay Area

Subregion 3.11
Frontal Corpus Christi Bay

Region 3
Study Area #4: Corpus Christi Bay Area
Subregion 3.11

Project ID: 9005
Project Name: Bayshore Pocket Beach Stabilization

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Studies (Studies, Policies & Programs)

Project Description:

The project proposes development of alternative stabilization methods for backshore bluffs at bayside pocket beaches. These small community beaches typically serve as local water access / launch sites, and erosion is compromising the beach environment by introducing incompatible sediment onto the beaches. A study may be required to determine the best methods for stabilizing pocket beaches.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #4: Corpus Christi Bay Area
Subregion 3.11

Project ID: 9045
Project Name: Packery Channel Nature Park Habitat Restoration - Phase II

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

 Birds & Invasive Species (Wildlife)

 Studies (Studies, Policies & Programs)

 Walkovers (Public Access & Improvements)

Project Description:

Portions of the original project narrative have been completed under a CIAP grant. The remaining work to be completed that still needs funding is an additional 2 acres of habitat restoration, additional elevated boardwalk for public access, and a living shoreline stabilization along the parks boundary on Packery Channel, which has been extremely erosive since the channel was opened. The habitat in this area is critical to neotropical migratory birds for food and cover as well as resident bird populations, and a key element of the project is to have funding to collect data on how the bird populations are responding to the restored habitat. A portion of the habitat restoration work also involves continued control and removal of invasive grasses and trees, such as Brazilian Pepper Trees.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #5: Nueces Bay Area

Subregion 3.10
Nueces Bay - Corpus Christi Bay

Region 3
Study Area #5: Nueces Bay Area
Subregion 3.10

Project ID: 9001
Project Name: Nueces Bay Living Shoreline and Marsh Enhancement, Southwest Portland

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:

The project proposes the creation of a living shoreline in southwest Portland that would act as a buffer to mitigate impacts on water quality in Nueces Bay. The enhanced marsh would also help mitigate the impacts of storm surge on the city's coastal infrastructure.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

○ 0 - not feasible

- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #5: Nueces Bay Area
Subregion 3.10

Project ID: 9002
Project Name: Lower Nueces River Freshwater Inflows

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

 Fresh Water Inflow (Environmental)

Project Description:
The proposed study would determine the impacts of limited or regulated freshwater inflow on the water quality of the Lower Nueces River below the saltwater barrier and Nueces Bay. There is a need of long-term monitoring of these systems across the Texas coast to capture these effects on the water quality and habitat and to understand all types of freshwater inflows for improved water and system-wide nutrient budgets.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*

0 *= no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #5: Nueces Bay Area
Subregion 3.10

Project ID: 9007
Project Name: Live Oak Woodland Pothole Wetland Habitat Protection, Live Oak Peninsula

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
The project proposes the acquisition of 400 to 600 acres of imperiled live oak / red bay woodlands with pothole wetlands that support the rare plant communities and state-listed species (e.g. Scarlet Snake). The proposed acquisition area is on the southern tip of the Live Oak Peninsula, at the former Ingleside naval station.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○

Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #5: Nueces Bay Area
Subregion 3.10

Project ID: 9013
Project Name: Nueces Bay Productivity Enhancement through Wastewater Delivery

Project Subtype (Type):

 Fresh Water Inflow (Environmental)

Project Description:

In this river basin there is very limited potential for transactions to purchase water upstream to provide increased freshwater inflows to the estuary. Accordingly, this project proposes to pipe treated wastewater for delivery to the bay at an advantageous location. A demonstration project that ended in 2003 has already illustrated the ecological benefits of this approach. This project would provide infrastructure to deliver between 5 to 8 MGD (5 to 9 thousand acre-ft./yr.) of freshwater and beneficial nutrients from treated wastewater from a somewhat distant treatment plant to a key portion of the Nueces Delta each year.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #5: Nueces Bay Area
Subregion 3.10

Project ID: 9014
Project Name: Causeway Island Rookery Habitat Protection

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Rookery Islands (Habitat Creation & Restoration)

Project Description:
This project will address actions needed to protect important rookery island habitat at Causeway Island. The island supports approximately 3,070 pairs of breeding colonial waterbirds per year and harbors numerous threatened and priority avian species. The erosion of the island's shoreline is

causing the on-going loss of critical rookery island habitat; the primary benefit from this project is the protection of the rookery island from wind and wave erosion.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #6: Upper Laguna Madre Area

Subregion 3.14
Upper Laguna Madre

Region 3
Study Area #6: Upper Laguna Madre Area
Subregion 3.14

Project ID: 9008
Project Name: Flour Bluff/ Laguna Shores Road Living Shoreline

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:
The project proposes the creation of approximately 1.5 miles of living shoreline to act as a buffer between Laguna Shores Road and the erosional shoreline of Laguna Madre, along the eastern shoreline of Flour Bluff. Doing so would improve water quality and the viability of existing transportation infrastructure.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #6: Upper Laguna Madre Area
Subregion 3.14

Project ID: 9009
Project Name: Flour Bluff/ Laguna Shores Road Abandoned Structures Removal

Project Subtype (Type):

 Structure on Public Easement (Structure/ Debris Removal)

Project Description:
The project would remove abandoned structures along Laguna Shores Road in Flour Bluff near Corpus Christi.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water	○	○	○	○	○	○

Quality and Quantity						
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #6: Upper Laguna Madre Area
Subregion 3.14

Project ID: 9011
Project Name: Hydrologic Study of the Freshwater Inflows to the Upper Laguna Madre

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

 Fresh Water Inflow (Environmental)

Project Description:

The proposed study would evaluate changes in freshwater inflows to the Upper Laguna Madre. The Laguna Madre is one of the world's few hypersaline lagoons; it is suggested that the salinity is increasing and it's unclear what impacts this might have to the ecosystems it houses. Anecdotal evidence indicates that groundwater discharge - the lagoon's main source of freshwater - has been decreasing, thereby increasing the lagoon's salinity.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 3
Study Area #6: Upper Laguna Madre Area
Subregion 3.14

Project ID: 9012
Project Name: Monitoring Water Quality on North Padre Island

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

Project Description:
The proposed project would involve monitoring of water quality on North Padre Island, which is experiencing a continued increase in development and recreational use. Monitoring would inform best practices and ecological needs for the area.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4

Region 4

Study Area #1: Gulf Facing Beaches and Dunes

Subregion 4.01
Gulf Facing Beaches and Dunes

Region 4
Study Area #1: Gulf Facing Beaches and Dunes
Subregion 4.01

Project ID: 9037
Project Name: Boca Chica Dune Tidal-Flat Cable Fence Protection

Project Subtype (Type):

 Birds (Wildlife)

 Other (Public Access and Improvements)

Project Description:
The project involves the installation of a cable fence and signage to prevent ATV usage and other detrimental encroachment on sensitive areas of the refuge. This will prevent excessive dune erosion and protect least tern nesting and wintering shorebirds (piping plovers) using tidal flats.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*

0 *= no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #1: Gulf Facing Beaches and Dunes
Subregion 4.01

Project ID: 9038
Project Name: Cameron County Land Acquisition Program

Project Subtype (Type):


Setbacks (Studies, Policies & Programs)


Fee Simple (Land Acquisition)

Project Description:
A land acquisition program is needed to help proactively prepare for a stricter building setback line in Cameron County. While this would be initially expensive, implementation of such a program would help avoid future lawsuits in structure/debris removal and offset the costs of beach nourishment, dune restoration, and shoreline stabilization over an indefinite amount of time on a severely eroding stretch of beach. Such a program could potentially reduce Texas Wind Insurance Association and National Flood Insurance Program expenditures, and would preserve dunes, beach, and public beach access.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○

Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #1: Gulf Facing Beaches and Dunes
Subregion 4.01

Project ID: 9040
Project Name: South Padre Island Tidal Flats Protection

Project Subtype (Type):

 Other (Public Access and Improvements)

Project Description:
The project proposes the installation of bollards south of the Mansfield Cut on South Padre Island. The bollards would restrict illegal vehicles from accessing the tidal flats along the jetties and the ship channel.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #1: Gulf Facing Beaches and Dunes
Subregion 4.01

Project ID: 9060
Project Name: Beach Re-Nourishment at Padre Island National Seashore

Project Subtype (Type):

 Gulf (Beach Nourishment)

Project Description:
This project proposes to place dredged sediment from the Mansfield Channel and transferred sand from the south side of the jetties onto the Padre Island National Seashore from Mansfield Channel to 15 miles north of the channel. The beach on these 15 miles of seashore is currently eroding into the primary dune line and cutting off public access because sediment flow is blocked by the jetties. This area amounts to one fifth of the park's Gulf beach and is the most heavily used beach for nesting by the endangered Kemp’s Ridley sea turtle. Further erosion will result in inlets forming in old wash overs that are currently snowy plover nesting habitat. USACE had previously dredged the

channel every 2 to 3 years, which was sufficient to maintain the beach; however, due to budget cuts, the channel has not been dredged since 2011.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #3: Laguna Acosta Area

Subregion 4.05
Upper Pilot Channel - Laguna Madre

Region 4
Study Area #3: Laguna Acosta Area
Subregion 4.05

Project ID: 9041
Project Name: Harlingen Ship Channel Living Shoreline

Project Subtype (Type):

 Breakwater (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

Project Description:
There is a need for shoreline protection on the north side of the Harlingen Ship Channel (Arroyo Colorado), across from Adolph Thomae Jr. County Park. Construction of a living shoreline or breakwater infrastructure would be ideal to prevent erosion in this area.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Subregion 4.07
Laguna Atascosa

Region 4
Study Area #3: Laguna Acosta Area
Subregion 4.07

Project ID: 9052
Project Name: Protect Freshwater Rsacas and Watershed to Lake Laguna Atascosa (Dulaney/ Waters Acquisition)

Project Subtype (Type):


Acquisitions (Land Acquisition)

Project Description:
Two parcels located in Cameron County, adjacent to the Laguna Atascosa National Wildlife Refuge and comprising approximately 4,100 acres, will be protected through this project: the Waters Tract and Dulaney Farms. The Waters Tract is 797 acres located just south of Laguna Atascosa NWR and, when restored, could provide almost 90 acres of critical freshwater wetland habitat in an old river oxbow system. The Dulaney Farms (3,368 acres) is surrounded on three sides by the Laguna Atascosa NWR and includes over 400 acres of fresh water wetlands which, when restored, could provide valuable fresh water habitat. Fresh water habitats located on these properties are a critical resource for large concentrations of wintering redhead ducks using the Laguna Madre, as well as wading birds, shorebirds and other waterfowl. These properties are also located in the heart of one of the last remaining breeding populations of ocelots in the United States, and restoration will be critical to the recovery of the ocelot population.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

***?** = I don't know*
***0** = no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #4: Lower Laguna Madre Area

Subregion 4.04
Lower Laguna Madre

Region 4
Study Area #4: Lower Laguna Madre Area
Subregion 4.04

Project ID: 9039
Project Name: Native Plant Propagation for Restoration & Resiliency

Project Subtype (Type):

 Dune (Dune Restoration)

 Other (Studies, Policies & Programs)

Project Description:
The proposed project involves identification or creation of a local source of native plants for coastal habitat and dune restoration. At this time, there is no large-scale local source of these materials, which limits the ability of the community to respond to natural/anthropogenic events in a timely manner. Providing a more convenient source of native plants could improve the community's resiliency and ability to quickly return impacted sites to a previous desired state.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #4: Lower Laguna Madre Area
Subregion 4.04

Project ID: 9043
Project Name: Lower Laguna Madre Pole and Troll Area

Project Subtype (Type):

 Other (Public Access and Improvements)

Project Description:
The project proposes the creation of a "no motor" zone in the Laguna Madre along the eastern shore of the Laguna Atascosa NWR. This area would include a fairly narrow zone within the shallow areas along the shoreline and only be accessible to kayak, canoes, and boats with trolling motors.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #4: Lower Laguna Madre Area
Subregion 4.04

Project ID: 9051
Project Name: Protect Shorebird and Turtle Nesting Habitat on South Padre Island

Project Subtype (Type):


Acquisitions (Land Acquisition)

Project Description:

The project involves protection of 10,000 acres of beach and dune habitats on South Padre Island through acquisition of parcels from willing landowners. The protection of these habitats would benefit nesting sea turtles and migratory and resident shorebirds.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*
0 *= no benefit*
1 *= slight benefit*
2 *= medium benefit*
3 *= high benefit*
4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Study Area #5: South Bay Area

Subregion 4.08
Brownsville Ship Channel

Region 4
Study Area #5: South Bay Area
Subregion 4.08

Project ID: 9036
Project Name: Laguna Madre Land Acquisition Endowment Initiative

Project Subtype (Type):

 Conservation Easements (Land Acquisition)

Project Description:
The proposed project will protect and manage coastal prairie and tidal flats totaling approximately 80,000 acres for aplomado falcons and associated species, and thornscrub totaling approximately 20,000 acres for ocelot and associated species. Protection would be accomplished by easement or fee-simple acquisition from willing sellers. An endowment would be established to perpetually fund management. Properties targeted for protection include Zarate, Davis, Holly Beach, and Hardic. Protected sites targeted for management include Laguna Atascosa and Bahia Grande NWRs.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*

***0** = no benefit*

***1** = slight benefit*

***2** = medium benefit*

***3** = high benefit*

***4** = essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #5: South Bay Area
Subregion 4.08

Project ID: 9042
Project Name: Bahia Grande Living Shoreline

Project Subtype (Type):

 Misc. Wave Break (Shoreline Stabilization)

 Marsh (Habitat Creation & Restoration)

 Other (Public Access and Improvements)

Project Description:
The project includes creation of a living shoreline through replacement of foreign-sourced riprap material with naturally-based, native materials. Additional proposed actions include creation of controlled access points for the public, bank / shoreline restoration using beneficial use dredged material, and installation of culverts or other structures under State Highway 48.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or	○	○	○	○	○	○

Lost Habitat Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #5: South Bay Area
Subregion 4.08

Project ID: 9053
Project Name: Protect Bahia Grande and Vadia Ancha Shorelines (Laguna Heights Acquisition)

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
The proposed project would protect wetland, coastal prairie and thornscrub habitat adjacent to the Bahia Grande unit of the Laguna Atascosa National Wildlife Refuge through acquisition of the 1,400-acre Laguna Heights parcel. The protection of this parcel will protect the shoreline of the Bahia Grande wetland complex and will assist in the maintenance of the functional values of the Bahia Grande wetland system, much of which has recently been restored.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #5: South Bay Area
Subregion 4.08

Project ID: 9054
Project Name: Habitat Protection in the Laguna Atascosa NWR (Shrimp Farm and Holly Beach)

Project Subtype (Type):

 Acquisitions (Land Acquisition)

Project Description:
This project proposes to acquire and permanently protect with conservation easements two parcels within the Bahia Grande Coastal Corridor: Shrimp Farm and Holly Beach. Together, these parcels comprise over 2,000 acres of coastal wetland, prairie and thornscrub. The Shrimp Farm property (325 acres) is located between the recently protected Boswell-Jenkins tract and the Laguna Atascosa NWR and produces shrimp and game fish; portions are known ocelot habitat. Holly Beach

(1,718 acres) provides important foraging habitat for nearby rookeries that support some of the largest populations of gull-billed terns, black skimmers, reddish egrets and brown pelicans in the Gulf of Mexico. These tracts are part of the Laguna Madre/Bahia Grande wetlands system, which hosts 85 percent of the world population of redhead ducks, one-third of the Great Plains population of endangered piping plover for nine months of the year, and hundreds of threatened peregrine falcons during migration.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = *I don't know*
0 = *no benefit*
1 = *slight benefit*
2 = *medium benefit*
3 = *high benefit*
4 = *essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility

- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Region 4
Study Area #5: South Bay Area
Subregion 4.08

Project ID: 9055
Project Name: Bahia Grande Watershed Corridor Protection

Project Subtype (Type):

 Conservation Easement (Land Acquisition)

Project Description:
Approximately 2,000 acres of oxbow wetlands and associated prairie and thornscrub habitat will be placed under a conservation easement to protect these habitats, which connect a historically-used corridor for ocelots. The property is located at the headwaters of the Bahia Grande, just north of the Bahia Grande Unit of the Laguna Atascosa NWR. The southern two-thirds of the property are very low and floods during heavy rains and tropical storms. Sheet flows through these brackish wetlands and salty prairie feed into the north basins of the Bahia Grande wetland complex. The northern one-third of the property connects with the 396-acre Waller Unit of the Lower Rio Grande NWR, which in turn connects to the Boswell-Jenkins tract of Laguna Atascosa NWR. This portion of the property has less saline wetlands and more diverse grassland and brush that could support breeding ocelots.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? *= I don't know*

0 *= no benefit*

1 *= slight benefit*

2 *= medium benefit*

3 *= high benefit*

4 *= essential*

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes ○ No ○ I don't know ○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Regionwide Projects

Regionwide

Project ID: 9020
Project Name: Alternative Solutions for Beach Erosion

Project Subtype (Type):

 Structure Raising & Other (Studies, Policies, and Programs)

Project Description:
The project aims to promote alternative solutions to beach and dune restoration and armoring, such as rising of structures, hardening of utilities, and managed retreat.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○

Gulf Beach Erosion and Dune Degradation						
Bay Shoreline Erosion						
Existing or Future Coastal Storm Surge Damage						
Coastal Flood Damage						
Impacts to Water Quality and Quantity						
Impacts to Coastal Resources						
Abandoned or Derelict Vessels, Structures and Debris						

Would you consider this project a priority for coastal resiliency?

Yes | No | I don't know

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9021
Project Name: Create & Restore Habitat for Neotropical Migrant Songbirds

Project Subtype (Type):

 Wetlands/ Forested Wetlands (Habitat Creation & Restoration)

 Birds (Wildlife)

Project Description:
The proposed project would restore and/or create habitat for neotropical migrant songbirds along the Texas Coast.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○

Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9000
Project Name: Managing Freshwater Inflows from Hill Country to Coast

Project Subtype (Type):

 Fresh Water Inflow (Environmental)

 Studies (Studies, Policies & Programs)

Project Description:
This project proposes the development of a study and/or plan to manage the quantities of fresh water reaching estuaries throughout the coastal zone.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9010
Project Name: Tidal Datums and Inundation Frequency Markers

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

Project Description:
Understanding and visualizing tidal datums is difficult along the Texas coast. Non-tidal forcings are very important in Texas and existing tidal datums are not practical for beach management. There is a need for practical datums such as Frequency of Inundation as well as a way to visualize these vertical levels on local landmarks. One way of implementing this program would be to install new

Inundation Frequency Markers.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility

- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9015
Project Name: Coastal Zoning and Flood Study

Project Subtype (Type):

 Studies (Studies, Policies & Programs)

 Other (Flood Risk Reduction)

Project Description:
A cost-effective way to improve coastal resiliency is to avoid building in areas that are prone to flooding and hence reduce National Flood Insurance Program liabilities. This is particularly important as our coastal cities will continue to grow for the foreseeable future. This study will review the recent flood maps, the zoning and the overall zoning process for the Texas Gulf Coast based on updated tidal datums and latest ADCIRC modeling.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit

1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9044
Project Name: Public Transportation Enhancement Program

Project Subtype (Type):

 Other (Public Access and Improvements)

Project Description:
The proposed project would involve working with municipalities to reduce parking on sensitive beaches and provide transit to those highly popular beach areas.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○

Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9057
Project Name: Wetland Restoration, Water Quality Improvement, and Flood Risk Reduction

Project Subtype (Type):

 Wetlands/ Forested Wetlands (Habitat Creation & Restoration)

 Hydrologic Restoration (Environmental)

Project Description:
Traditional methods of channelization to reduce flood risk have resulted in a loss of wetlands, recreational opportunities and water quality in Texas coastal counties. Opportunities exist to develop approaches that restore wetlands, improve water quality and reduce flood risk by working with coastal drainage and flood control districts, interested private landowners, public land managers and natural resource agencies. These opportunities may include creation/restoration of wetland basins, in-channel wetlands, and restoration of historic flow patterns. These approaches require a multi-disciplinary analyses and assessments. Results would improve conditions for fish and wildlife, improve water quality and create/restore natural resource based recreational opportunities.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○

Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes	No	I don't know
○	○	○

What is the feasibility of executing this project?

- ○ 0 - not feasible
- ○ 1 - low feasibility
- ○ 2 - moderate feasibility
- ○ 3 - high feasibility
- ○ 4 - certain feasibility
- ○ I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Regionwide

Project ID: 9058
Project Name: Wetland Restoration, Water Quality Improvement, and Flood Risk Reduction

Project Subtype (Type):

 Other (Studies, Policies & Programs)

 Other (Public Access and Improvements)

Project Description:
Observations and review of aerial imagery show a distinct increase in off-road vehicle impacts to sensitive natural resources along the coast. The resources at risk include wetlands, salt flats, dunes, nesting and roosting birds, and sea turtles. In order to protect sensitive resource areas from damage while maintaining public access, a concerted effort and public investment are required. Approaches may include increased law enforcement, bollards and cables, signage, education and outreach. Some example locations include Bryan Beach, San Luis Pass, and Mitchell's Cut.

Please indicate the level of benefit this project achieves for the following Issues of Concern.

? = I don't know
0 = no benefit
1 = slight benefit
2 = medium benefit
3 = high benefit
4 = essential

	?	0	1	2	3	4
Altered, Degraded, or Lost Habitat	○	○	○	○	○	○
Gulf Beach Erosion and Dune Degradation	○	○	○	○	○	○
Bay Shoreline Erosion	○	○	○	○	○	○
Existing or Future Coastal Storm Surge Damage	○	○	○	○	○	○
Coastal Flood Damage	○	○	○	○	○	○
Impacts to Water Quality and Quantity	○	○	○	○	○	○
Impacts to Coastal Resources	○	○	○	○	○	○
Abandoned or Derelict Vessels, Structures and Debris	○	○	○	○	○	○

Would you consider this project a priority for coastal resiliency?

Yes | No | I don't know

What is the feasibility of executing this project?

- 0 - not feasible
- 1 - low feasibility
- 2 - moderate feasibility
- 3 - high feasibility
- 4 - certain feasibility
- I don't know

Additional information (for example, additional project details, known impediments to implementing this project, ways the project could be improved):

Click to submit

You have reached the end of the survey. You may use the back arrow at the bottom of this page to review or change your responses. Please select the forward arrow to submit your responses.

If you complete the survey and would like to provide input on additional projects or regions at a later time, you can start the survey again from the beginning by clicking again on the link provided to you via email. During analysis, we will only consider your most recent responses for each project.

Sample of the Issues of Concern Qualtrics Survey Sent to the Technical Advisory Committee

DEVELOPED BY THE HARTE RESEARCH INSTITUTE

A full copy is available upon request.

Texas Coastal Resiliency Master Plan
Identifying Texas Coastal Issues of Concern
Frequently Asked Questions

1.) What is the Texas Coastal Resiliency Master Plan?

Under development by the Texas General Land Office ("GLO"), the Texas Coastal Resiliency Master Plan ("Plan") is a long-term framework to mitigate damage from future coastal natural disasters, and to preserve and enhance the state's coastal resources. This Plan will be presented to the 85th Texas Legislature in 2017 to raise awareness of the state's coastal vulnerabilities from natural hazards and present possible solutions to these hazards.

This work builds on previous GLO coastal planning efforts, most notably work starting in 2012 to identify coastal priorities along the Texas coast. In this effort, a Technical

Advisory Committee ("TAC") was formed to identify Issues of Concern ("IOCs") for coastal regions and evaluate potential solutions. Potential solutions were developed from a wide variety of information gathered through public comment, grant deliverables, projects collected from GLO partner assessments, plans, and reports, and recent projects submitted to the GLO. A summary document, "The Texas Coast: Shoring up our Future," was published in 2013.

2.) What is the Technical Advisory Committee ("TAC")?

The TAC is a diverse group of professionals and subject matter experts in the broad field of coastal studies, with specific expertise in one or more regions of the Texas coast.

3.) How were the Issues of Concern ("IOCs") developed?

Sixteen Issues of Concern ("IOCs") were developed during the 2012 GLO effort to identify Texas coastal needs. At that time, the TAC was asked to assess the level of concern for IOCs in 36 subregions along the Texas coast. For the current effort in 2016, the GLO streamlined the IOCs to a list of eight, to reflect issues most directly related to coastal resiliency.

Identified Issue of Concern	Example Considerations	
a. Altered, Degraded or Lost Habitat	• Seagrass • Mangroves • Coastal Marshes • Forested Wetlands	• Coastal Prairies • Invasive Species • Future Projections of Loss
b. Gulf Beach Erosion & Dune Degradation	• Subsidence • Sediment Deficit • Impacts from Development	• Storm Impacts • Erosion • Sea Level Rise
c. Bay Shoreline Erosion	• Subsidence • Sediment Deficit • Impacts from Development	• Storm Impacts • Erosion • Sea Level Rise
d. Existing and Future Coastal Storm Surge Damage	• Sea Level Rise • Coastal Storms • Impacts from Development	
e. Coastal Flood Damage	• Rainfall • Associated Riverine	• Nuisance Flooding • Impacts from Development
f. Impact on Water Quality & Quantity	• Freshwater Inflows • Nutrients • Water Pollution (Chemical) • Sediment • Saltwater Intrusion	• Nonpoint Source • Hydrologic Connectivity • Harmful Algal Blooms • Oil Spills
g. Impact on Coastal Resources	• Oysters • Turtles • Birds	• Fish • Crabs • Endangered Species

h. **Abandoned or Derelict Vessels, Structures, and Debris**	• Obstructions to Public's Easement • Abandoned Oil and Gas Wells • Abandoned Boats	• Dock Pilings • Post Storm Cleanup • Obstacles • Plastics, Glass, Rubber, Metal

4.) How were the levels of concern determined for IOCs?

In 2012, the TAC was asked to assess their level of concern for sixteen IOCs across 36 subregions on a scale from zero (no concern) to four (extremely concerned). All TAC members' responses were averaged for each IOC within each subregion to obtain the level of concern (i.e. IOC score). For the current 2016 effort, the IOC scores for the 2012 subregions were applied to the subregions delineated in 2016 in areas where the two sets of subregions coincided. If there was no 2012 subregion to intersect a 2016 subregion, no IOC scores were applied.

One of the first steps in the 2016 process is to have the TAC help us determine levels of concern for IOCs in subregions that have not yet been assessed and verify the levels of concern for IOCs in the subregions that have been assessed.

5.) How were the subregions delineated?

One of the lessons learned from the 2012 effort was that the subregions should be ecologically meaningful, based on units with readily available boundary data, and be applicable along the entire Texas coast. After considering many different ways to divide the Texas coast, it was decided that watershed boundaries fit these requirements. For the most part, the subregions are based on the USGS Watershed Boundary Dataset (10 digit Hydrologic Unit Codes). Gulf-facing beaches and dunes are the exception. For Gulf-facing beaches and dunes, a line was drawn 1,000 ft landward and parallel to the shoreline to encompass the foredune complex and the entire Gulf-facing beach in each subregion. Gulf-facing subregions extend to the Gulfward boundary of the state, three leagues (10.35 miles) out into the Gulf of Mexico.

6.) Where did the underlying data for IOC survey come from?

Another lesson learned from the 2012 effort was that the TAC could use more information when assessing the Issues of Concern in each subregion. We have produced several maps and graphs in order to provide more subregion information to the TAC in 2016. For each subregion, four maps, one chart, and one table were produced.

- Location map

The location map serves to show the location of the selected subregion within the larger region. The basemap is the standard dark grey basemap from ESRI.

- Figure 1, Shorelines

This map shows historical shoreline change rates where available and armored shorelines overlaid on 2009 natural color aerial imagery. Bay and Gulf shoreline change data comes from the University of Texas Bureau of Economic Geology and armored shorelines are from Environmental Sensitivity Index data developed by Harte Research Institute.

- Figure 2, Storm Surge and Human Development

This map shows potential inundation from worst case scenario (direct hit, high tide) Category 1 and Category 3 hurricanes, along with developed lands. Storm surge inundation model results are from NOAA's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model outputs. The SLOSH product used in this map is known as the MOM (more detailed information can be found here) which is the maximum level of possible inundation generated by running SLOSH several thousand times with hypothetical hurricanes under a variety of different storm conditions. SLOSH MOMs are used nationwide in emergency management to develop evacuation zones for hurricane preparedness.

Developed lands are derived from percent impervious data from NOAA's Coastal Change Analysis Program (C-CAP) Land Cover Atlas. The basemap is a Digital Elevation Model depicting land surface elevation in feet.

- Figure 3, Land Cover and Habitats

This map shows the coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oyster reef locations compiled by HRI from multiple sources, and seagrass from NOAA and TPWD. The basemap is black and white aerial imagery. C-CAP land cover classes were generalized according to the following table:

Land Cover Class	C-CAP Land Cover Categories Included
Upland	• Bare Land • Cultivated Crops • Developed, High Intensity • Developed, Medium Intensity • Developed, Low Intensity • Developed, Open Space • Grassland/Herbaceous • Pasture/Hay • Scrub/Shrub
Forest	• Deciduous Forest • Evergreen Forest • Mixed Forest
Estuarine and Marine Wetland	• Estuarine Emergent Wetland • Estuarine Forested Wetland • Estuarine Scrub/Shrub Wetland

Freshwater Wetland	• Palustrine Emergent Wetland • Palustrine Forested Wetland • Palustrine Scrub/Shrub Wetland
Flats and Beaches	• Unconsolidated Shore
Open Water	• Open Water

- Figure 4, Land Cover Change

This bar chart shows the total area (acres) and percent change for four broad land cover categories in the subregion in 1996 and 2010. Data is taken from C-CAP, and land cover classes were generalized according to the table above.

- Table 1, Regional Ocean Economy Data

This table shows dollar amounts, number of establishments, and number of employees related to different sectors of the ocean economy. Data is taken from NOAA Economics: National Ocean Watch (ENOW) by county. Data for all counties within a single region were aggregated to show totals on a region-wide level. For more information on NOAA ENOW data, please see the FAQ sheet here, and explore the data here.

7.) What if I completed the survey but want to change my answers or provide information for additional subregions?

You can always go back to the survey link in your email and complete the survey again. Please be sure to provide the same name and email address each time you complete the survey. For each IOC in each subregion, only the MOST RECENT answers will be analyzed. If you go complete the survey multiple times for a single subregion, the newest answer will supersede the older answer. If you complete the survey for new subregions, both sets of responses will be saved. If you would like to provide more clarification regarding your responses, you can always let us know in the comment box within the survey or contact Luz.Lumb@tamucc.edu.

8.) What can I expect next?

After all the responses are collected and analyzed, HRI will develop new scores for each Issue of Concern within each subregion. During face-to-face TAC meetings in July, we will present these results and the TAC will be given another opportunity to provide input on IOCs. At that time, the TAC will also be asked to evaluate potential solutions to IOCs for each subregion along the Texas coast.

9.) Whom can I contact for more information?

For any questions regarding the IOC survey, please contact Luz Lumb at the Harte Research Institute. Luz.lumb@tamucc.edu, 361-825-3681

Introduction

Q1.

Texas Coastal Issues of Concern Technical Advisory Committee Survey

The purpose of this survey is to elicit expert assessment of the issues of concern (IOC) related to coastal resiliency along the Texas coast. The Texas coast has been sectioned into 68 subregions to capture information at the HUC-10 watershed level.

The eight potential issues of concern to evaluate are the following:

- Altered, degraded, or lost habitat
- Gulf beach erosion and dune degradation
- Bay shoreline erosion
- Existing and future coastal storm surge damage
- Coastal flood damage
- Impact on water quality and quantity
- Impact on coastal resources
- Abandoned or derelict vessels, structures, and debris

The survey is structured as follows:

1. On an interactive map, you will select all subregions for which you can effectively evaluate the IOCs.
2. You will have the opportunity to review a short description, maps, and data for each selected subregion.
3. You will answer questions for each selected subregion, as the following example shows.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

	A	?	0	1	2	3	4
Altered, degraded, or lost habitat	○	○	○	○	○	○	○
Gulf beach erosion and dune degradation	○	○	○	○	○	○	○
Bay shoreline erosion	○	○	○	○	○	○	○
Existing and future coastal storm surge damage	○	○	○	○	○	○	○
Coastal flooding damage	○	○	○	○	○	○	○
Impact on water quality and quantity	○	○	○	○	○	○	○
Impact on coastal resources	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures and debris	○	○	○	○	○	○	○

4. You will be asked to provide any additional information you are aware of to assist with the IOC assessment. Examples of additional information that would be useful include knowledge of on-going or planned restoration efforts in an area, erosional hot-spots, recent degradation or damage, or other issues and processes known to local experts.

If you complete the survey and would like to provide input on additional subregions, you can start the survey again from the beginning. If you do repeat the survey, you will not be able to view your previous responses. During analysis, we will only consider your most recent response for each subregion.

For more information, including example considerations for each IOC and supporting information for datasets presented in this survey, please download this PDF.

Note: This survey is not anonymous. You will be required to enter your contact information below. You may be contacted via this email address for further clarification of your responses.

Q2. Please enter your contact information (required)

Name

Organization

Email address

Hot Spot Map

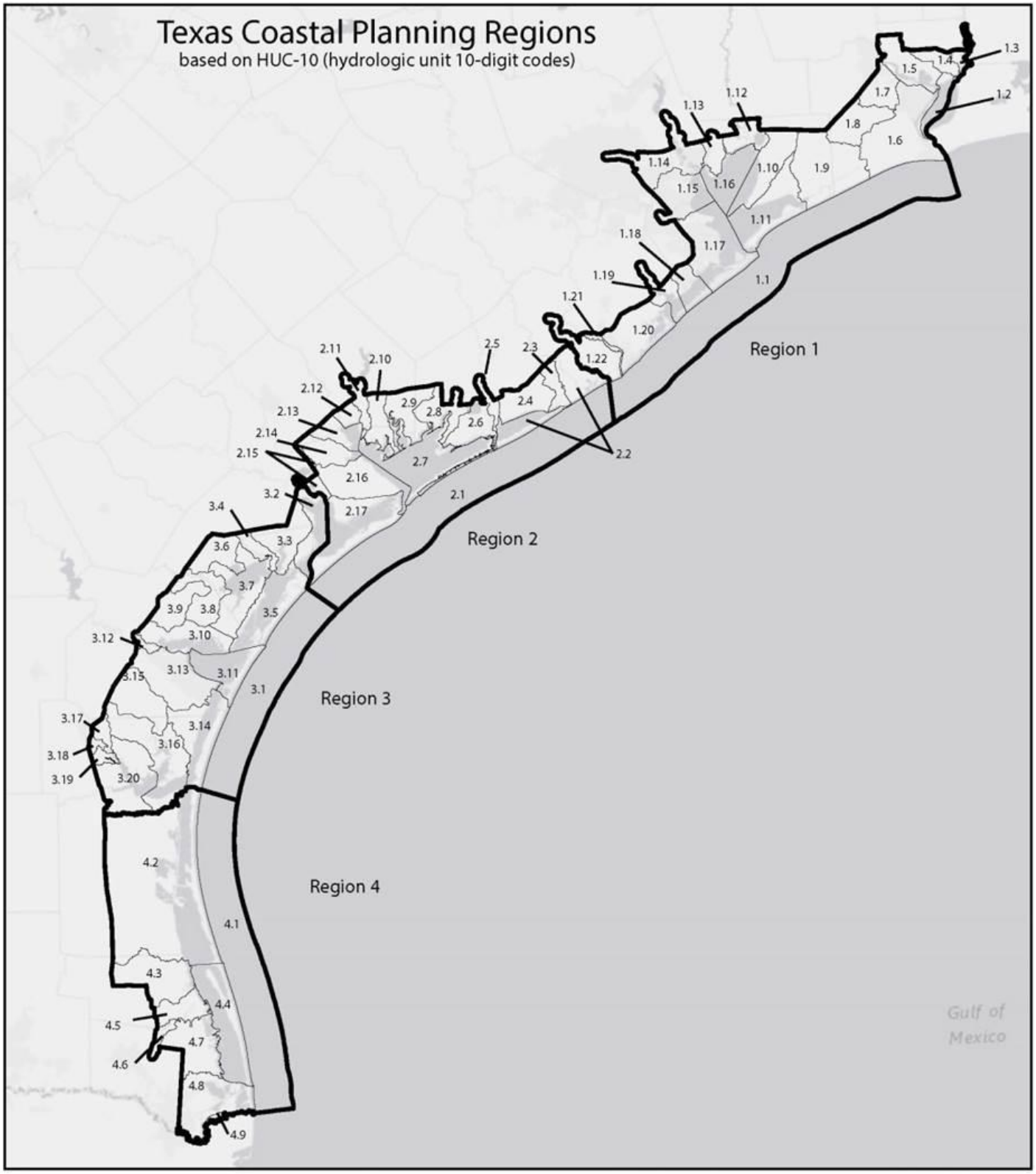
Q3. Please select the subregions for which you can effectively evaluate the IOCs. **Please only select subregions you feel you have sufficient knowledge of to provide feedback regarding one or more of the following issues:**

- Altered, degraded or lost habitat
- Gulf beach erosion and dune degradation
- Bay shoreline erosion
- Existing and future coastal storm surge damage
- Coastal flood damage
- Impacts on water quality and quantity
- Impacts on marine resources

- Abandoned or derelict vessels, structures and debris

(click here for more information on IOCs)

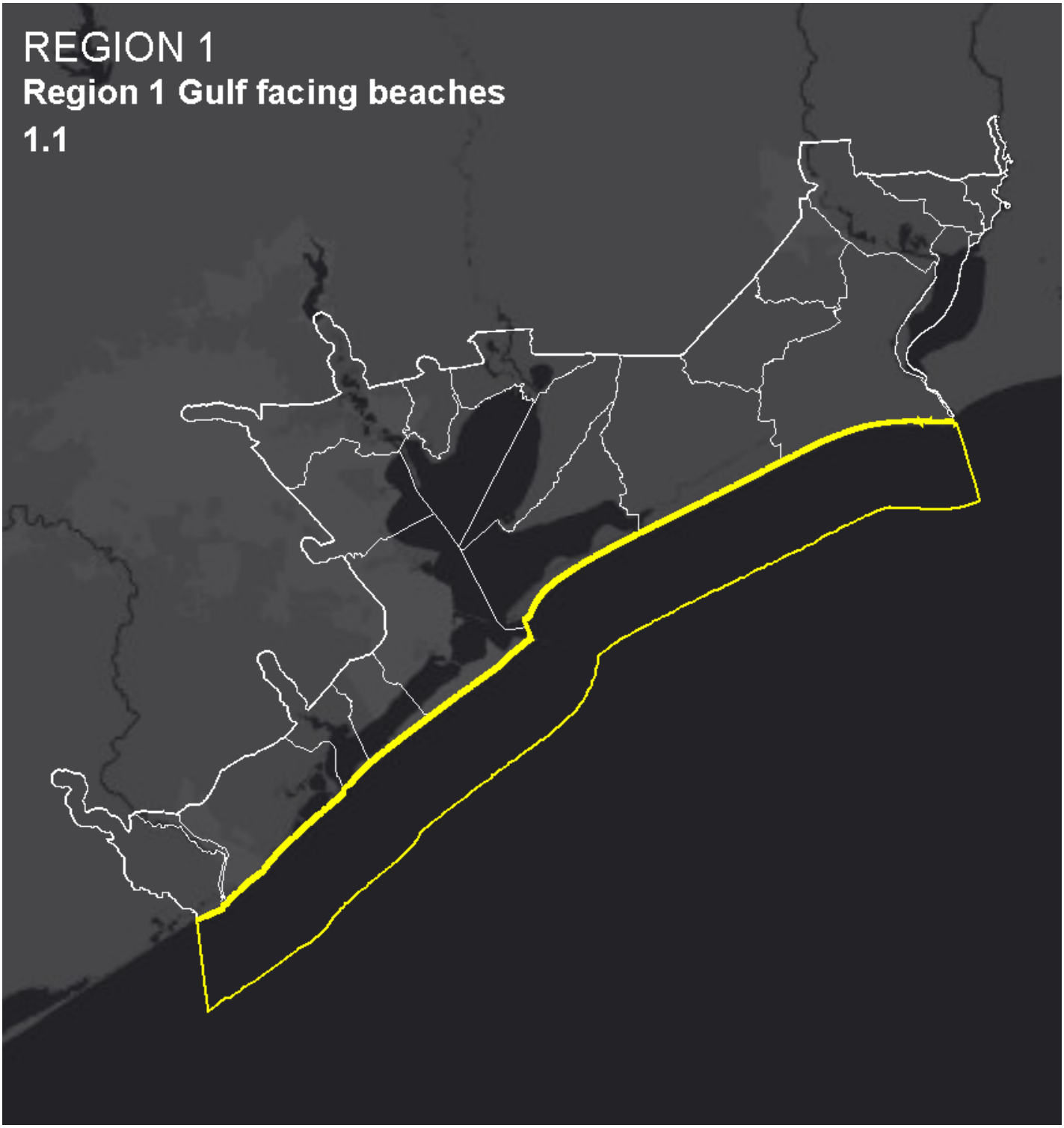
To select a subregion please click on the subregion label to highlight the label green. If you would like to provide input on all the subregions within a region, please select the region label by clicking to highlight it green. After you make your selections click the next arrow to advance.



Subregion 1.1 Gulf Facing Beaches and Dunes

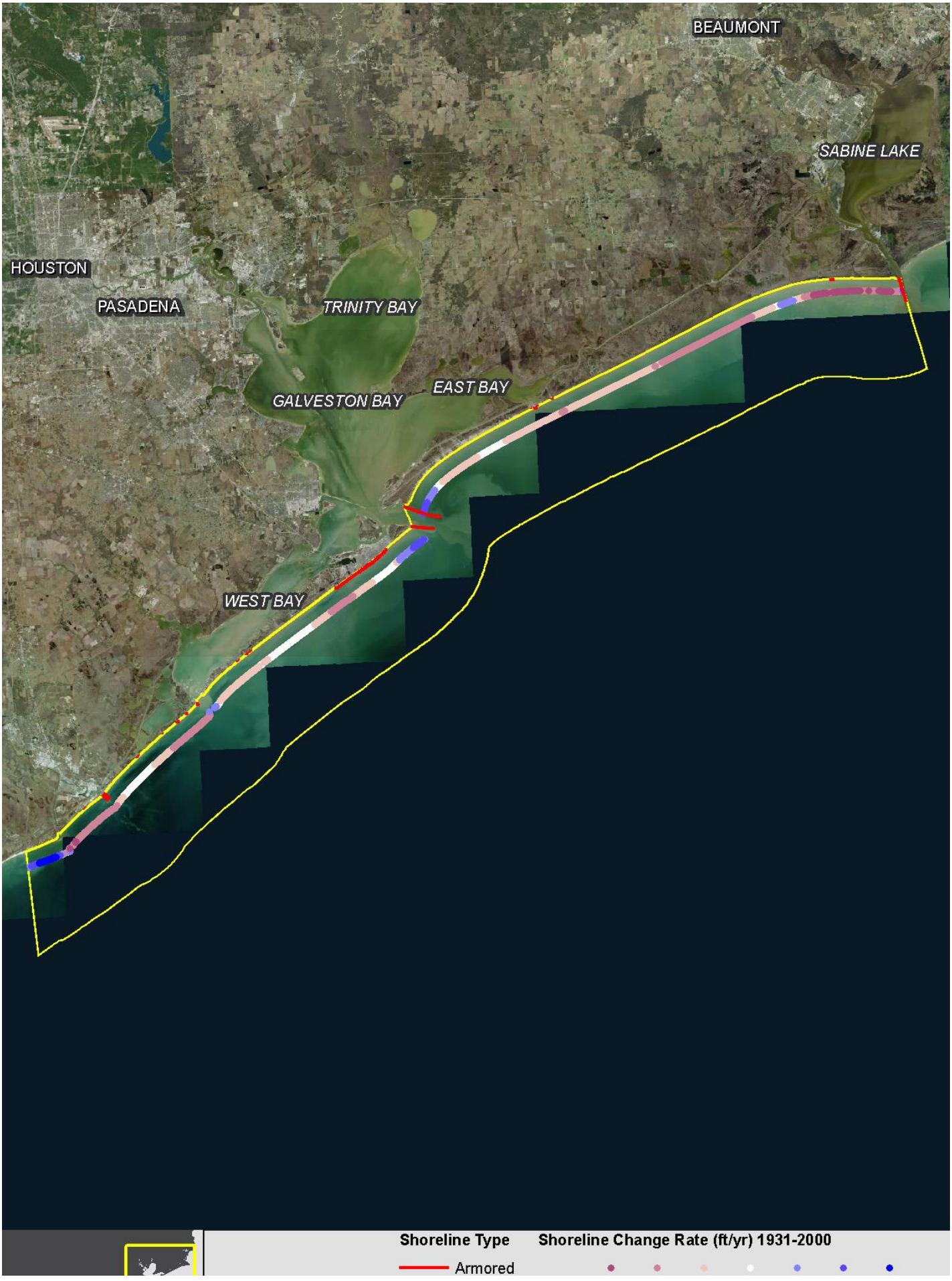
Q4.

Subregion 1.1 Gulf Facing Beaches and Dunes



- Includes the Gulf-facing beaches and foredunes from the Sabine River to the mouth of the Brazos River

Maps and Data



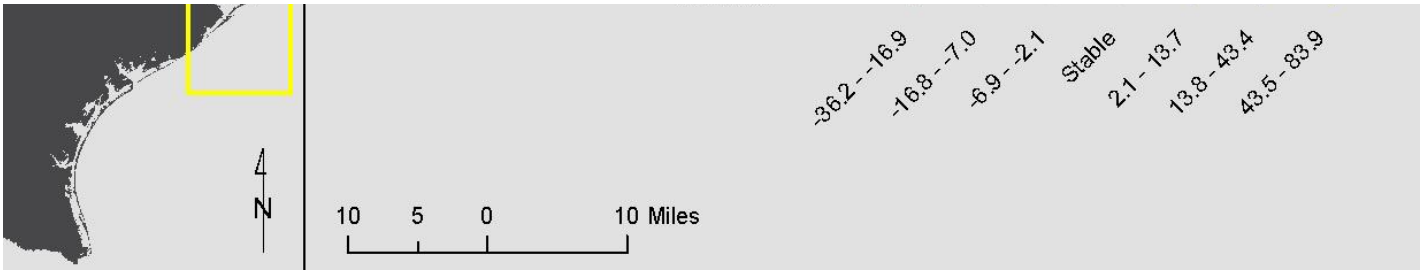


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

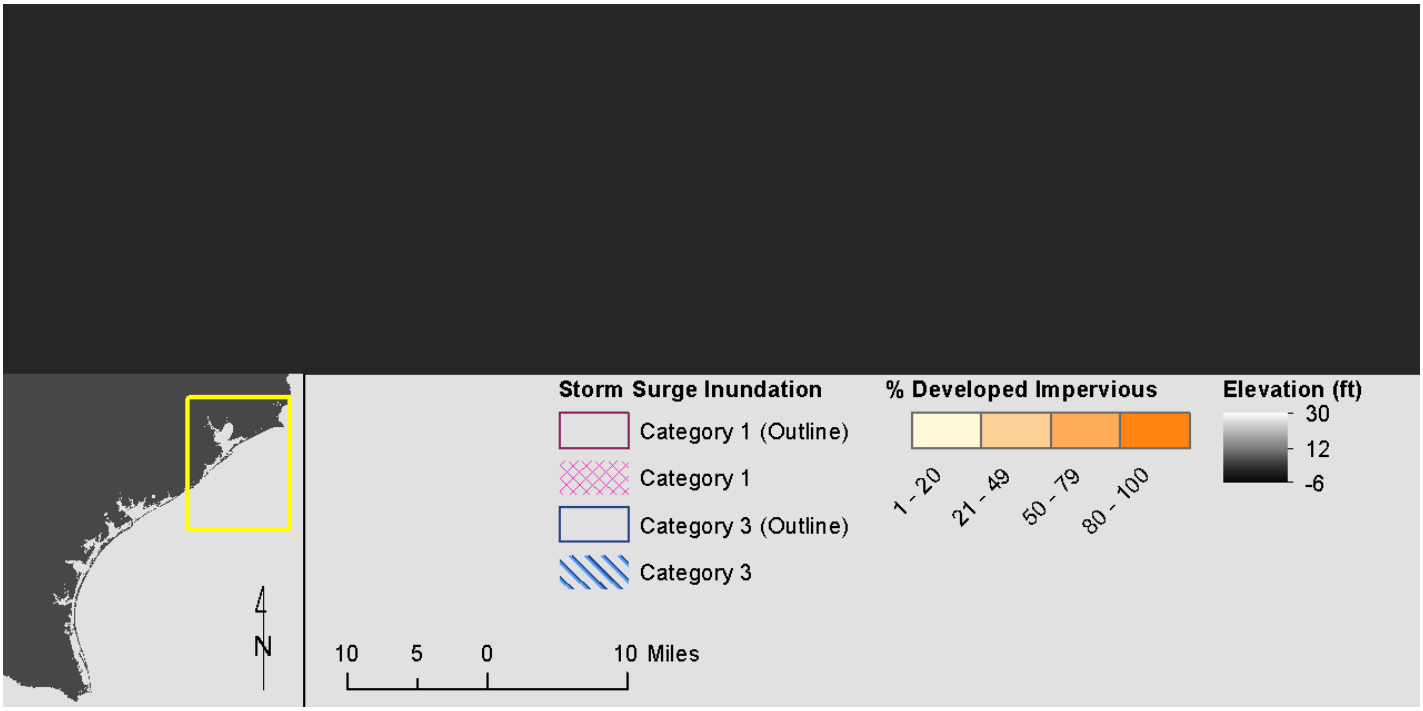


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.

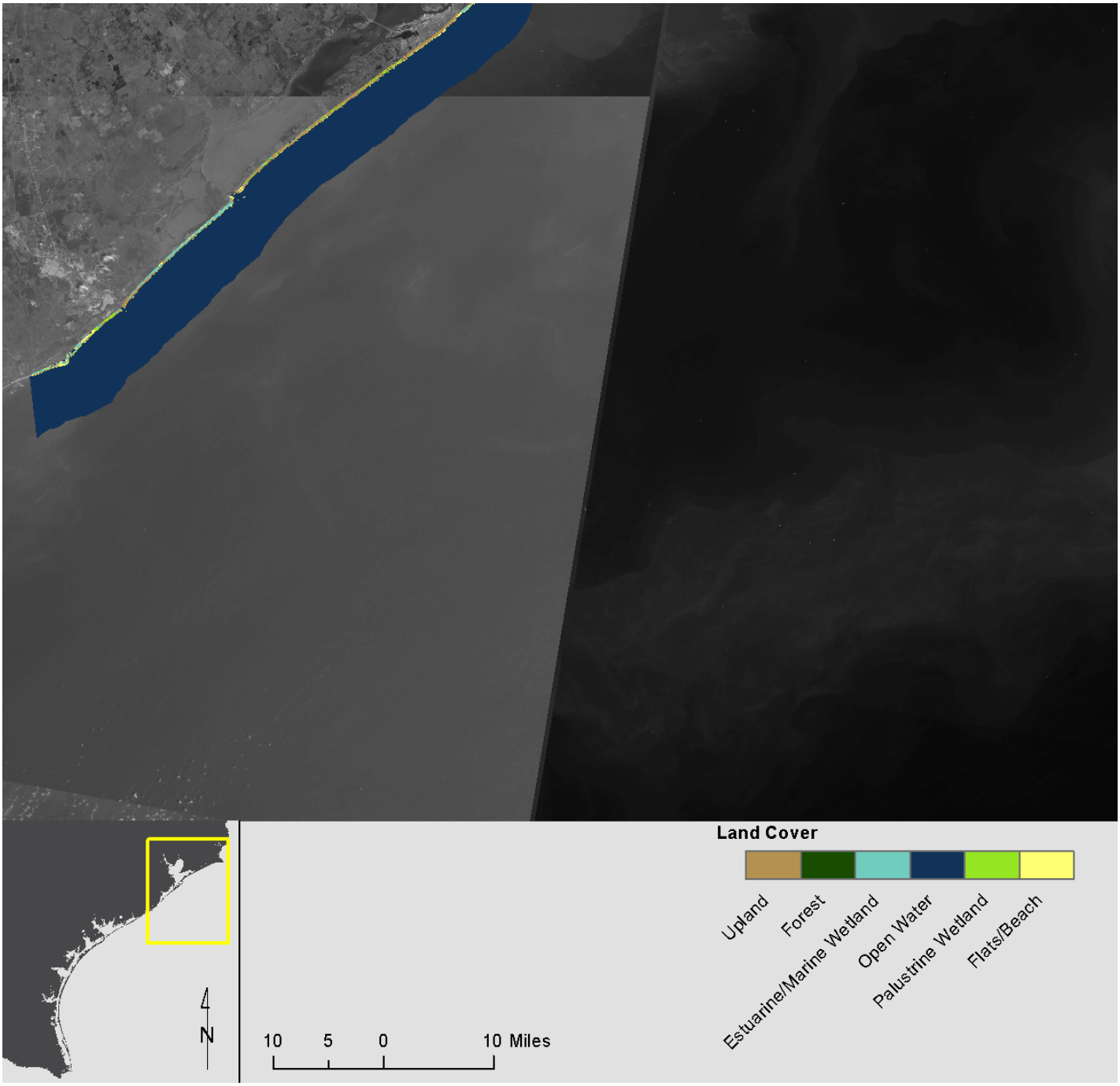


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD.

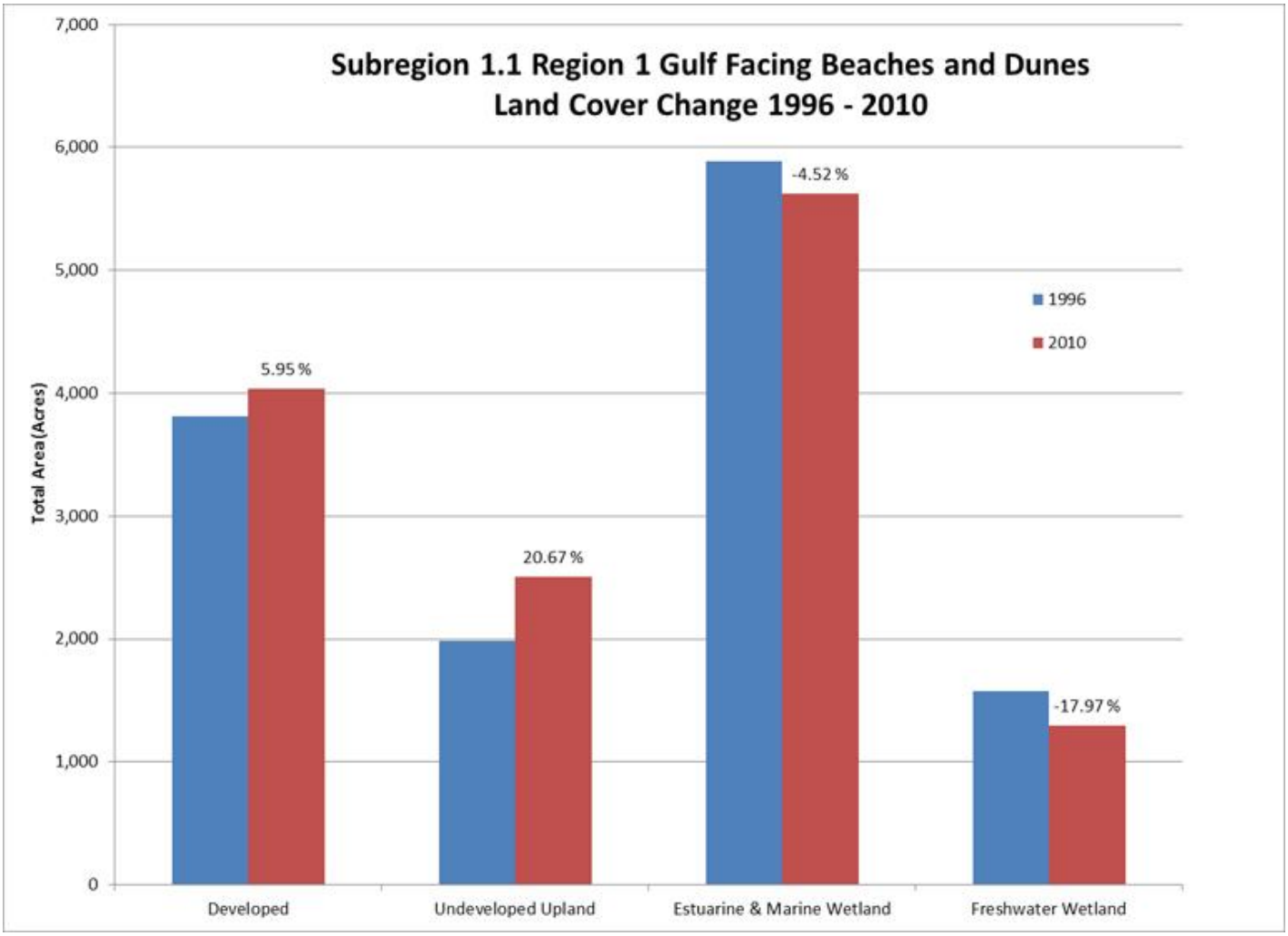


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 1. NOAA Economics: National Ocean Watch (ENOW) data for 6 counties (Brazoria, Chambers, Galveston, Harris, Jefferson, and Orange) located in Region 1. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 1 (6 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
152217	3775	$19,268,600,000	$126,586	$129,602,300,000	$851,431
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
21666	1051	$355,700,000	$16,417	$768,000,000	$35,447
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
612	64	$13,900,000	$22,712	$39,600,000	$64,706
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
3601	122	$265,200,000	$73,646	$550,600,000	$152,902
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
98659	1966	$16,976,300,000	$172,070	$123,101,500,000	$1,247,747
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
18793	448	$1,028,100,000	$54,707	$2,157,900,000	$114,825
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
618	7	$39,000,000	$63,107	$100,700,000	$162,945

Q5.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

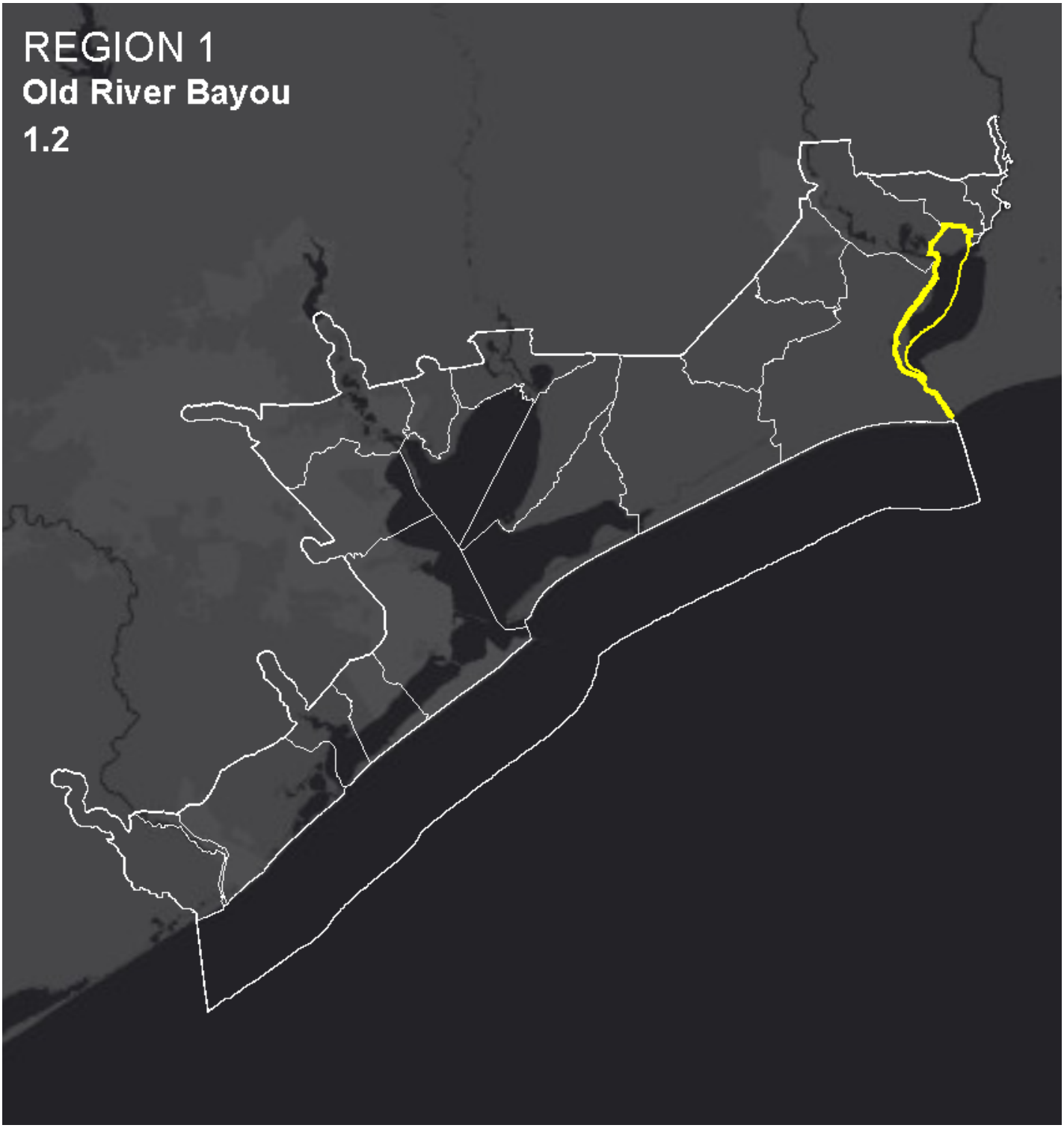
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(2.9)**	○	○	○	○	○	○	○

Gulf beach erosion and dune degradation **(3.2)**	○	○	○	○	○	○	○
Bay shoreline erosion **(0.0)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(2.8)**	○	○	○	○	○	○	○
Coastal flood damage **(2.8)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.0)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.2)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures and debris **(0.9)**	○	○	○	○	○	○	○

Q6. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 1.2 Old River Bayou

Q7. **Subregion 1.2 Old River Bayou**



- Includes the Lower Neches Wildlife Management Area, most of Sabine Lane, and the western shore of the GIWW from the mouth of the Neches to the Port Arthur Ship Channel

Maps and Data

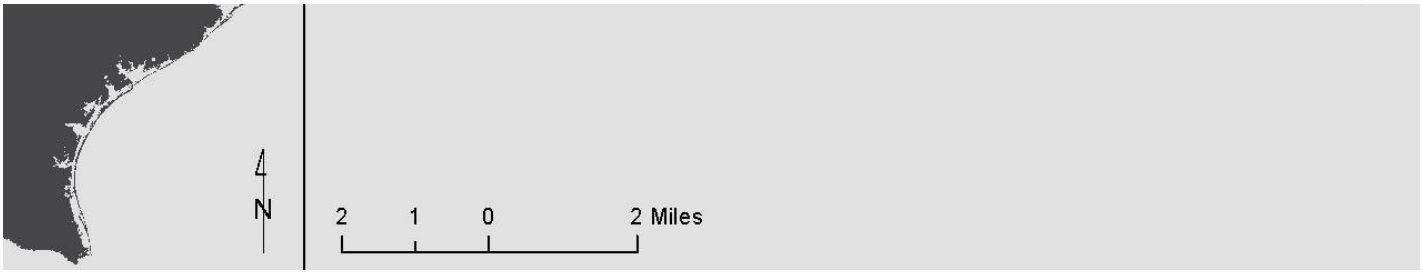


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

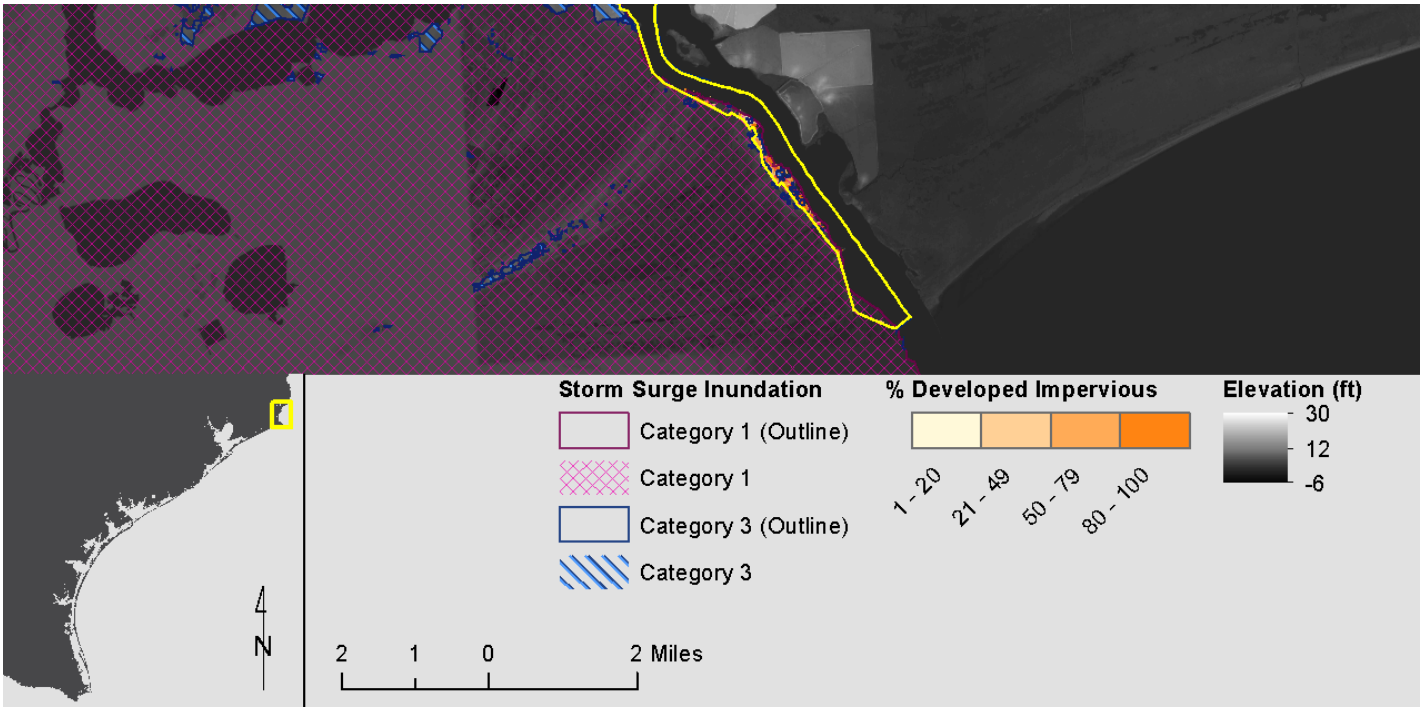
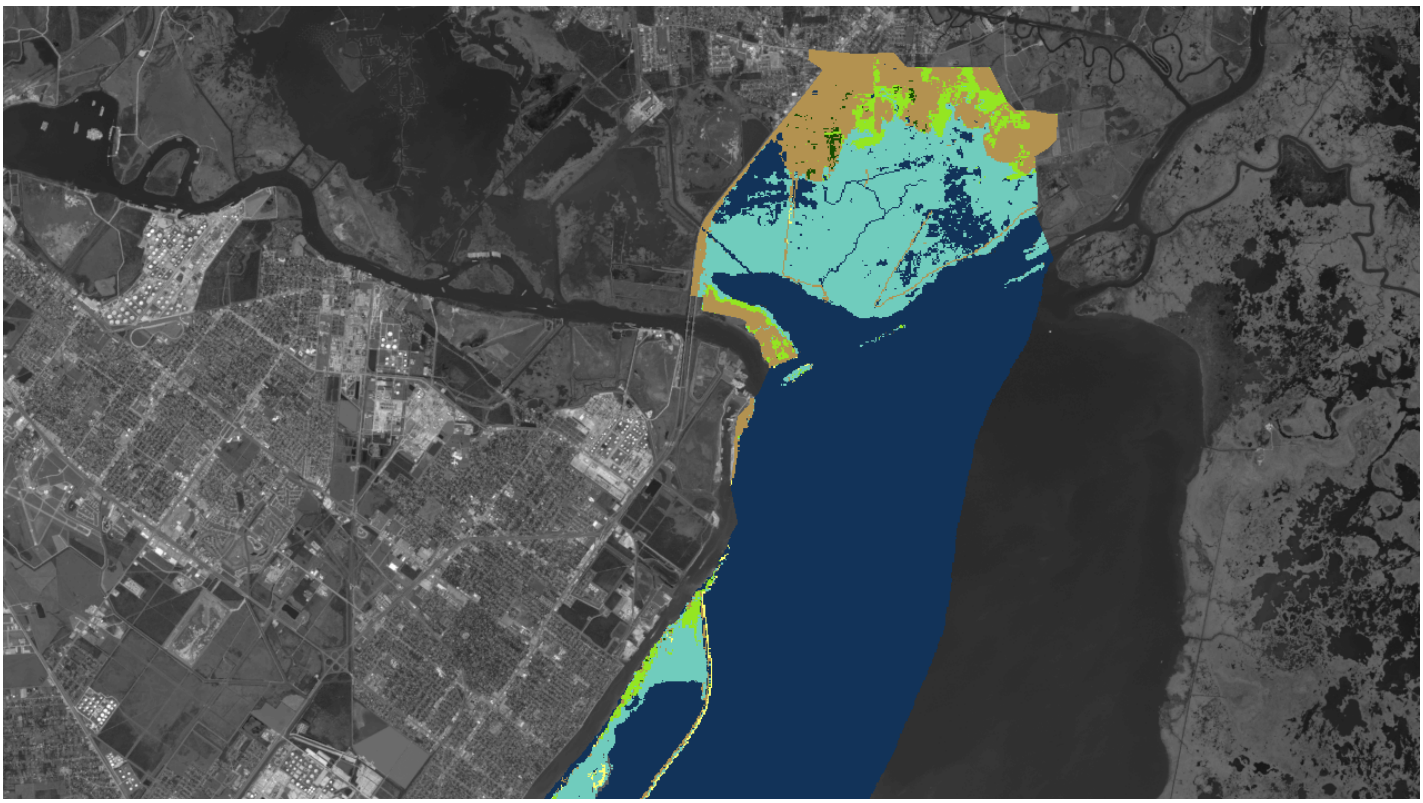


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.



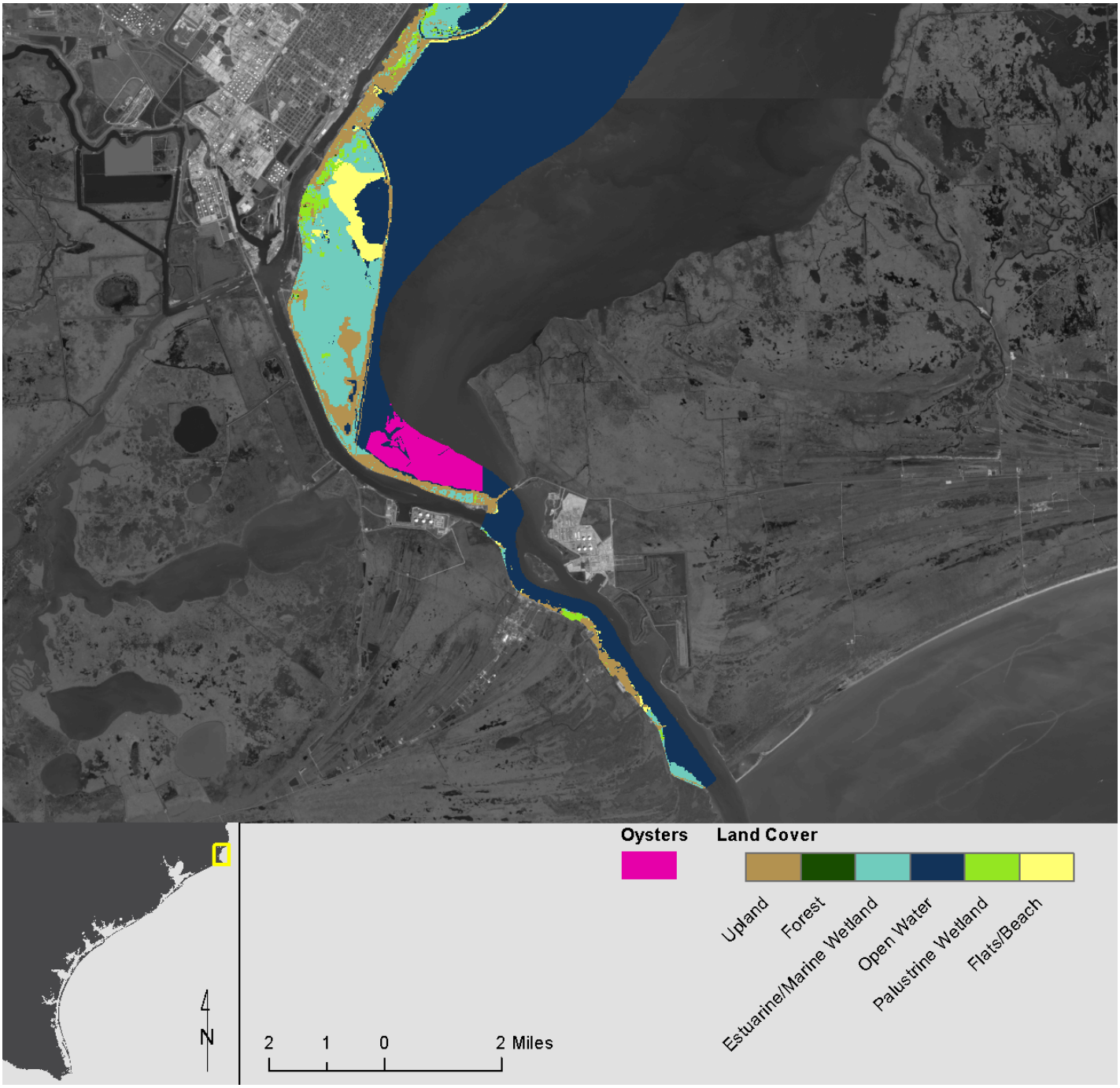


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD.

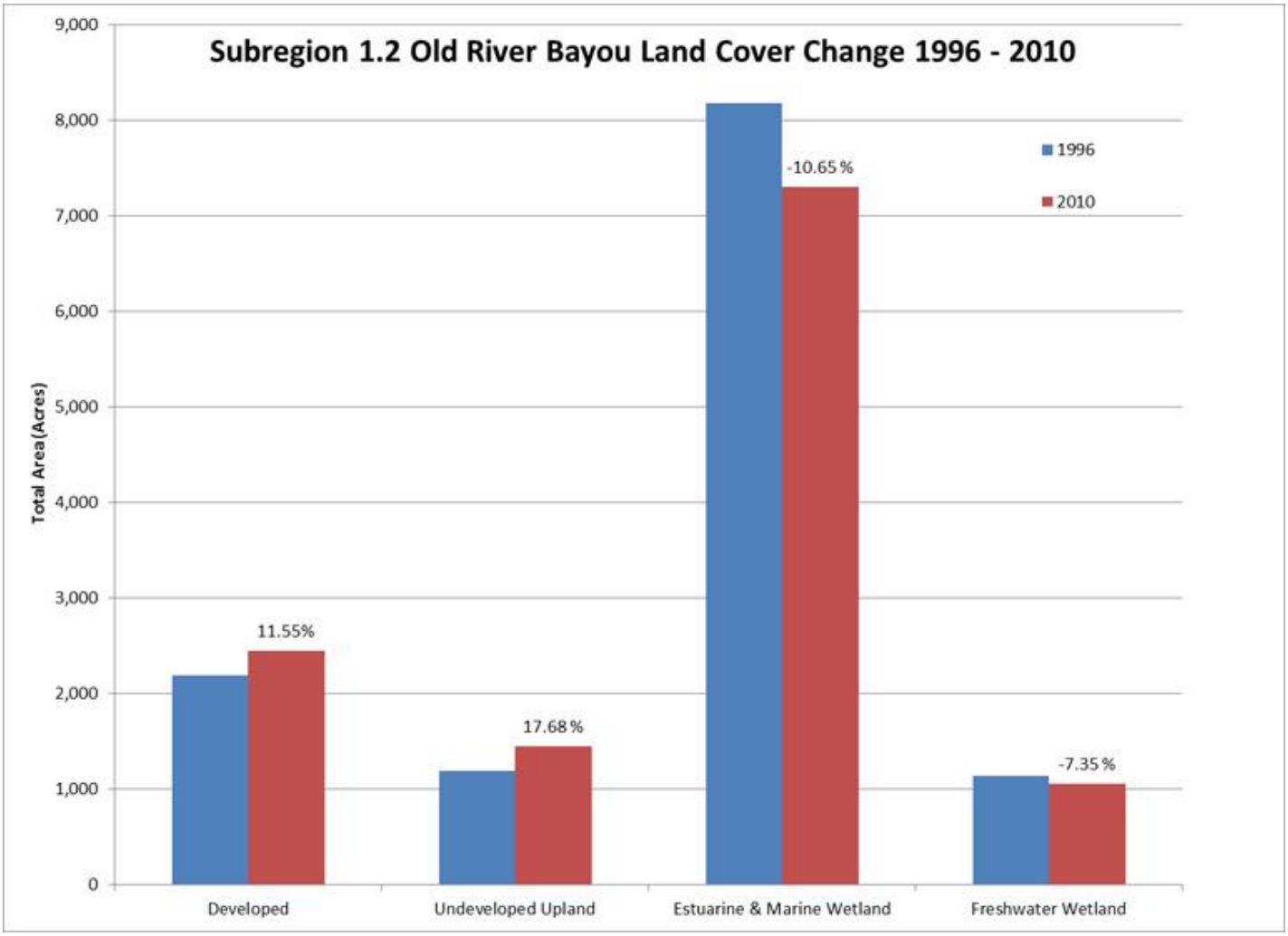


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 1. NOAA Economics: National Ocean Watch (ENOW) data for 6 counties (Brazoria, Chambers, Galveston, Harris, Jefferson, and Orange) located in Region 1. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 1 (6 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
152217	3775	$19,268,600,000	$126,586	$129,602,300,000	$851,431
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
21666	1051	$355,700,000	$16,417	$768,000,000	$35,447
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
612	64	$13,900,000	$22,712	$39,600,000	$64,706
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
3601	122	$265,200,000	$73,646	$550,600,000	$152,902
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
98659	1966	$16,976,300,000	$172,070	$123,101,500,000	$1,247,747
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
18793	448	$1,028,100,000	$54,707	$2,157,900,000	$114,825
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
618	7	$39,000,000	$63,107	$100,700,000	$162,945

Q8.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

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1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(3.1)**	○	○	○	○	○	○	○

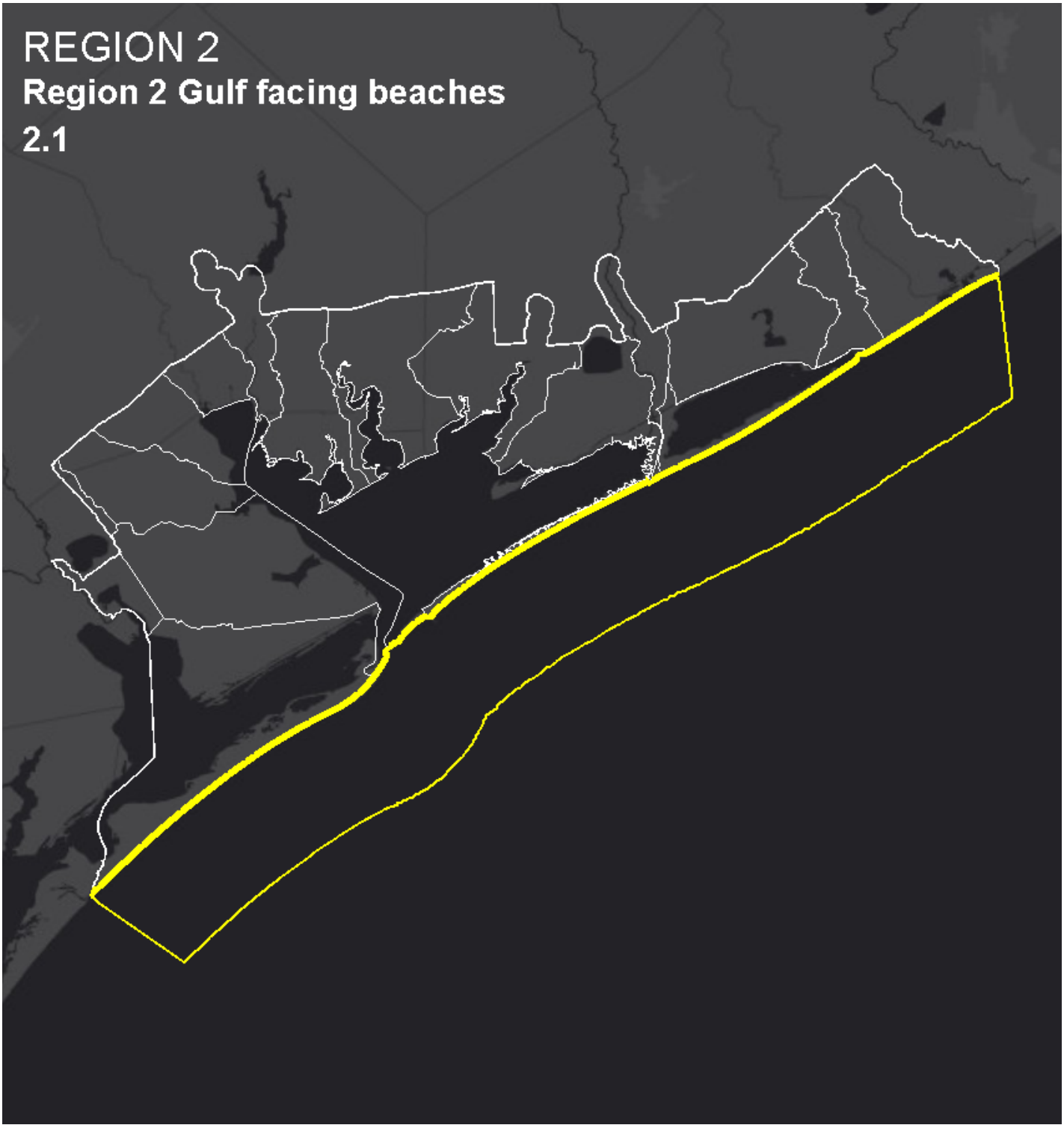
Gulf beach erosion and dune degradation **(0.0)**	○	○	○	○	○	○	○
Bay shoreline erosion **(2.2)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(2.5)**	○	○	○	○	○	○	○
Coastal flood damage **(2.5)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.8)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.3)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures and debris **(0.8)**	○	○	○	○	○	○	○

Q9. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 1.3 Adams Bayou-Sabine River

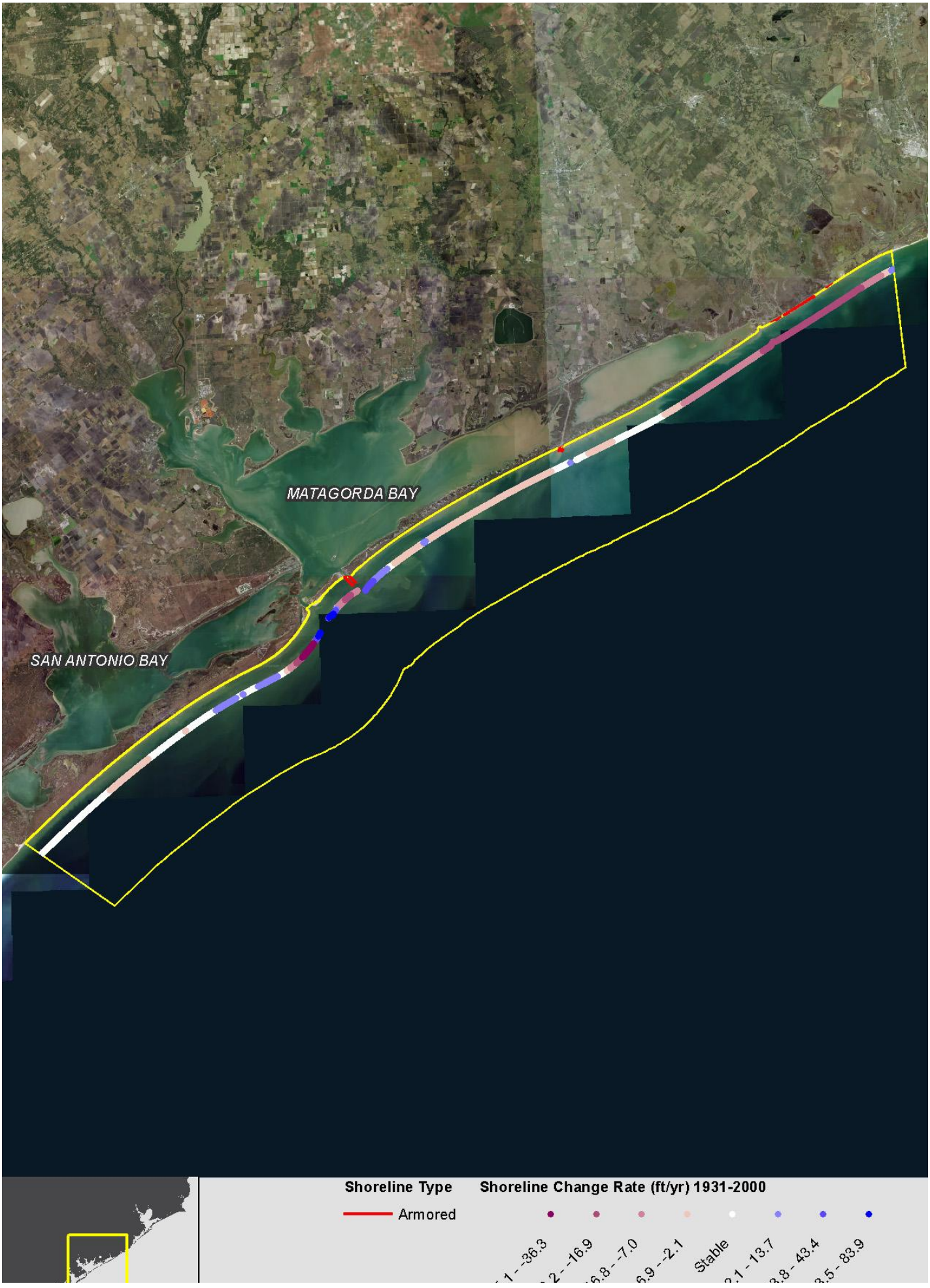
Q10.

Subregion 1.3 Adams Bayou-Sabine River



- Includes the Gulf-facing beaches and foredunes from the mouth of the Brazos River to Cedar Bayou

Maps and Data


MATAGORDA BAY
SAN ANTONIO BAY
Shoreline Type
Armored
Shoreline Change Rate (ft/yr) 1931-2000
Stable

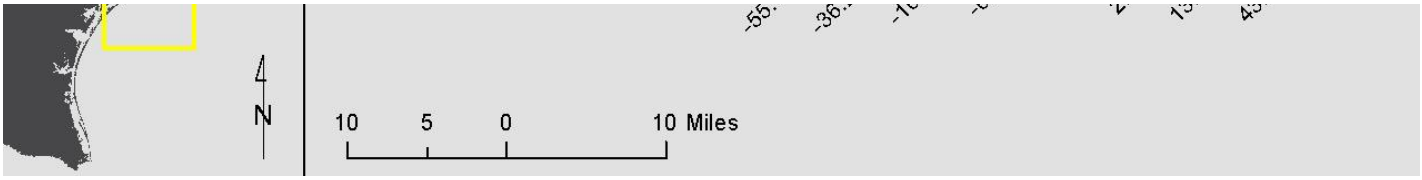


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

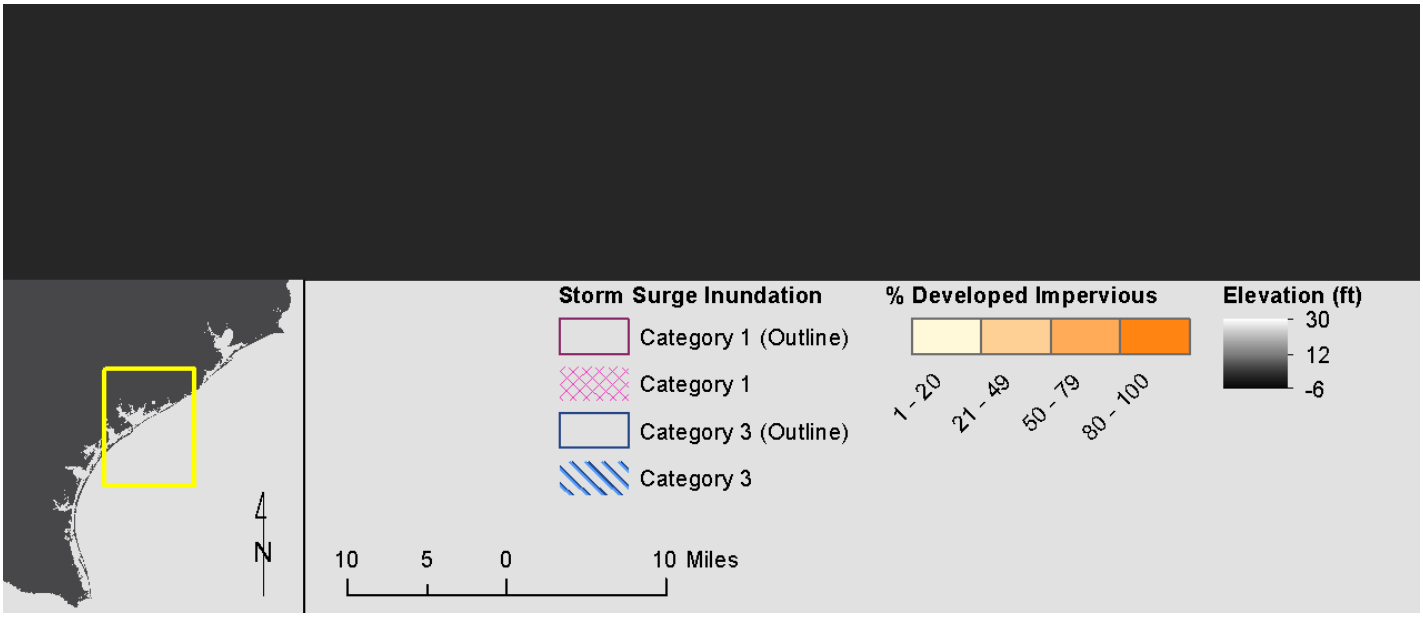


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.

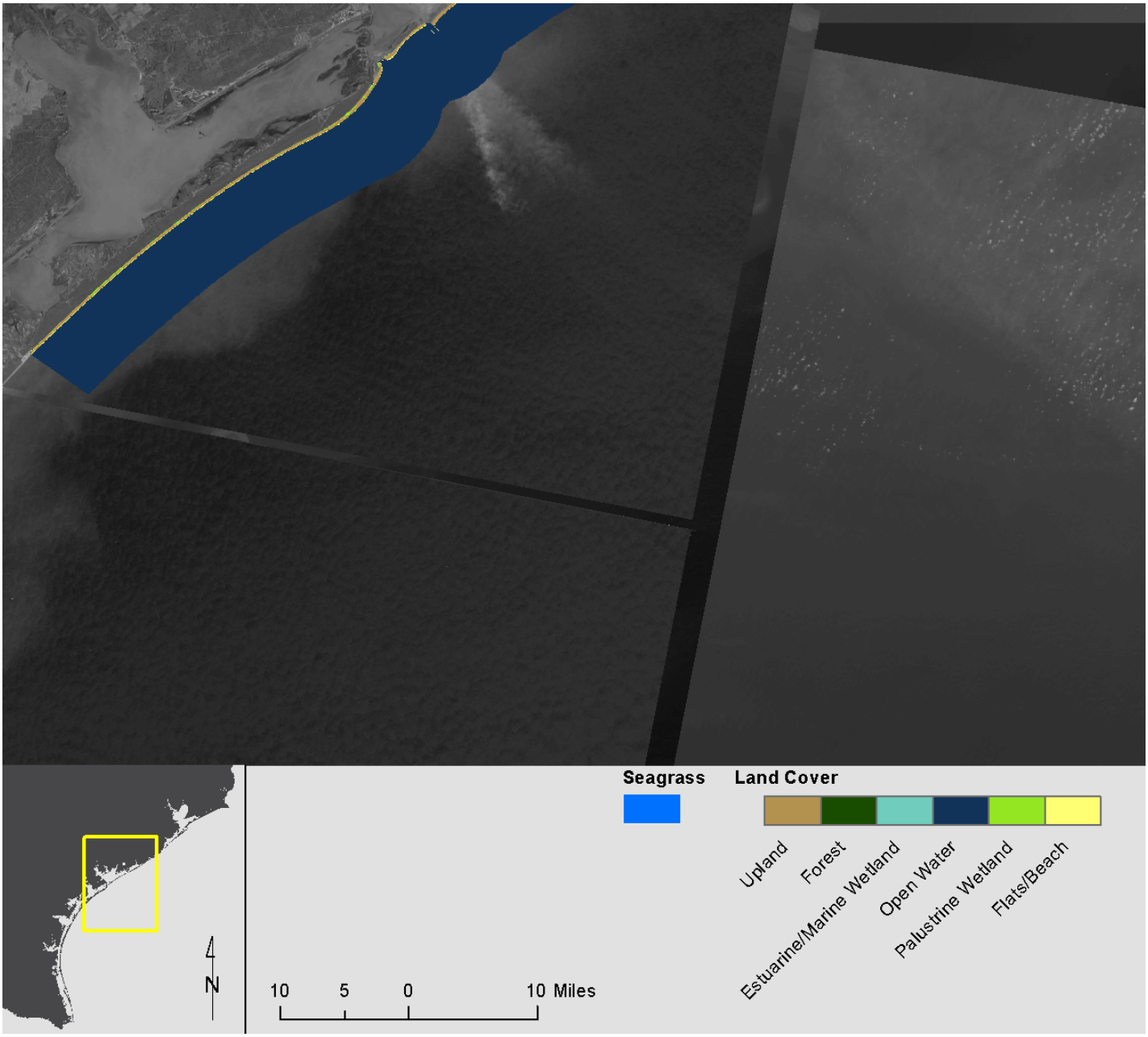


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD.

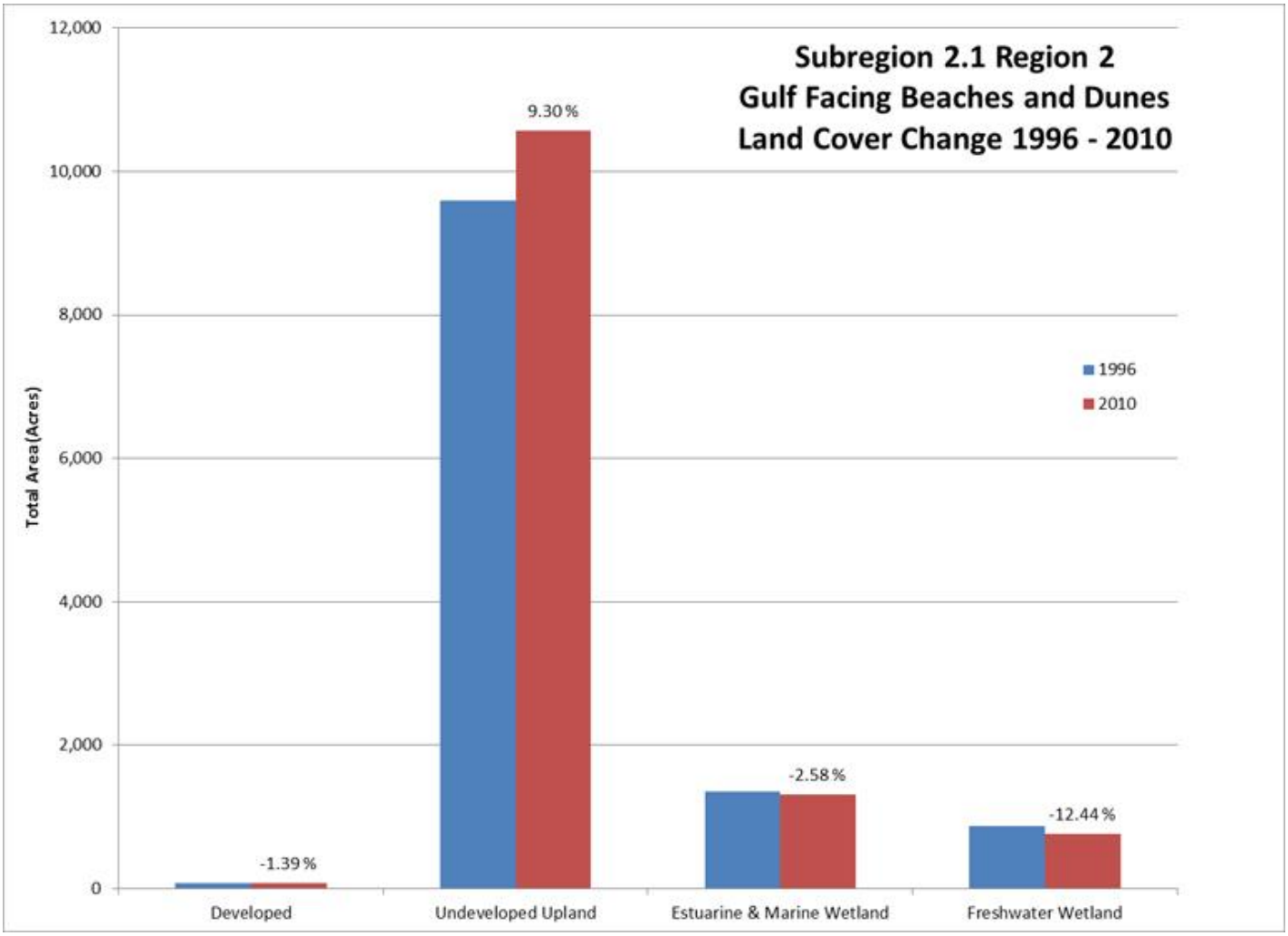


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 2. NOAA Economics: National Ocean Watch (ENOW) data for 4 counties (Calhoun, Jackson, Matagorda, and Victoria) located in Region 2. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 2 (4 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
7282	405	$400,300,000	$54,971	$1,186,500,000	$162,936
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
1537	152	$20,800,000	$13,533	$45,200,000	$29,408
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
7	20	$400,000	$57,143	$1,800,000	$257,143
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
549	4	$30,200,000	$55,009	$62,800,000	$114,390
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
44	31	$2,100,000	$47,727	$20,900,000	$475,000
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
134	6	$5,300,000	$39,552	$11,700,000	$87,313
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q71. The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

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4 = extremely concerned

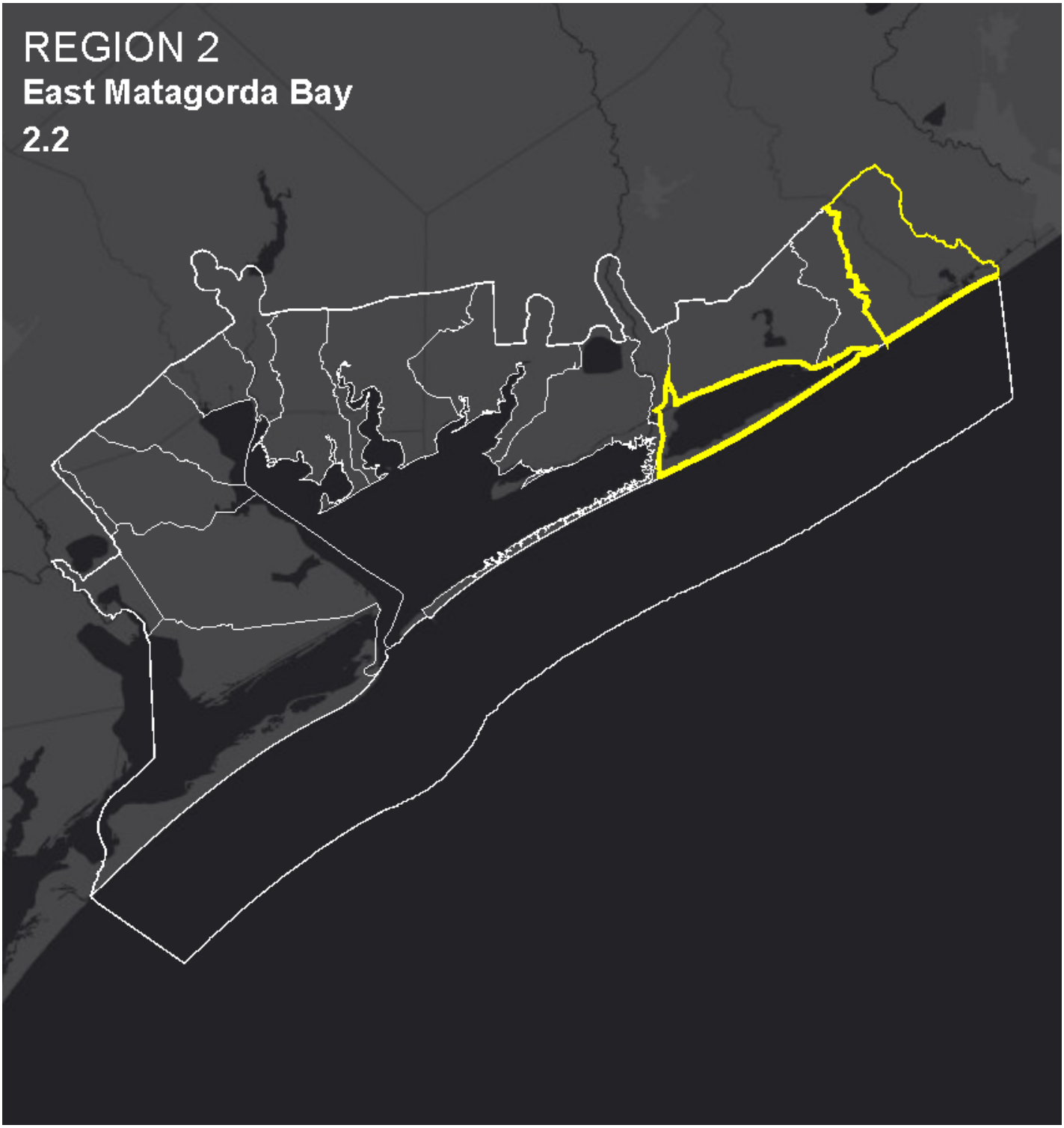
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(2.9)**	○	○	○	○	○	○	○
Gulf beach erosion and dune	○	○	○	○	○	○	○

degradation **(1.7)**							
Bay shoreline erosion **(0.0)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(1.9)**	○	○	○	○	○	○	○
Coastal flood damage **(1.9)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.1)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.3)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(0.9)**	○	○	○	○	○	○	○

Q72. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 2.2 East Matagorda Bay

Q73. **Subregion 2.2 East Matagorda Bay**



- Includes the Cedar Lakes area and the terminus of the Brazos River, as well as East Matagorda Bay
- Includes most of the San Bernard National Wildlife Refuge and a small portion of Big Boggy National Wildlife Refuge
- Includes the bay-fringing marshes of Matagorda peninsula, but not the Gulf-facing beaches and dunes

- Includes the GIWW from the Brazos River to the city of Matagorda with the exception of the GIWW near Bay City and Dead Caney Lake, but excludes much of the north shoreline of the GIWW
- Does not include the Colorado River

Maps and Data

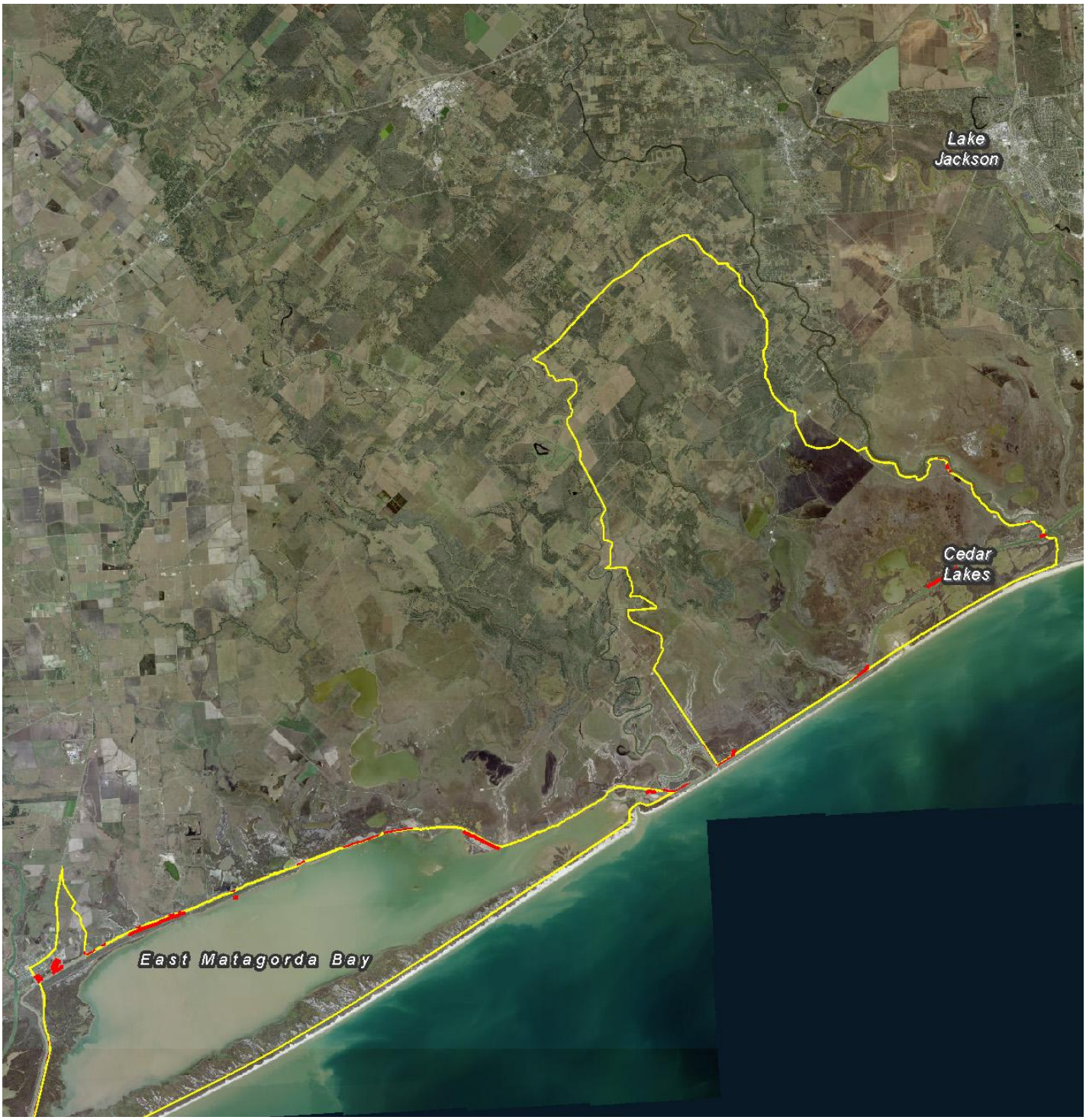
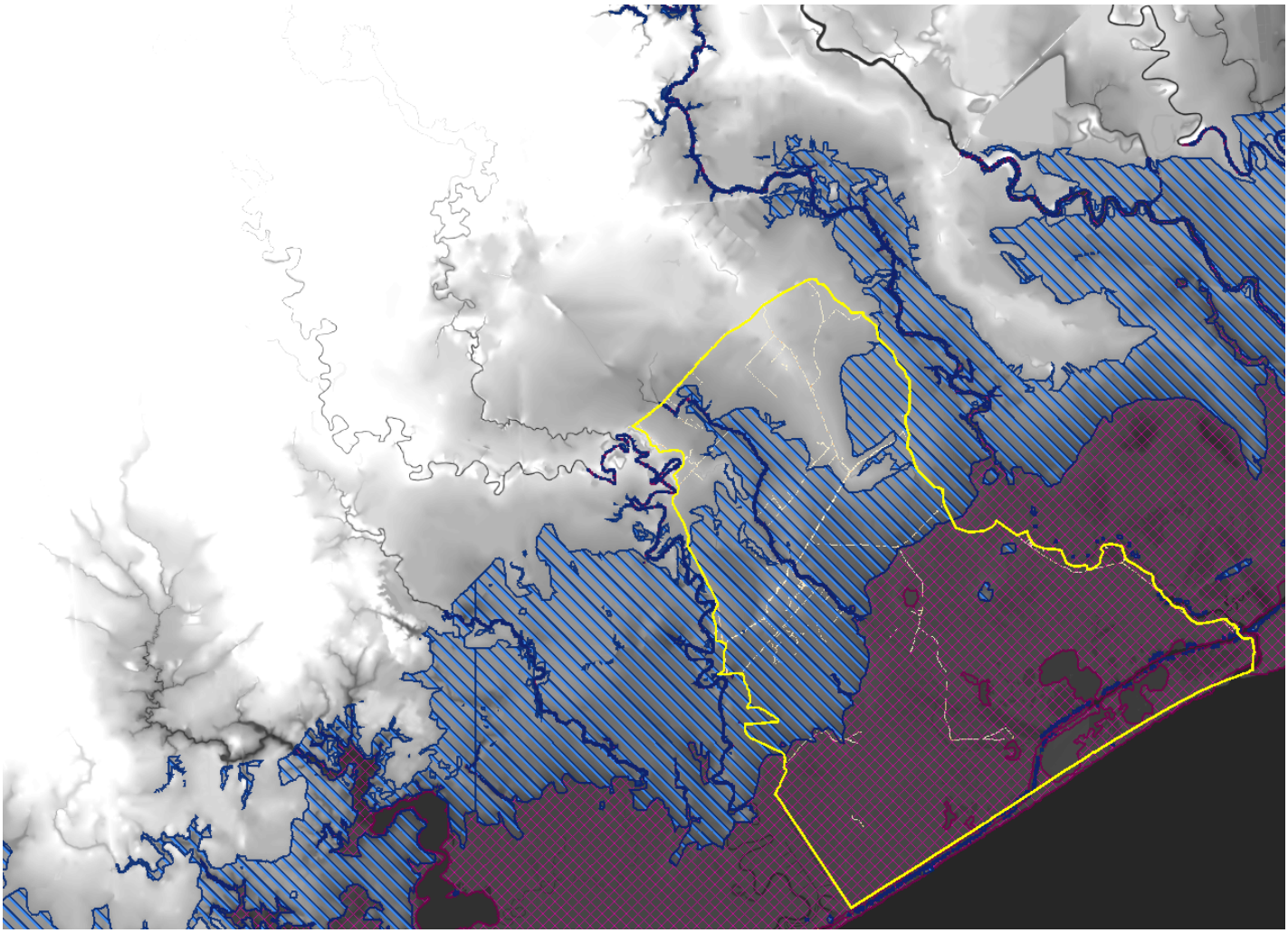


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.



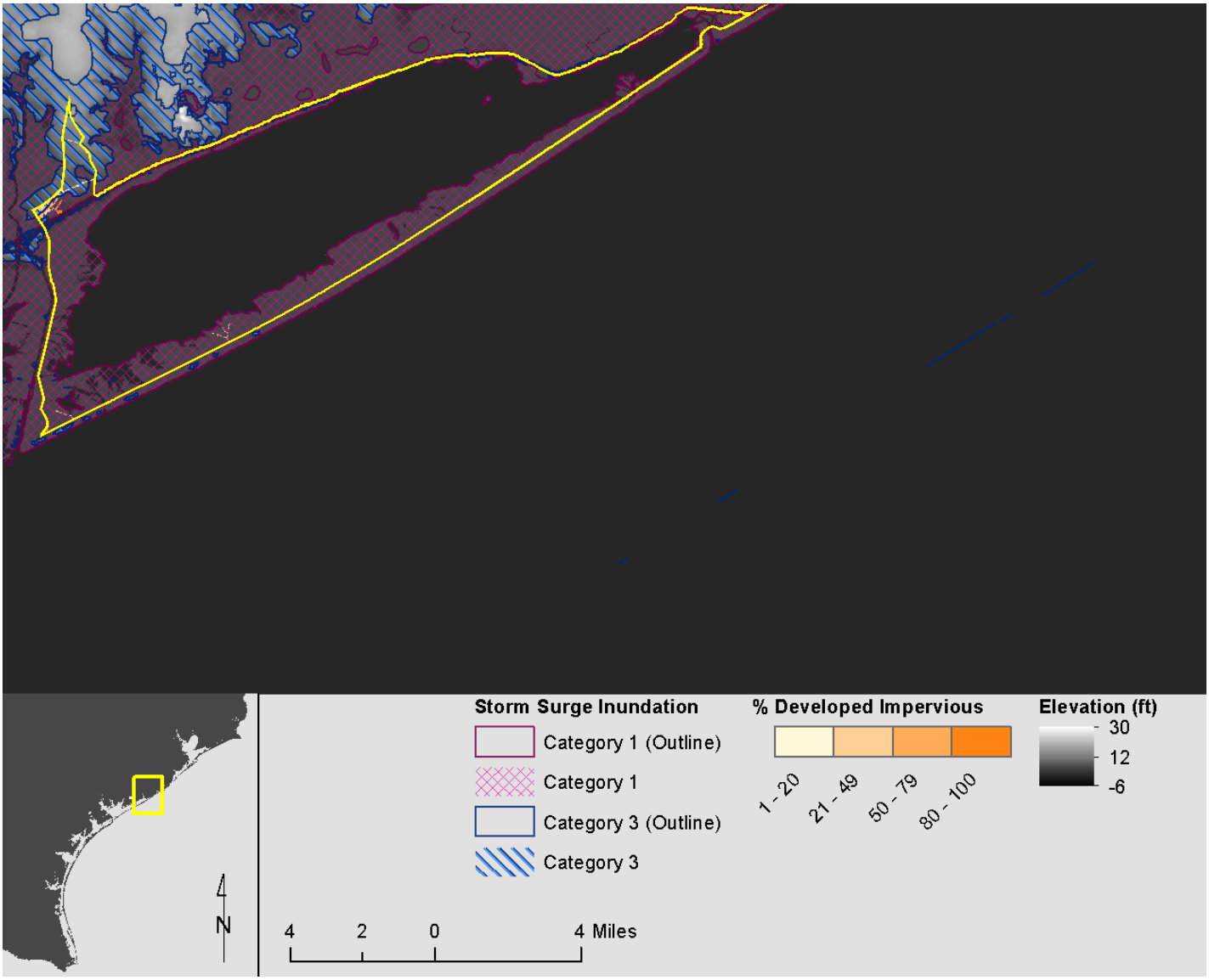
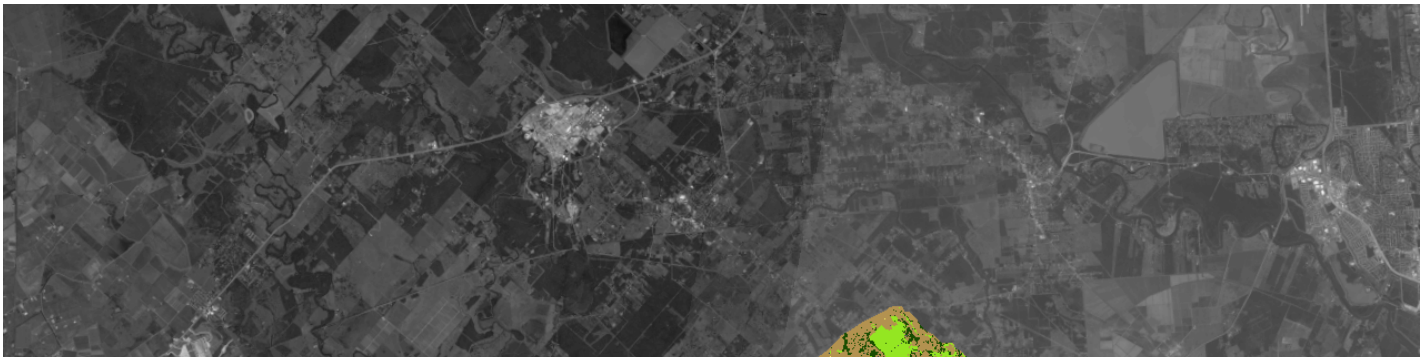


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.



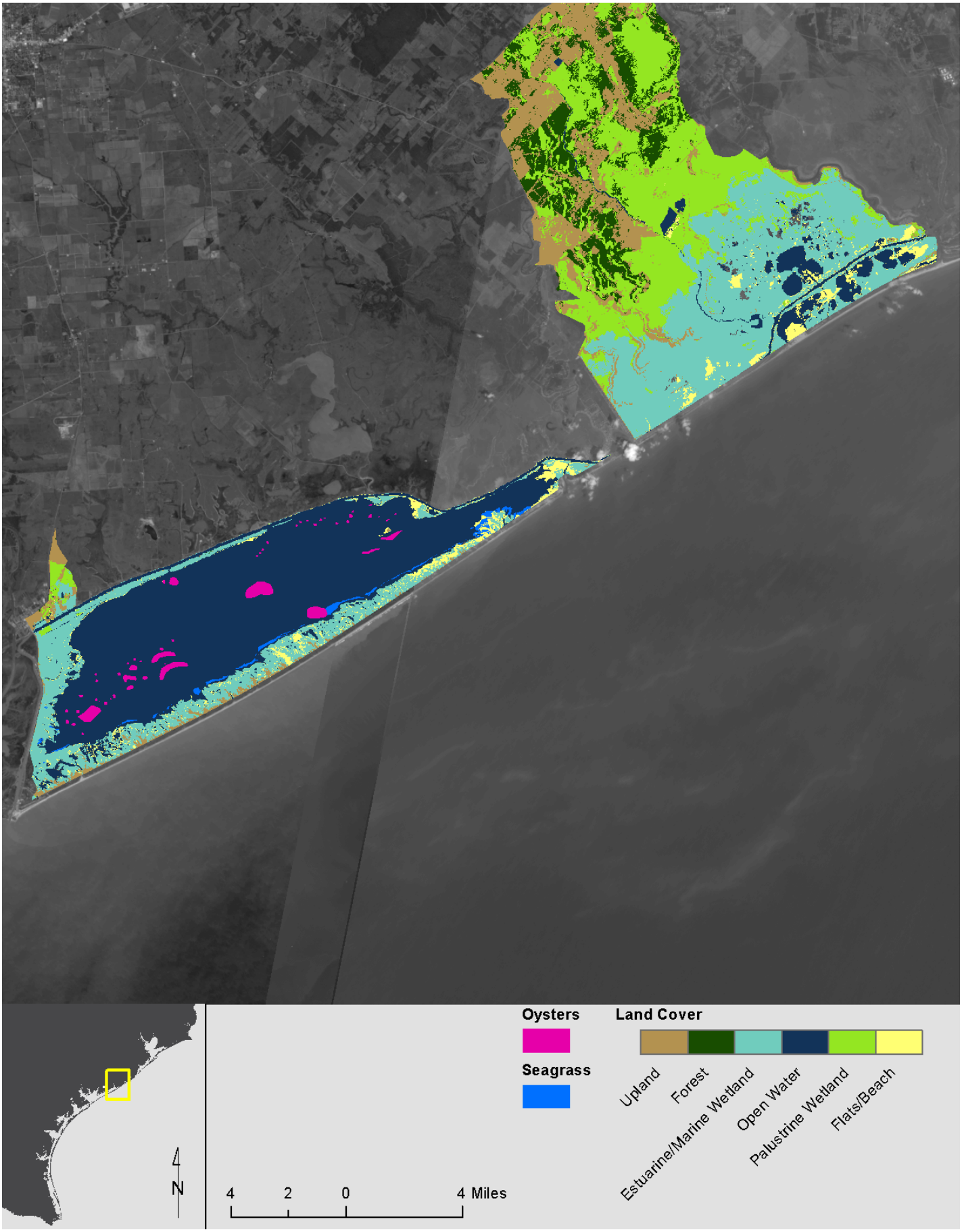


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA

and TPWD.

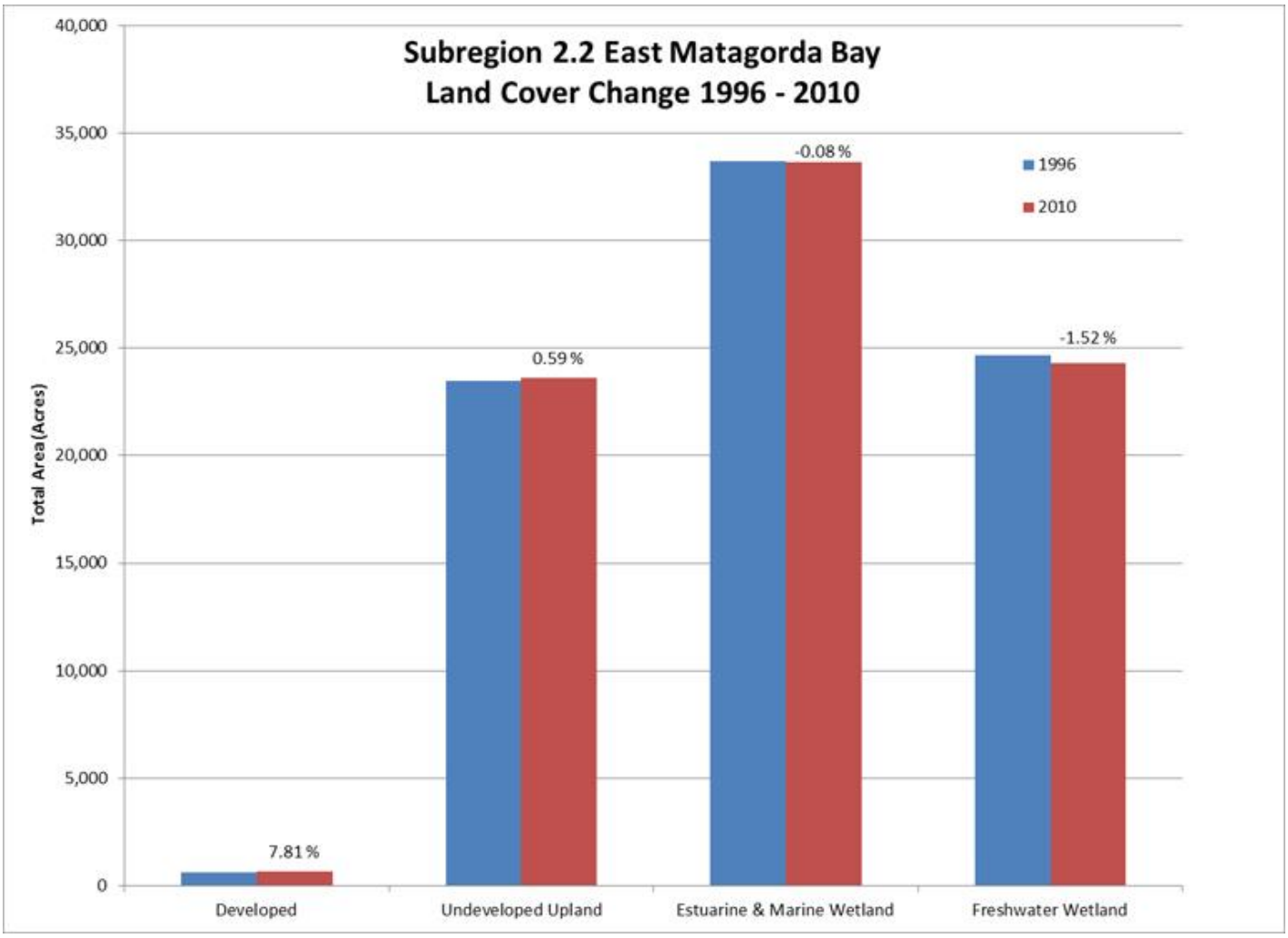


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 2. NOAA Economics: National Ocean Watch (ENOW) data for 4 counties (Calhoun, Jackson, Matagorda, and Victoria) located in Region 2. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 2 (4 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
7282	405	$400,300,000	$54,971	$1,186,500,000	$162,936
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
1537	152	$20,800,000	$13,533	$45,200,000	$29,408
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
7	20	$400,000	$57,143	$1,800,000	$257,143
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
549	4	$30,200,000	$55,009	$62,800,000	$114,390
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
44	31	$2,100,000	$47,727	$20,900,000	$475,000
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
134	6	$5,300,000	$39,552	$11,700,000	$87,313
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q74.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

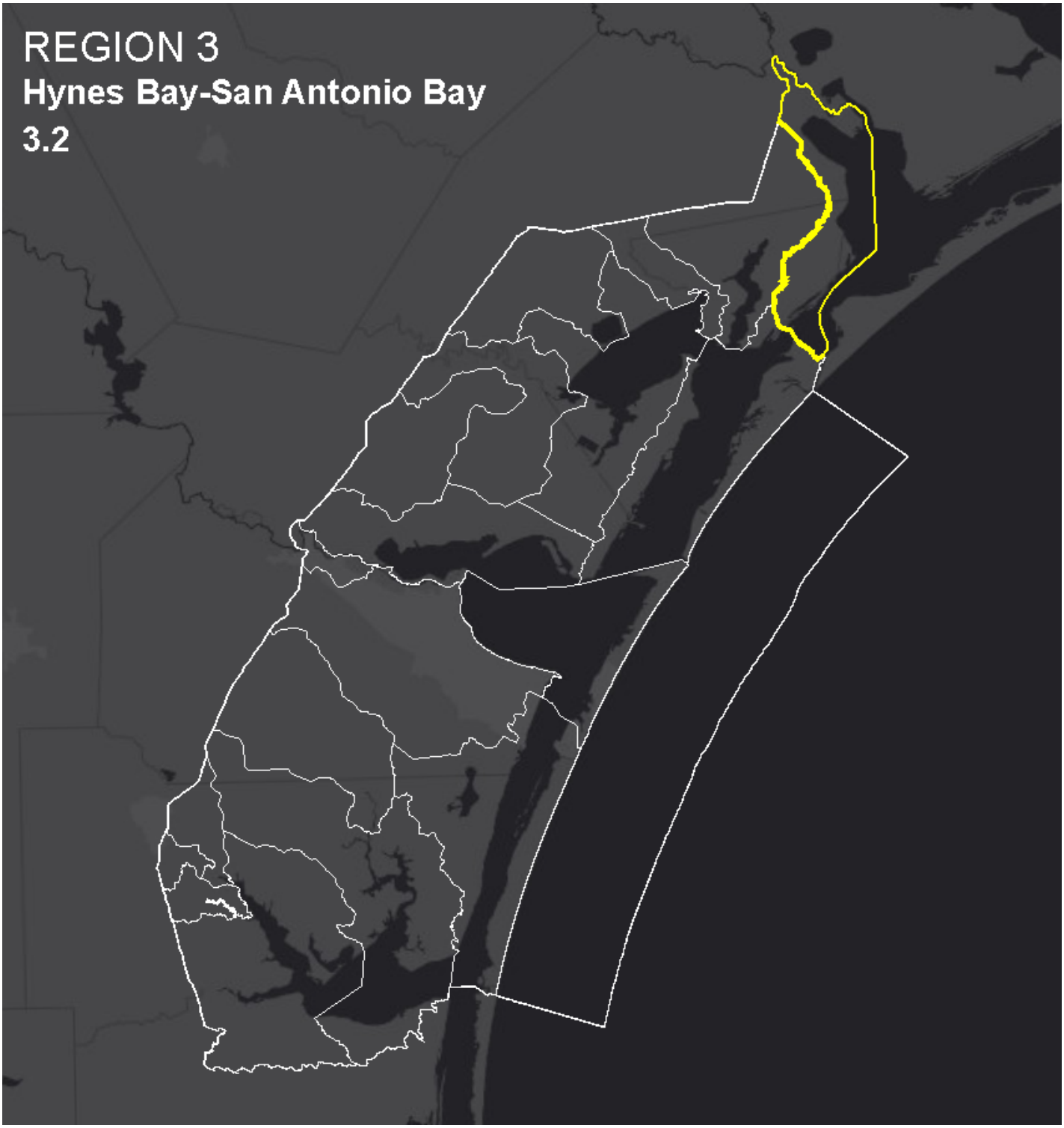
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(3.1)**	○	○	○	○	○	○	○

Gulf beach erosion and dune degradation **(0.0)**	○	○	○	○	○	○	○
Bay shoreline erosion **(2.7)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(2.2)**	○	○	○	○	○	○	○
Coastal flood damage **(2.2)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.1)**	○	○	○	○	○	○	○
Impacts on coastal resources **(2.1)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(0.9)**	○	○	○	○	○	○	○

Q75. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 2.3 Water Hole Creek - Caney Creek

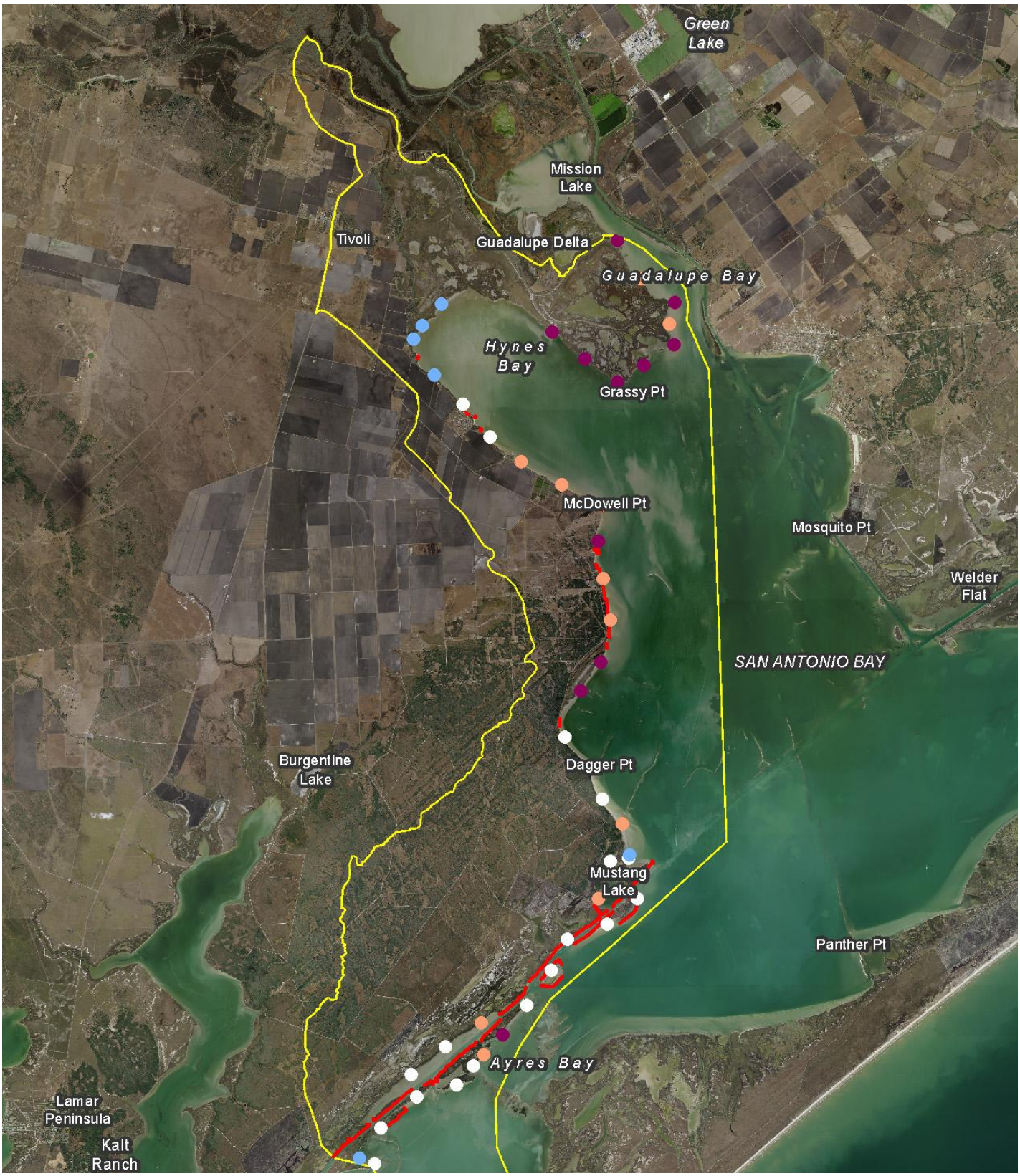
Q76. **Subregion 2.3 Water Hole Creek - Caney Creek**



- Includes Hynes Bay, the eastern portion of San Antonio Bay, and Mesquite Bay, and the bayous and marshes between Hynes Bay and Mission Lake
- Does not include any part of Mustang or San Jose Island
- Includes most of Blackjack Peninsula, the Aransas National Wildlife Refuge, and most the GIWW and associated dredge spoil islands along Blackjack Peninsula

- Includes the towns of Austwell and Tivoli
- Extensive whooping crane activity in this area

Maps and Data



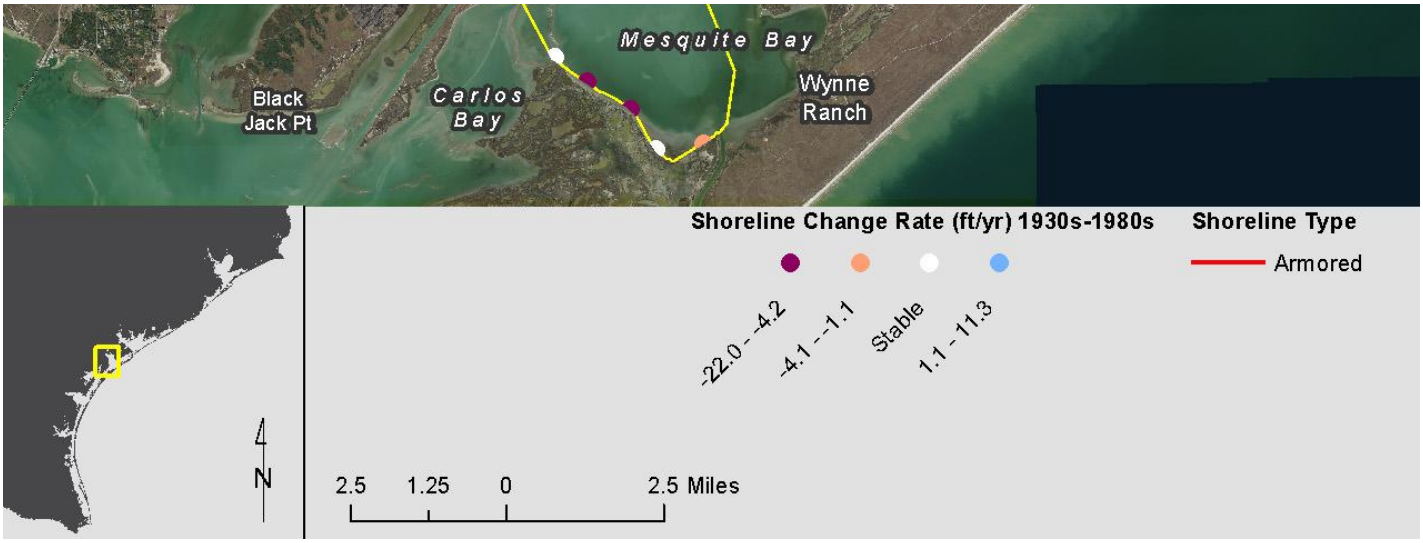
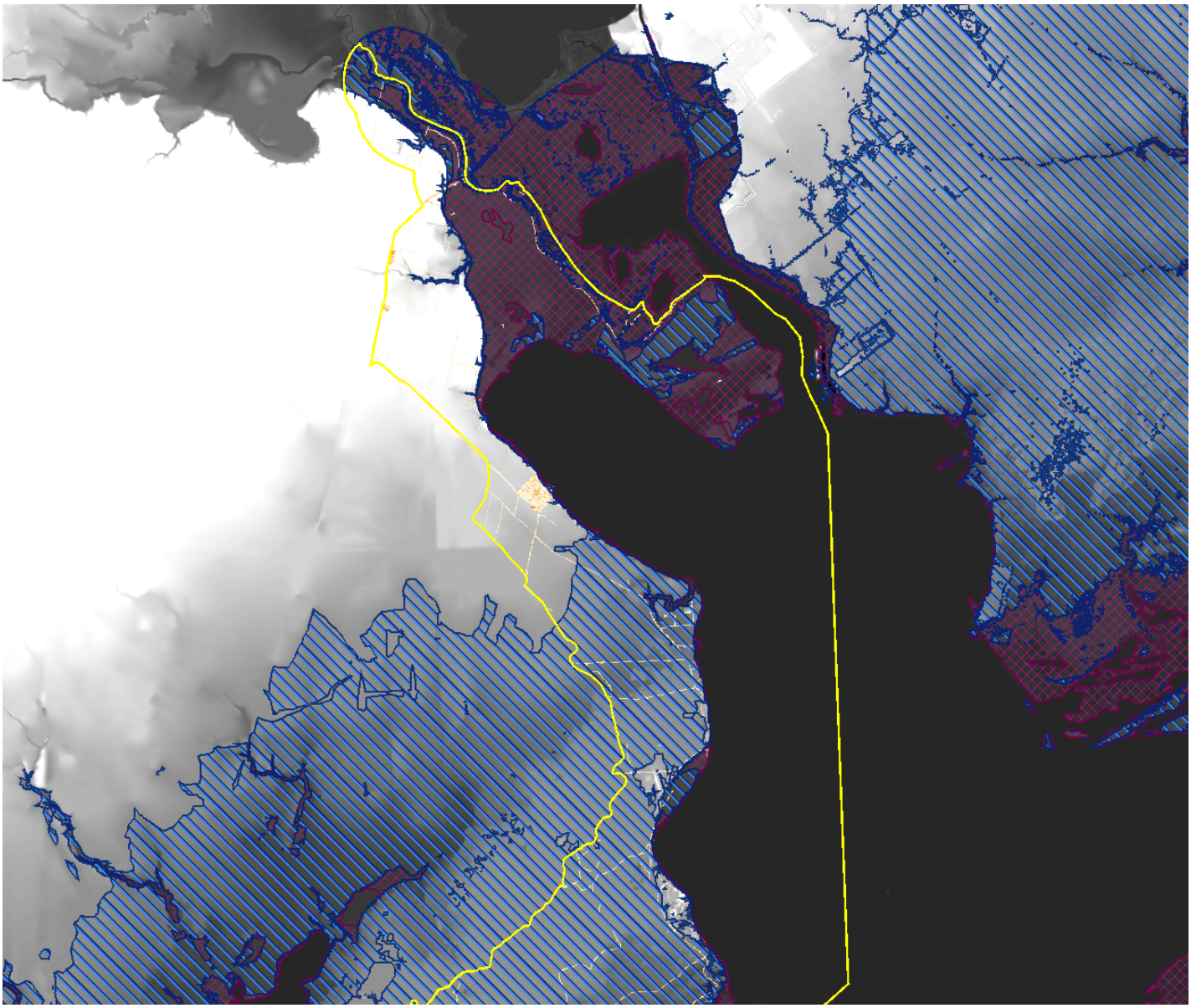


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.



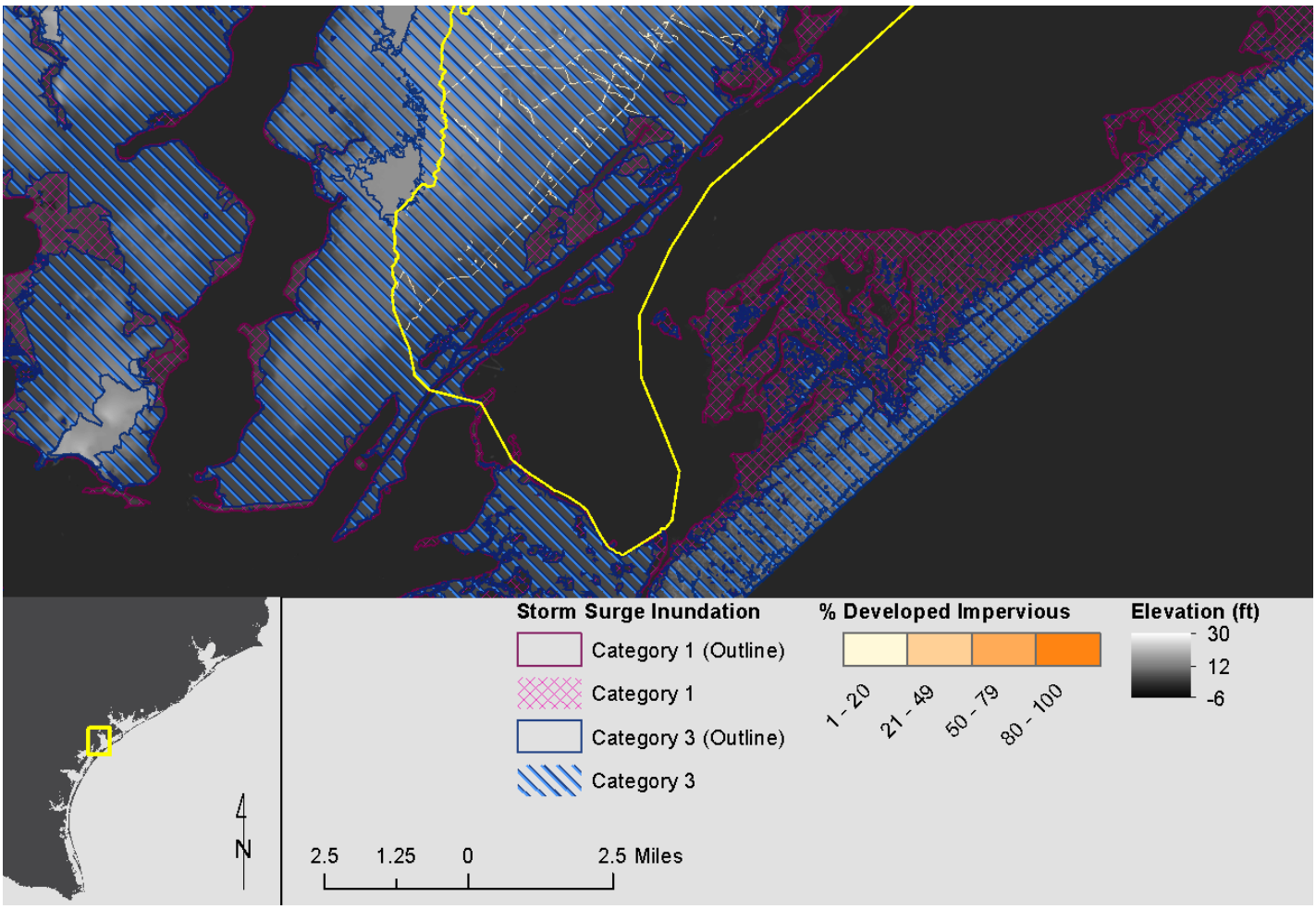
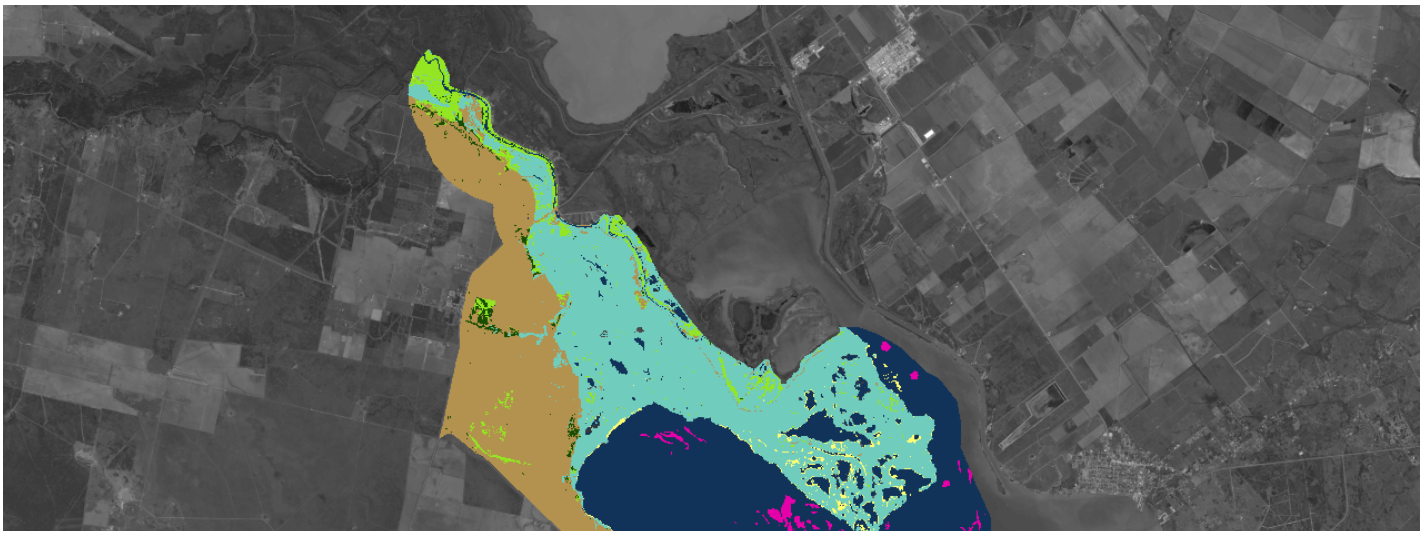


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.



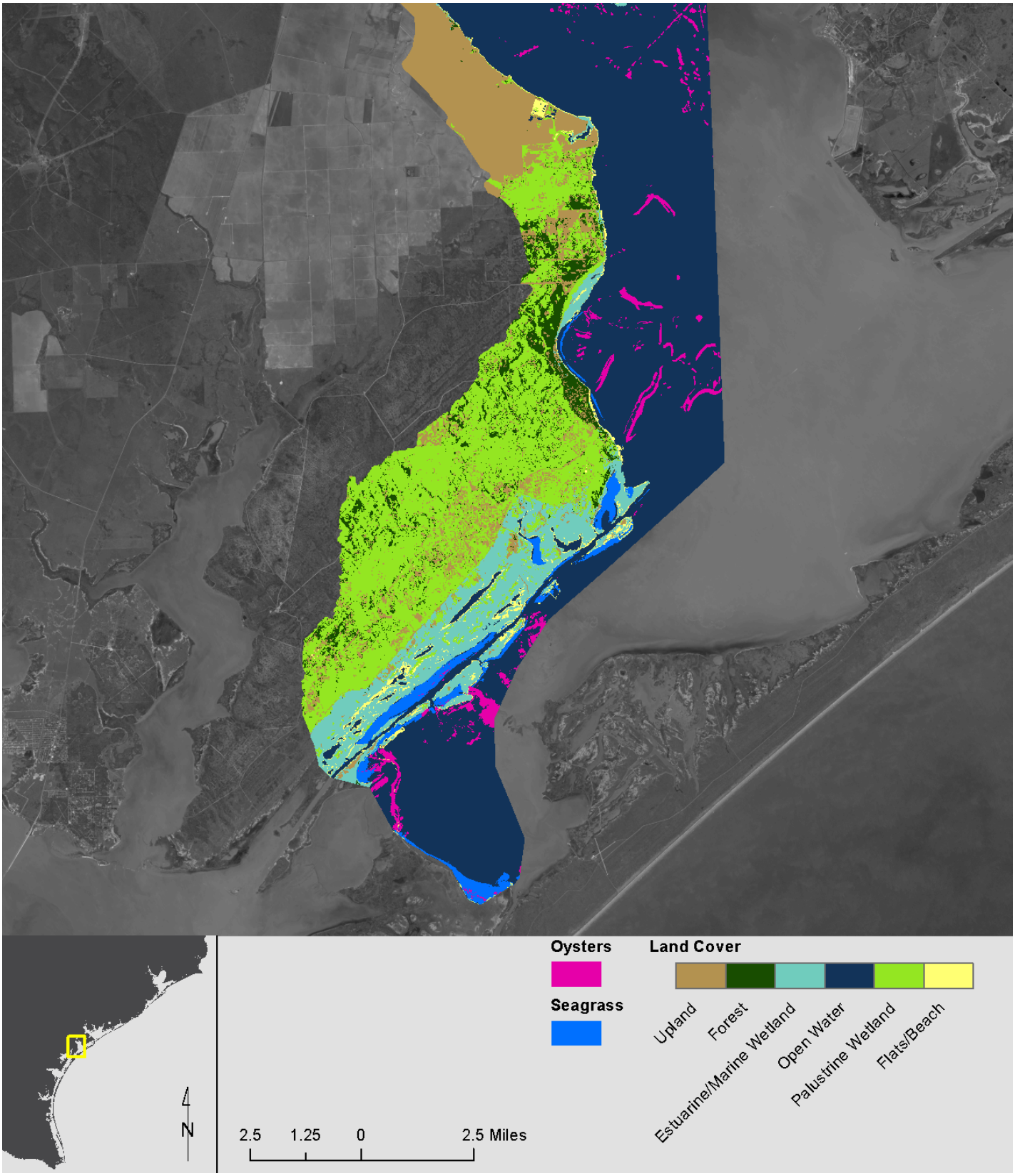


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD.

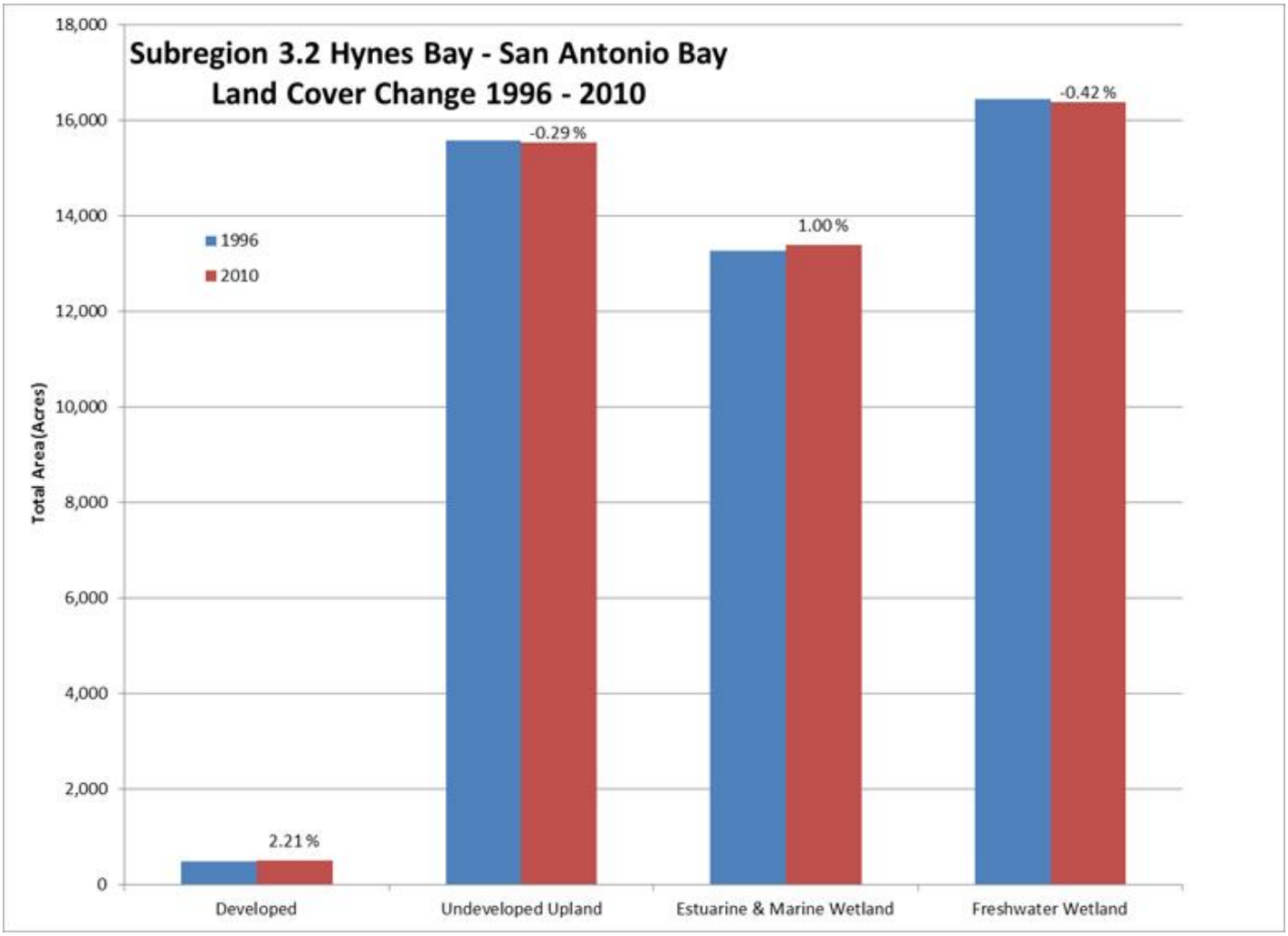


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 3. NOAA Economics: National Ocean Watch (ENOW) data for 5 counties (Aransas, Kleberg, Nueces, Refugio, and San Patricio) located in Region 3. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 3 (5 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
29074	1203	$1,202,600,000	$41,363	$3,317,600,000	$114,109
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
17255	815	$299,600,000	$17,363	$660,800,000	$38,296
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
5575	246	$488,900,000	$87,695	$1,690,600,000	$303,247
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
390	36	$18,300,000	$46,923	$38,100,000	$97,692
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q125.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

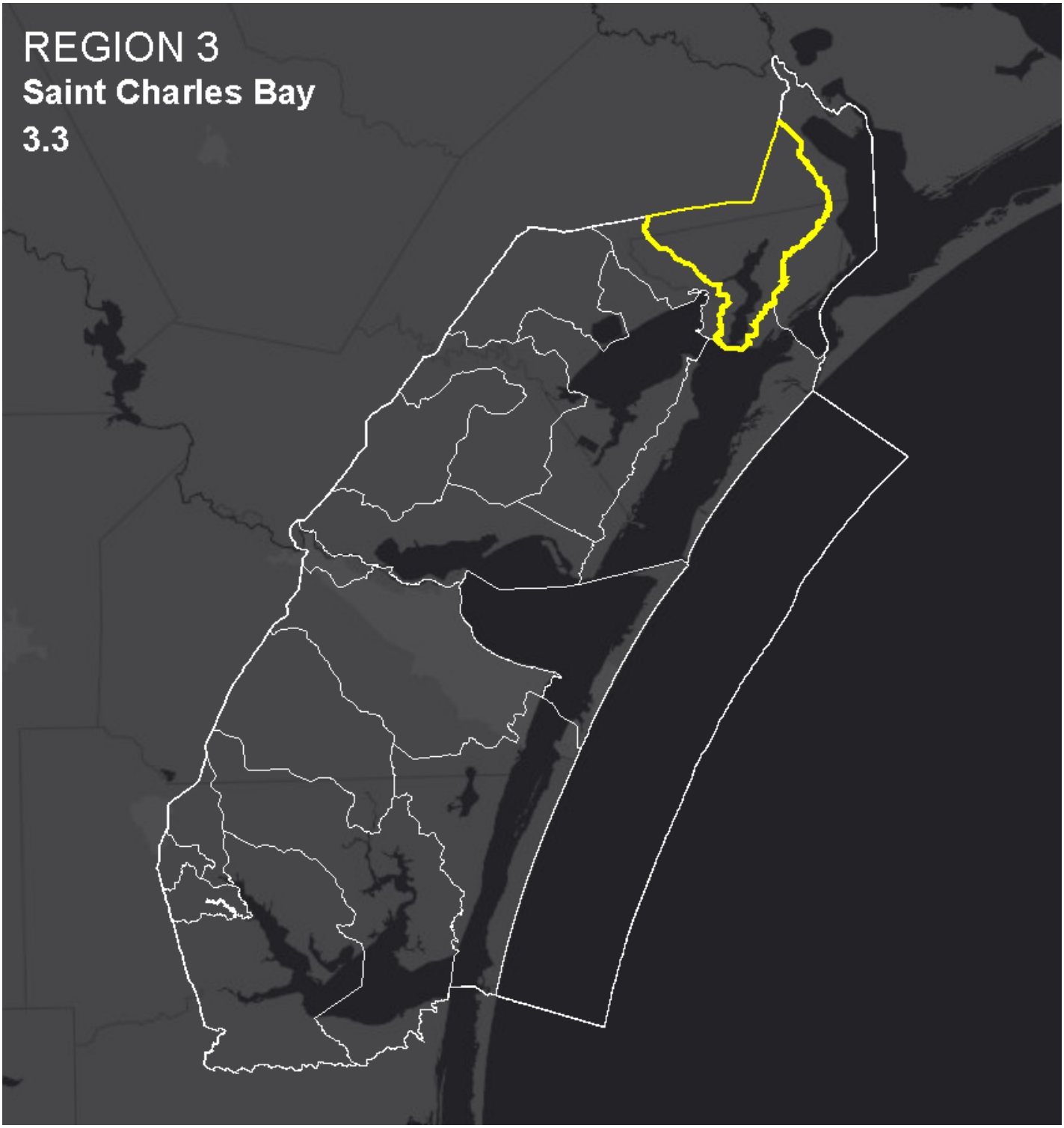
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(3.1)**	○	○	○	○	○	○	○

Gulf beach erosion and dune degradation **(0.0)**	○	○	○	○	○	○	○
Bay shoreline erosion **(2.7)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(1.8)**	○	○	○	○	○	○	○
Coastal flood damage **(1.8)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.7)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.8)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(1.0)**	○	○	○	○	○	○	○

Q126. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 3.3 Saint Charles Bay

Q127. **Subregion 3.3 Saint Charles Bay**

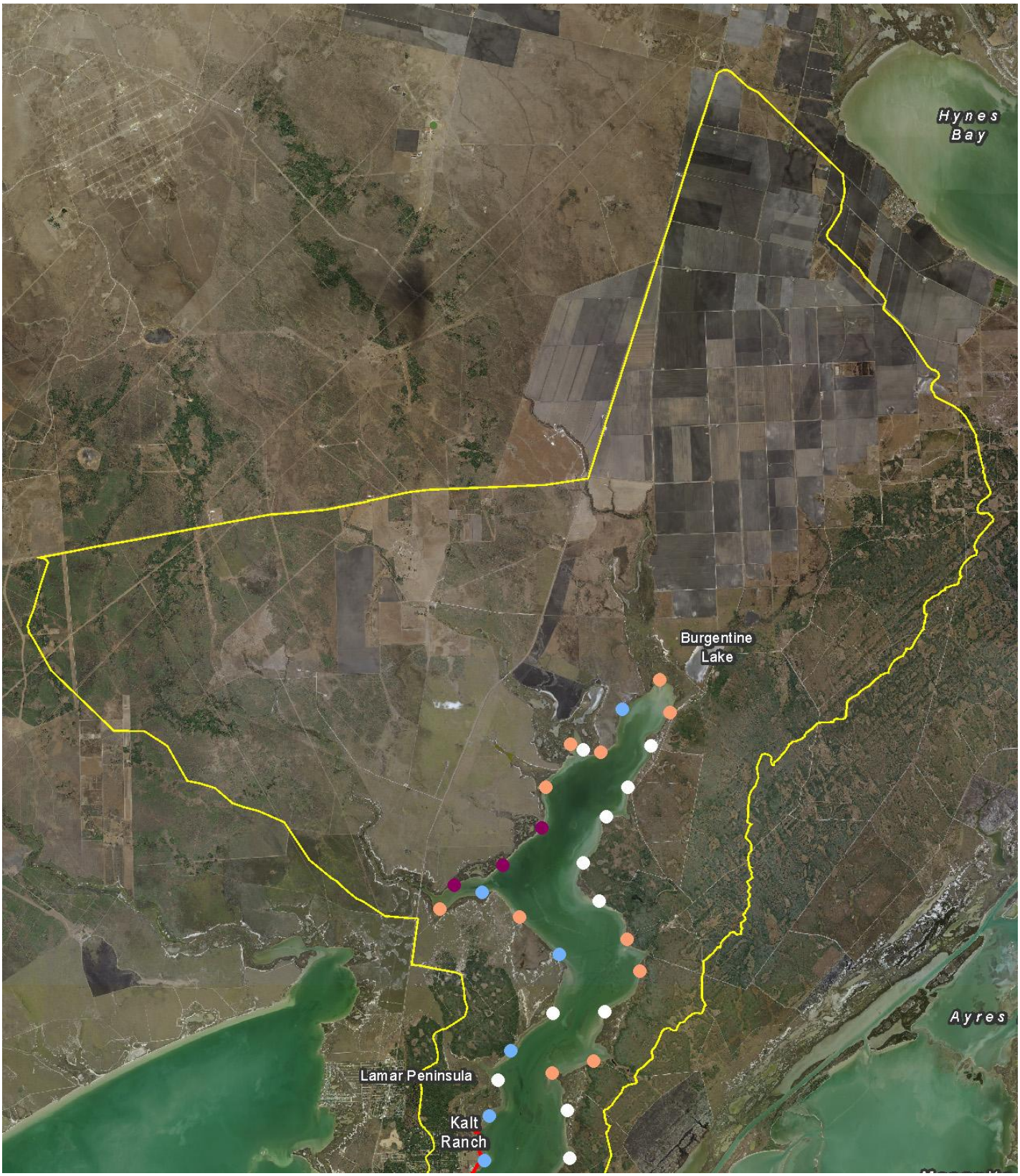


- Includes the northern and western portions of Blackjack Peninsula and the extensive agricultural fields surrounding Austwell
- Includes all of St. Charles Bay and the adjacent shorelines and marshes along the eastern half of Lamar Peninsula and western portion of Blackjack Peninsula
- Includes a large portion of the Aransas National Wildlife Refuge, as well as

Goose Island State Park

- Extensive whooping crane activity in this area

Maps and Data



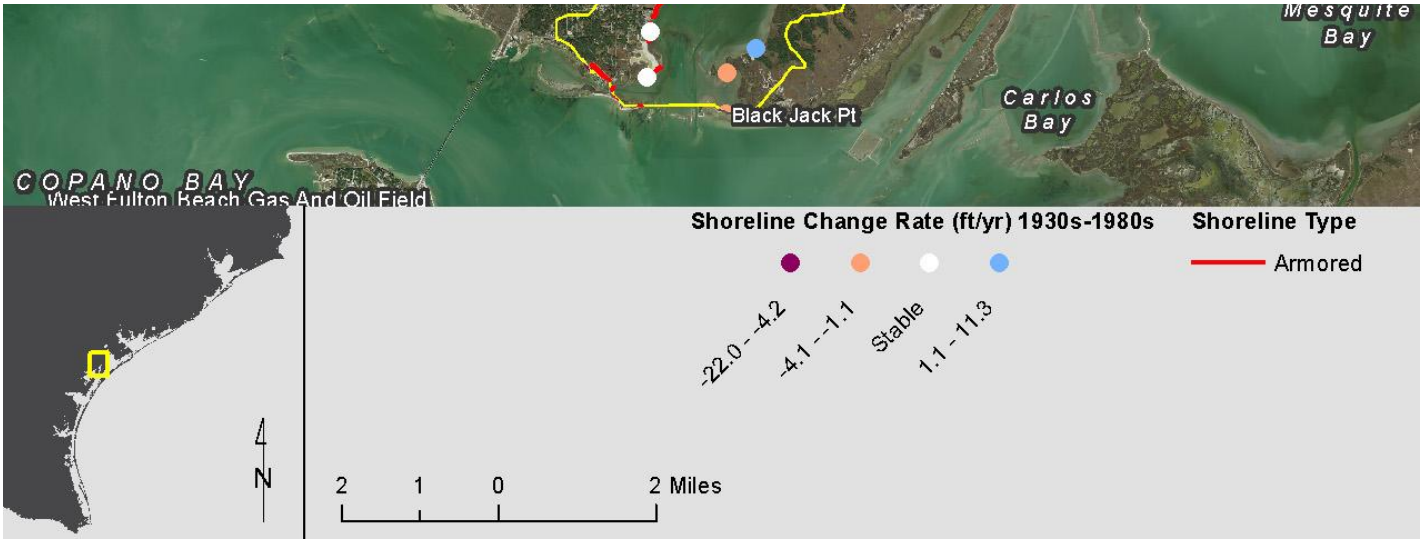


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

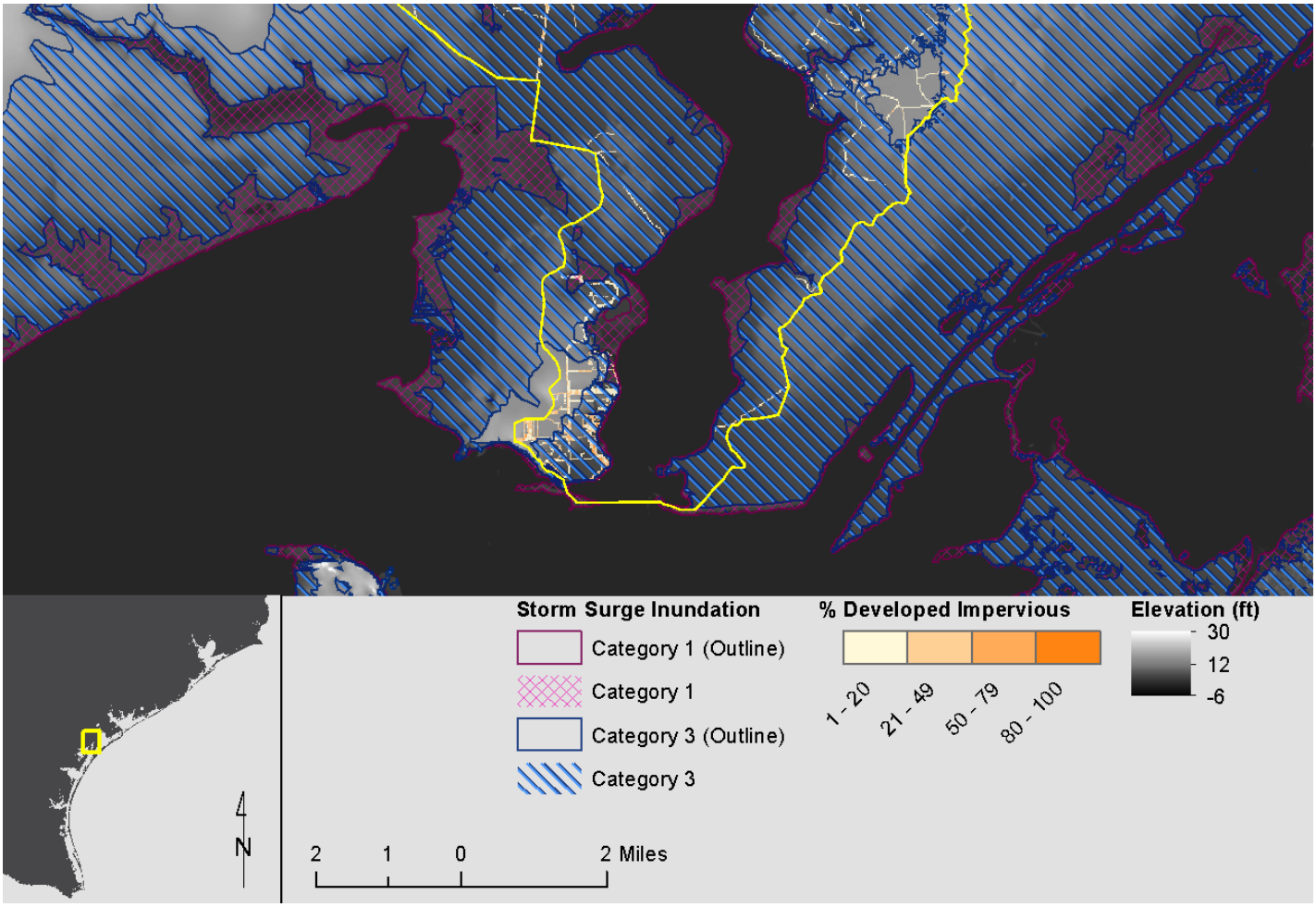


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.

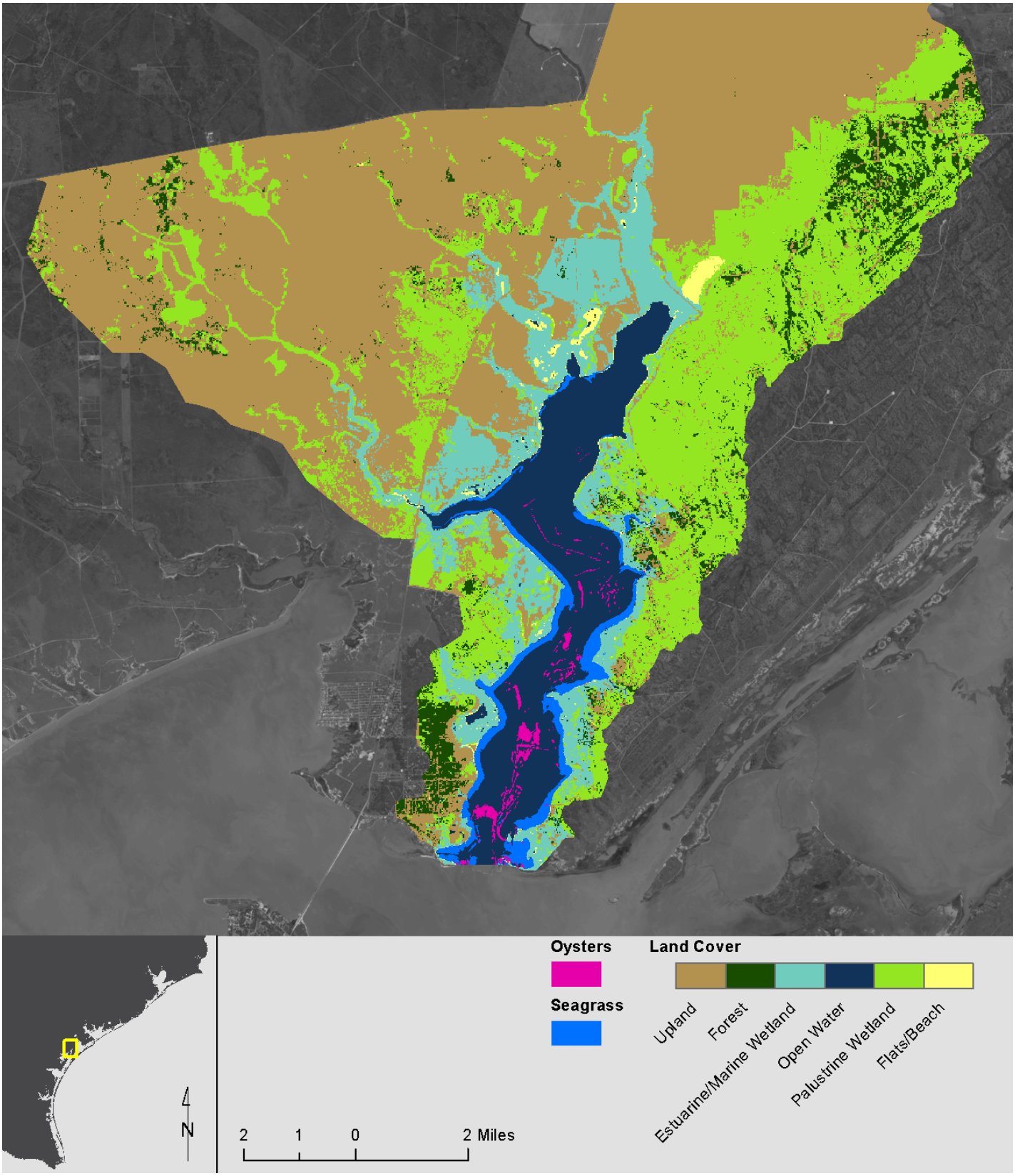


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPW

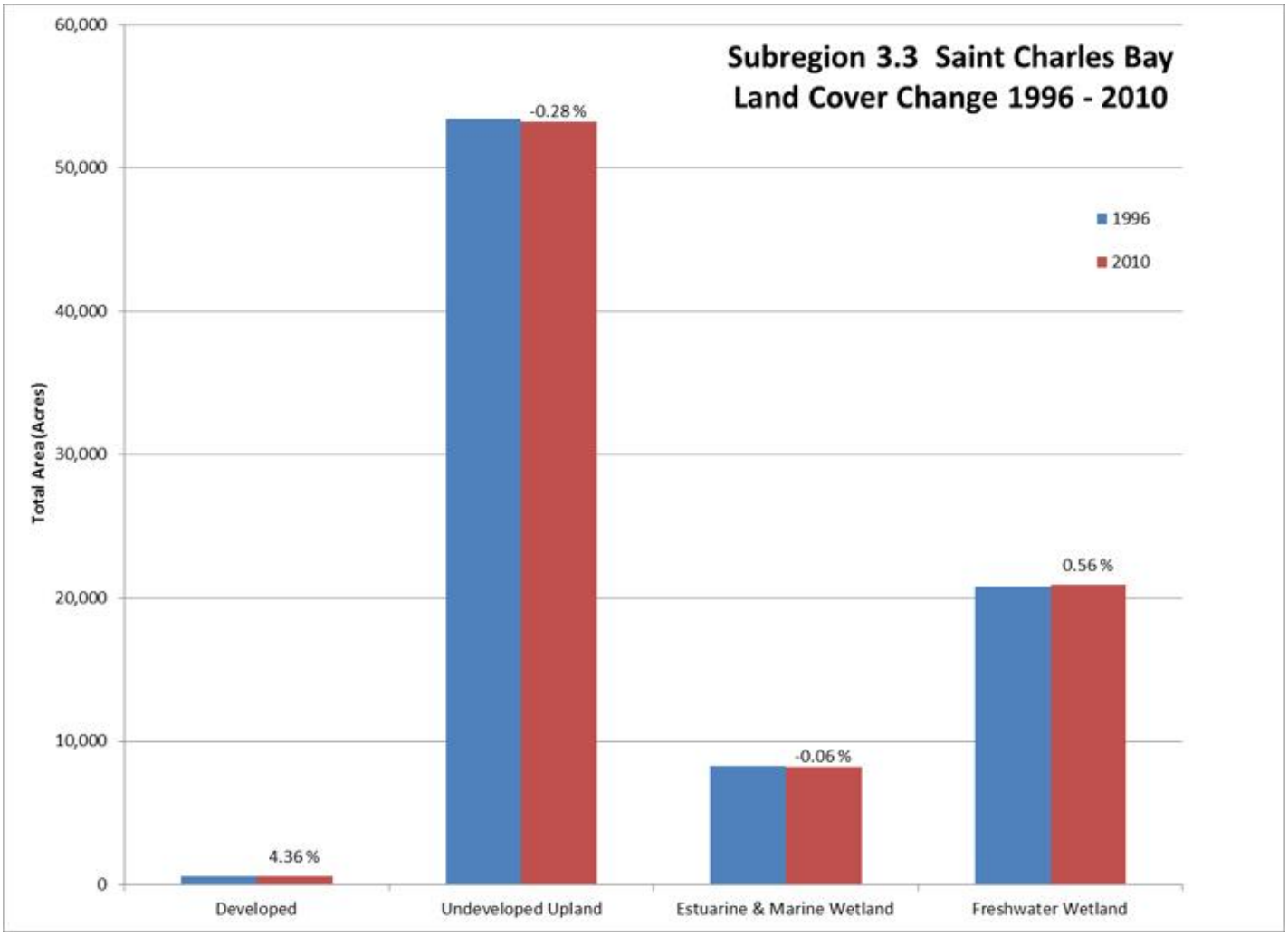


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 3. NOAA Economics: National Ocean Watch (ENOW) data for 5 counties (Aransas, Kleberg, Nueces, Refugio, and San Patricio) located in Region 3. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 3 (5 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
29074	1203	$1,202,600,000	$41,363	$3,317,600,000	$114,109
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
17255	815	$299,600,000	$17,363	$660,800,000	$38,296
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
5575	246	$488,900,000	$87,695	$1,690,600,000	$303,247
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
390	36	$18,300,000	$46,923	$38,100,000	$97,692
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q128. The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

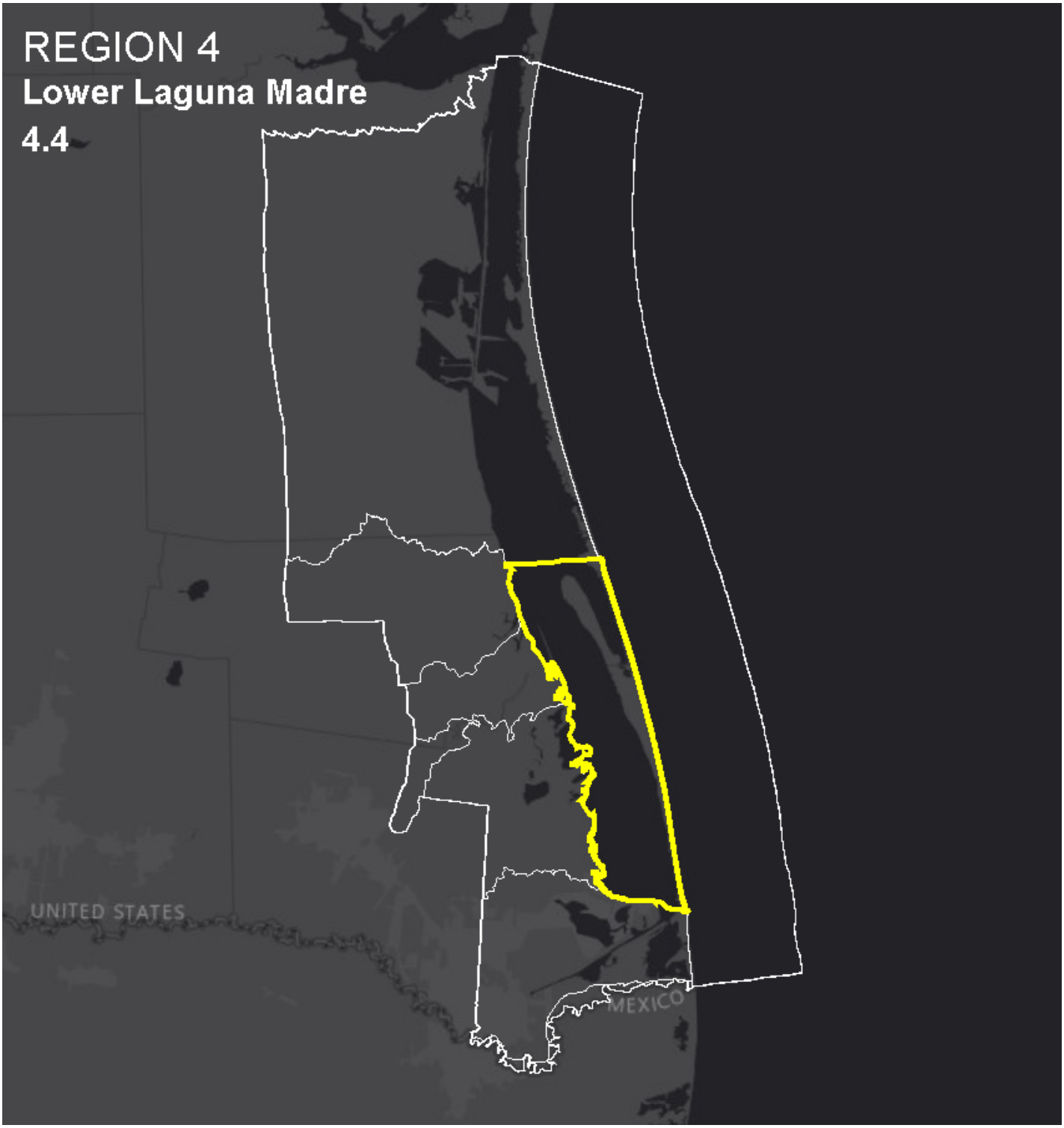
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(2.7)**	○	○	○	○	○	○	○
Gulf beach erosion and dune	○	○	○	○	○	○	○

degradation **(0.0)**							
Bay shoreline erosion **(2.2)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(1.4)**	○	○	○	○	○	○	○
Coastal flood damage **(1.4)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.0)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.4)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(0.7)**	○	○	○	○	○	○	○

Q129. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 3.4 Copano Creek

Q130. **Subregion 3.4 Copano Creek**



- Includes South Padre Island and the southern portion of Padre Island National Seashore, excluding Gulf-facing beaches
- Includes the Lower Rio Grande Valley National Wildlife Refuge

Maps and Data


LAGUNA MADRE
Laguna
Atascosa
Bahia
Grande
Shoreline Type
Armored

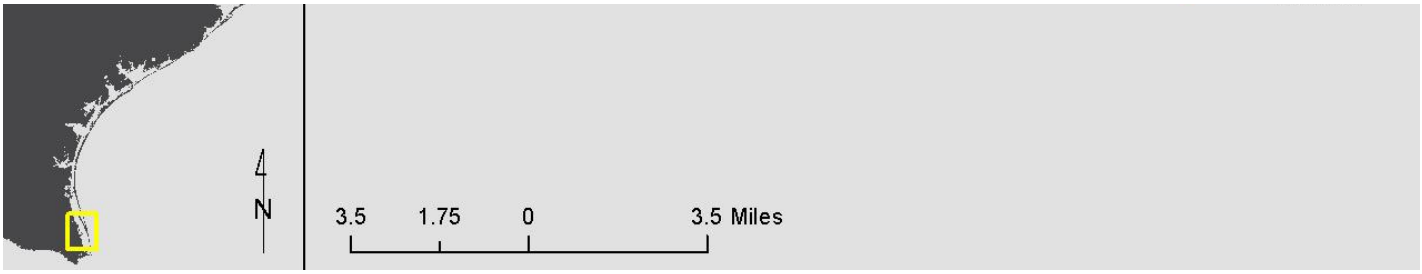


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

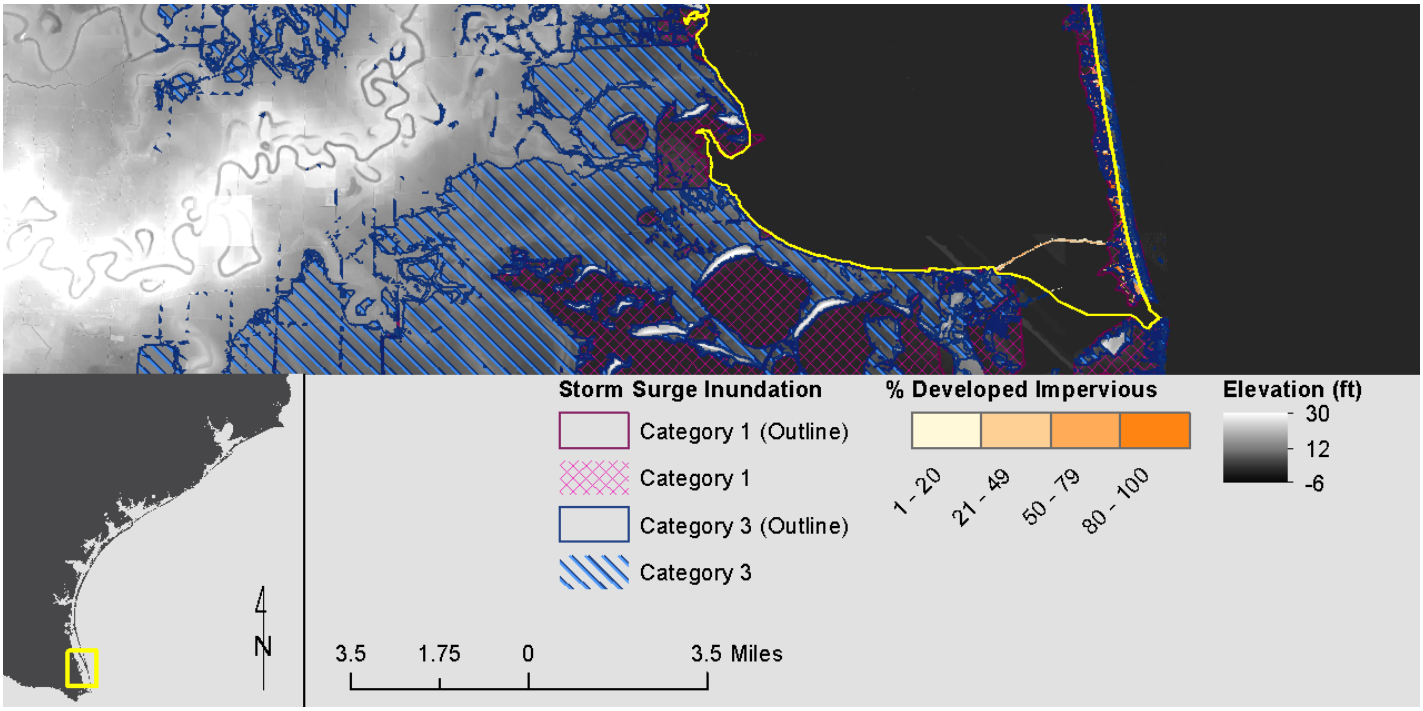
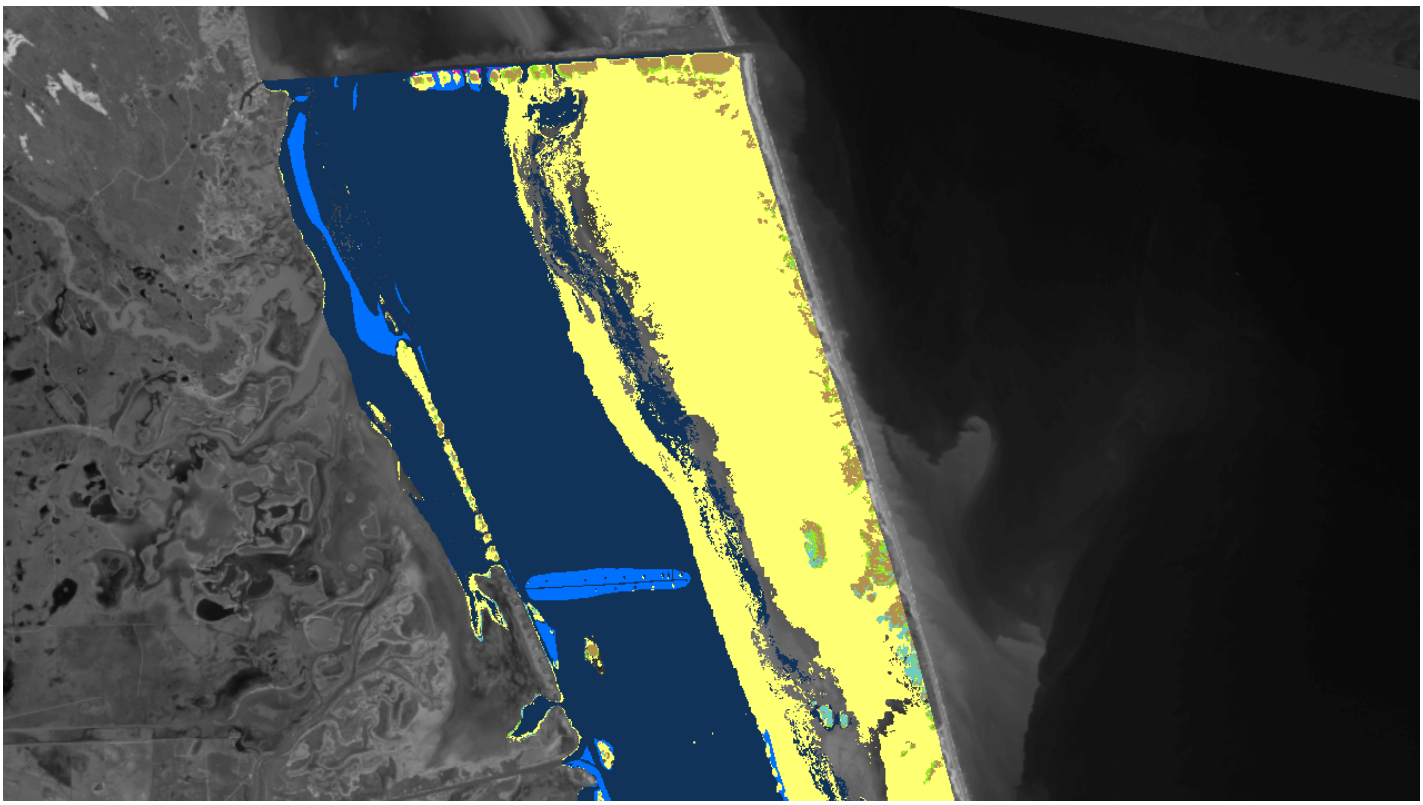


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.



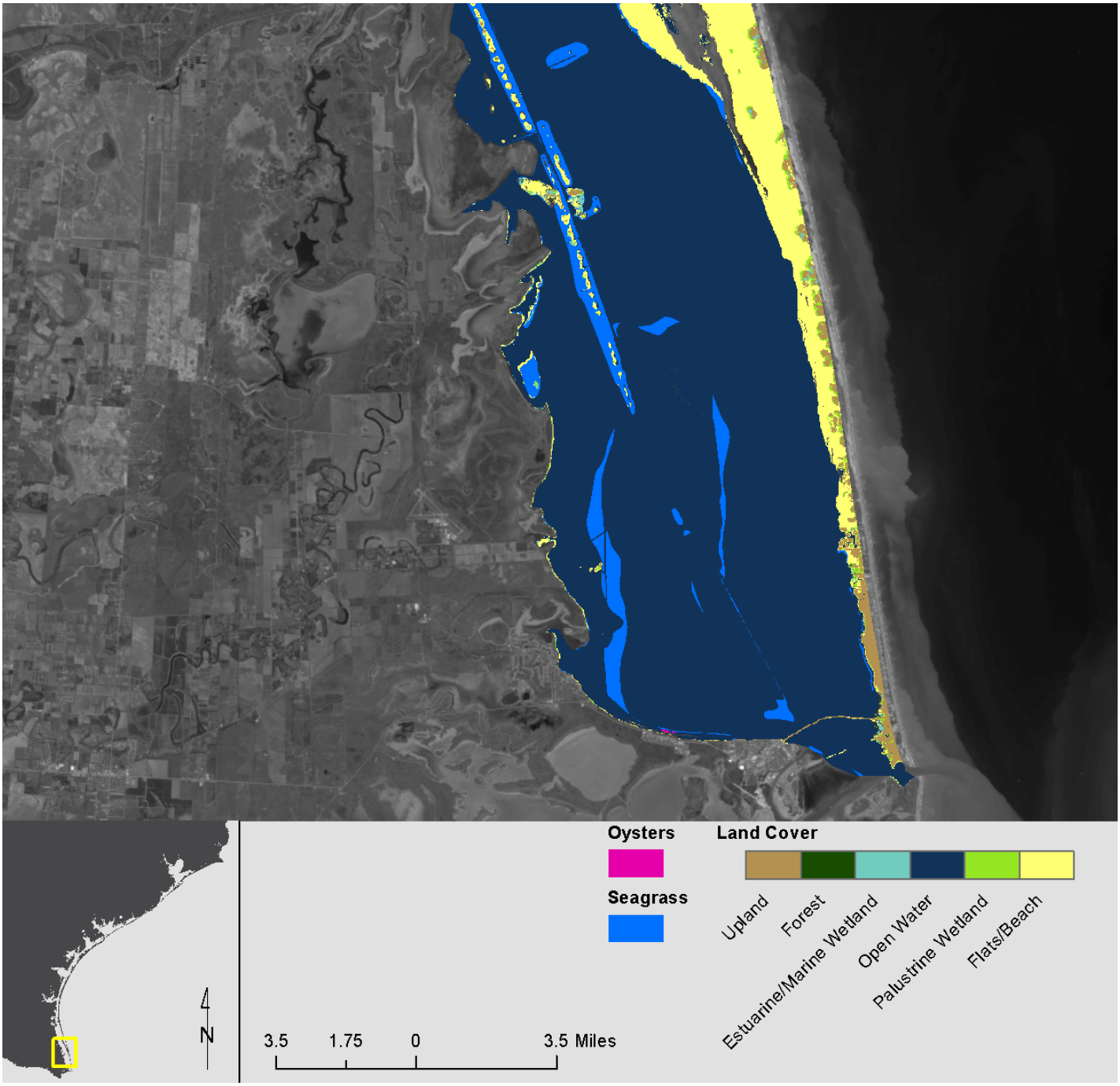


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD.

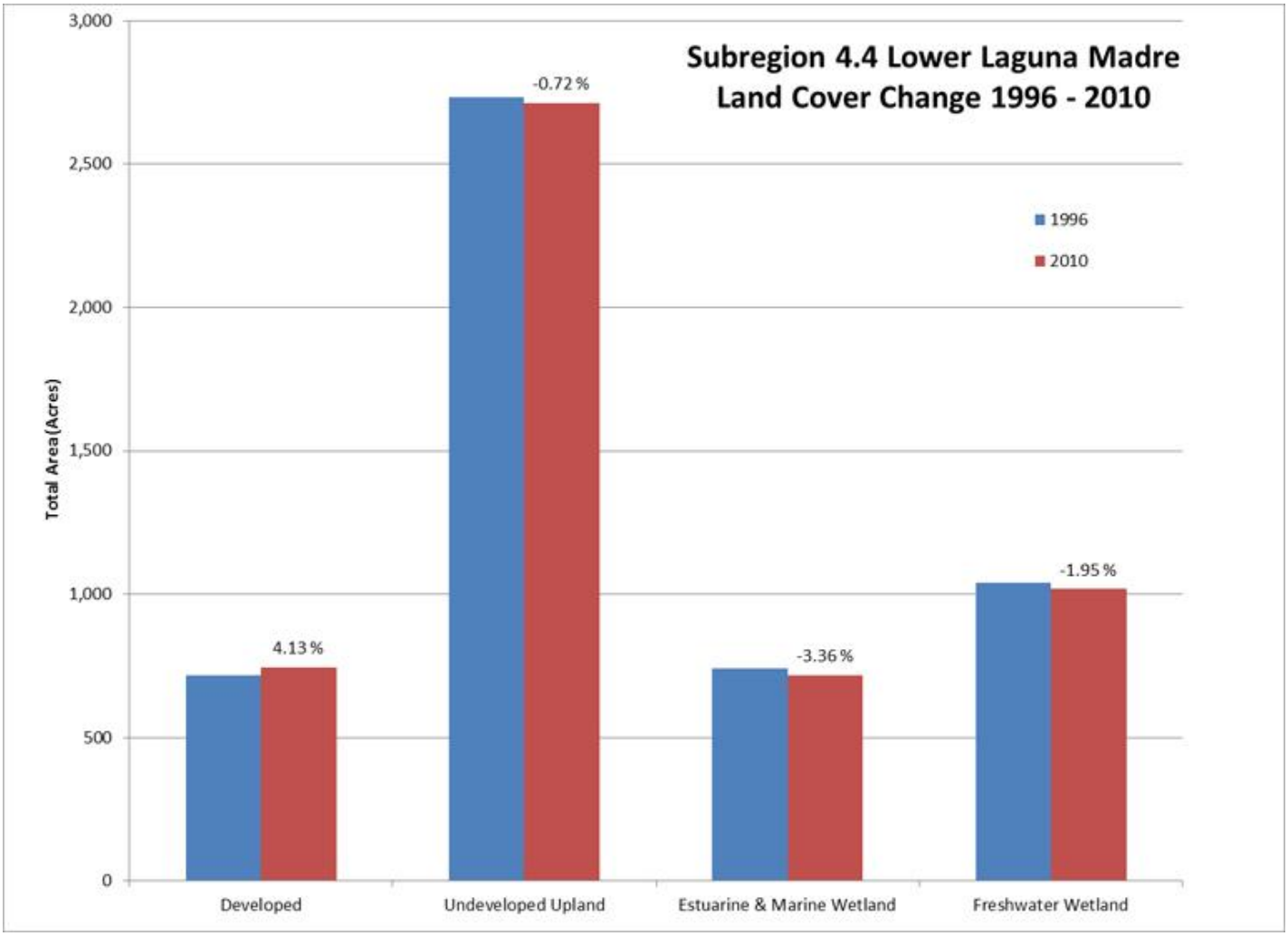


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 4. NOAA Economics: National Ocean Watch (ENOW) data for 3 counties (Cameron, Kenedy, and Willacy) located in Region 4. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 4 (3 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
8519	407	$203,400,000	$23,876	$539,800,000	$63,364
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
5633	274	$84,400,000	$14,983	$187,000,000	$33,197
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
64	47	$1,500,000	$23,438	$7,400,000	$115,625
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
28	4	$900,000	$32,143	$1,800,000	$64,286
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
589	47	$20,600,000	$34,975	$42,600,000	$72,326
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q191. The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as **(red bold numbers)**.

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

0 = not at all concerned
1 = slightly concerned
2 = moderately concerned
3 = very concerned
4 = extremely concerned

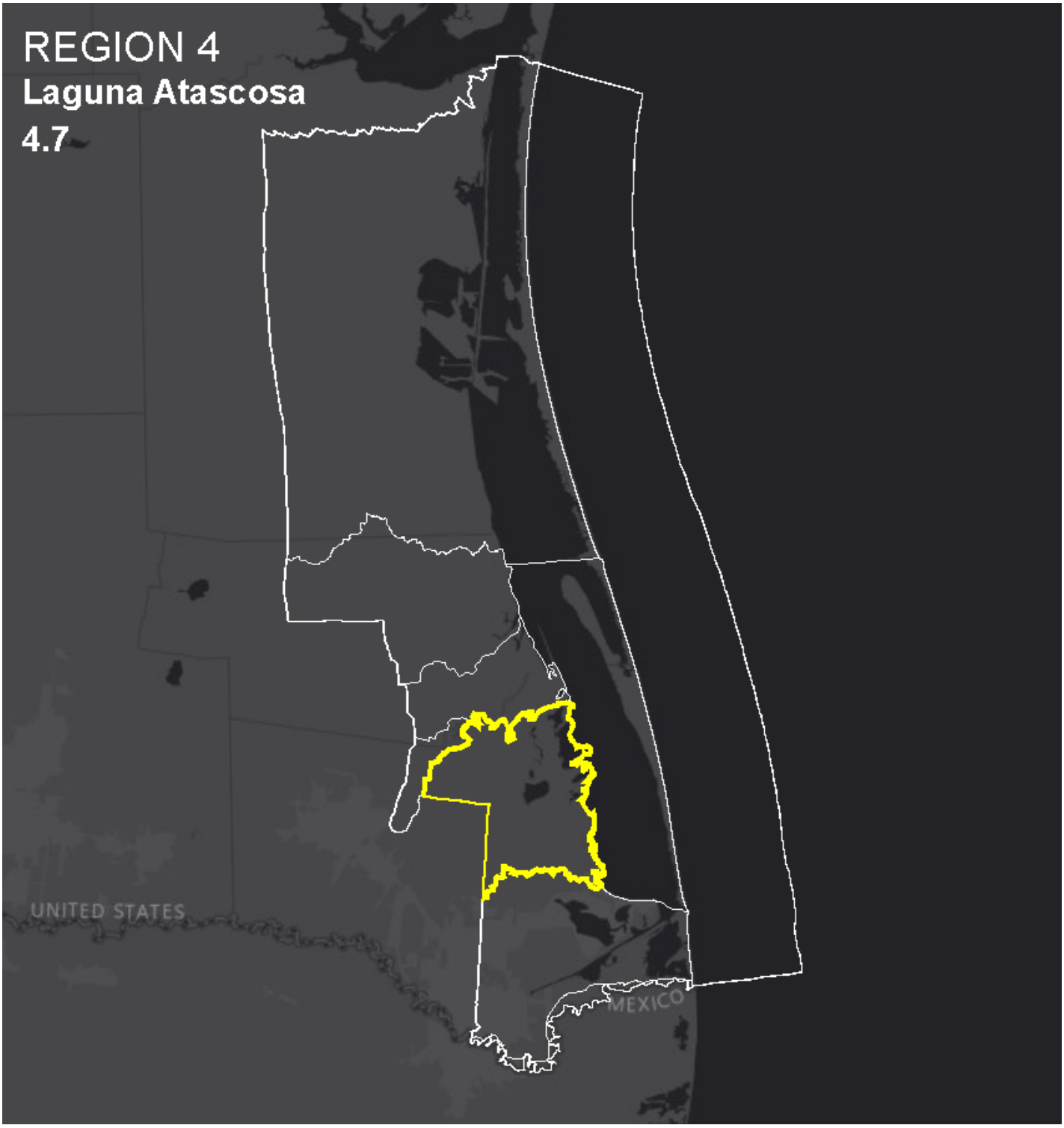
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(2.8)**	○	○	○	○	○	○	○
Gulf beach erosion and dune	○	○	○	○	○	○	○

degradation **(0.0)**							
Bay shoreline erosion **(1.7)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(2.1)**	○	○	○	○	○	○	○
Coastal flood damage **(2.1)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(1.9)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.3)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(1.0)**	○	○	○	○	○	○	○

Q192. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 4.5 Upper Pilot Channel - Laguna Madre

Q193. **Subregion 4.5 Upper Pilot Channel - Laguna Madre**



- Includes the Laguna Atascosa National Wildlife Refuge, which is composed primarily of freshwater wetlands surrounding the Laguna Atascosa
- Includes Arroyo City

Maps and Data


El Sabinto Ranch
Los Coyotes Ranch
Totman Ranch
Rancho Nuevo
El Ranchito
Leona Ranch
Miradores Ranch
Buena Vista Ranch
Rancho Buena Vista
Granjeno Ranch
Laguna Atascosa
La Coma Ranch
Port Isabel-Cameron County Airport
Wardner Ranch
Bahia Grande
Shoreline Type
Armored

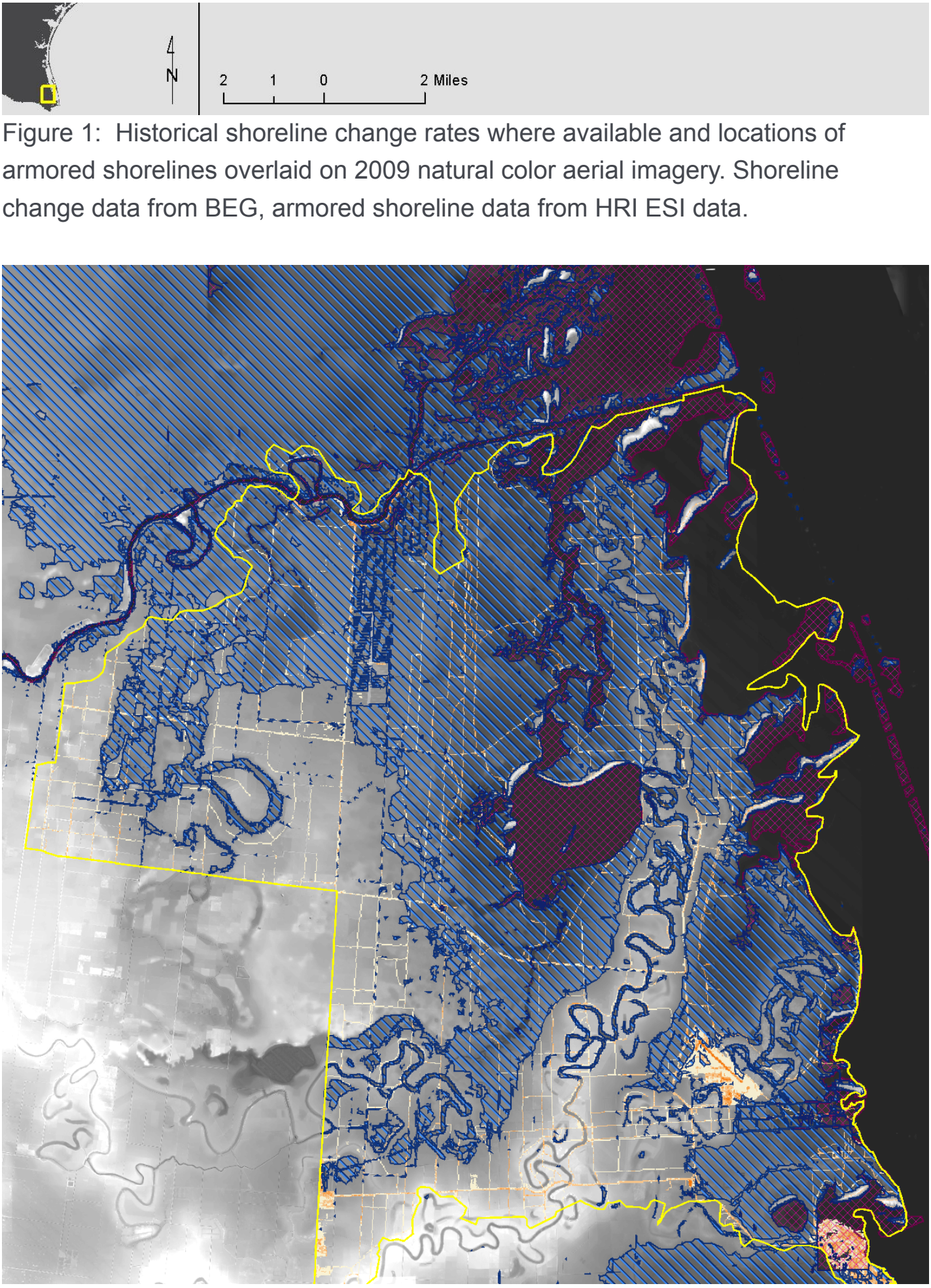


Figure 1: Historical shoreline change rates where available and locations of armored shorelines overlaid on 2009 natural color aerial imagery. Shoreline change data from BEG, armored shoreline data from HRI ESI data.

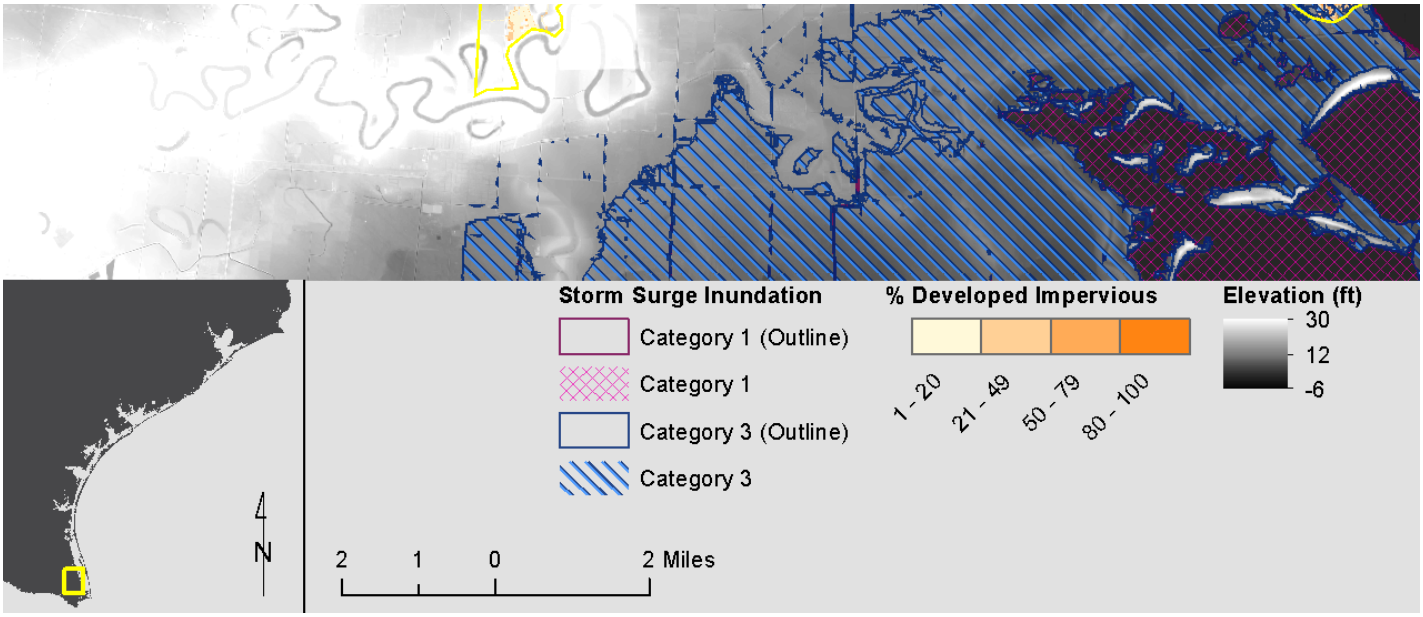
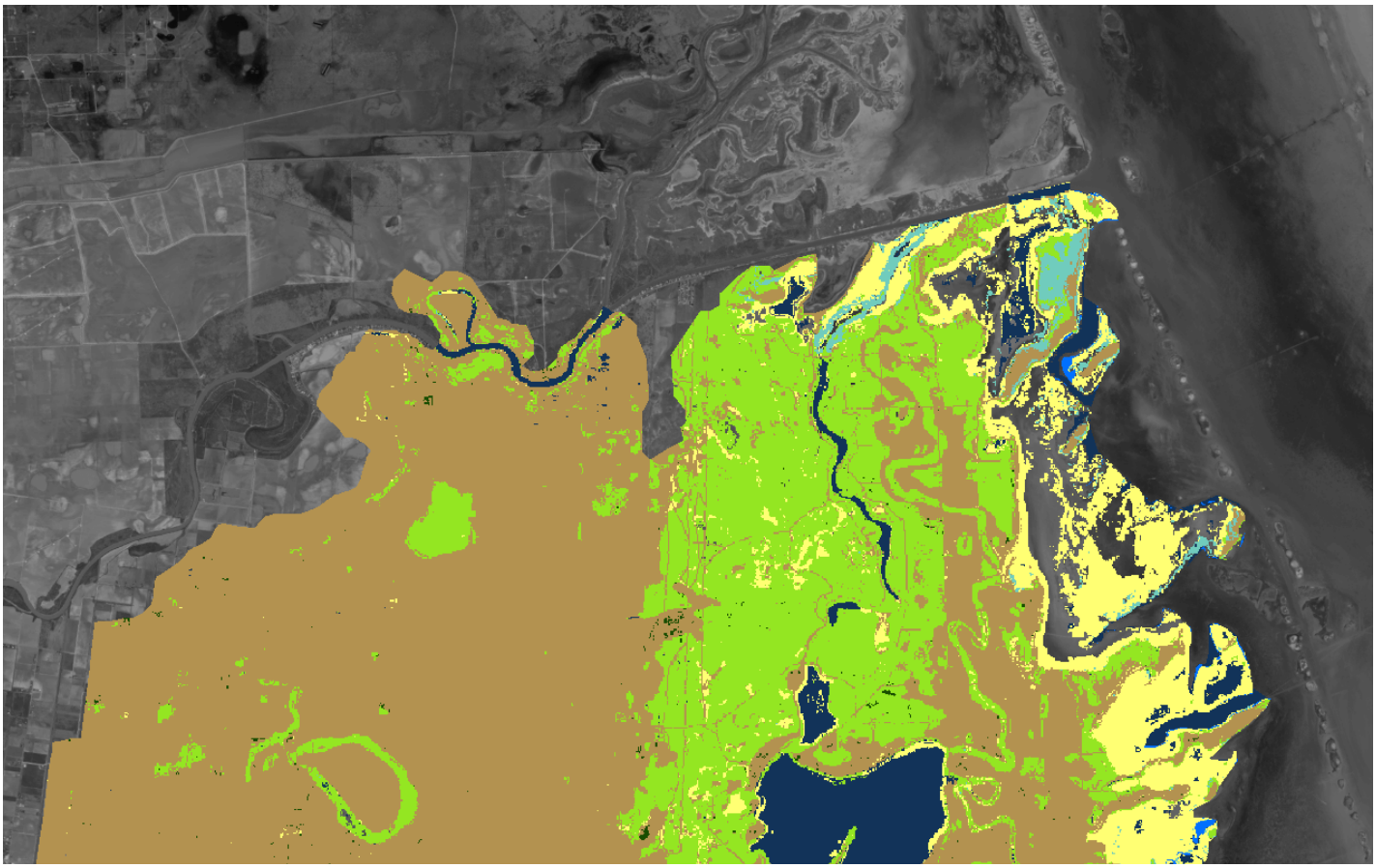


Figure 2: Percent of developed impervious cover shows open space (< 1% cover), developed open space (1-20% cover), low intensity development (21-49% cover), medium intensity development (50-79% cover) and high intensity development (80-100% cover) from C-CAP data. Inundation envelopes show the inland extent of storm surge from worst case scenarios for Category 1 and Category 3 hurricanes from SLOSH model output. Basemap is a Digital Elevation Model depicting land surface elevation in feet.



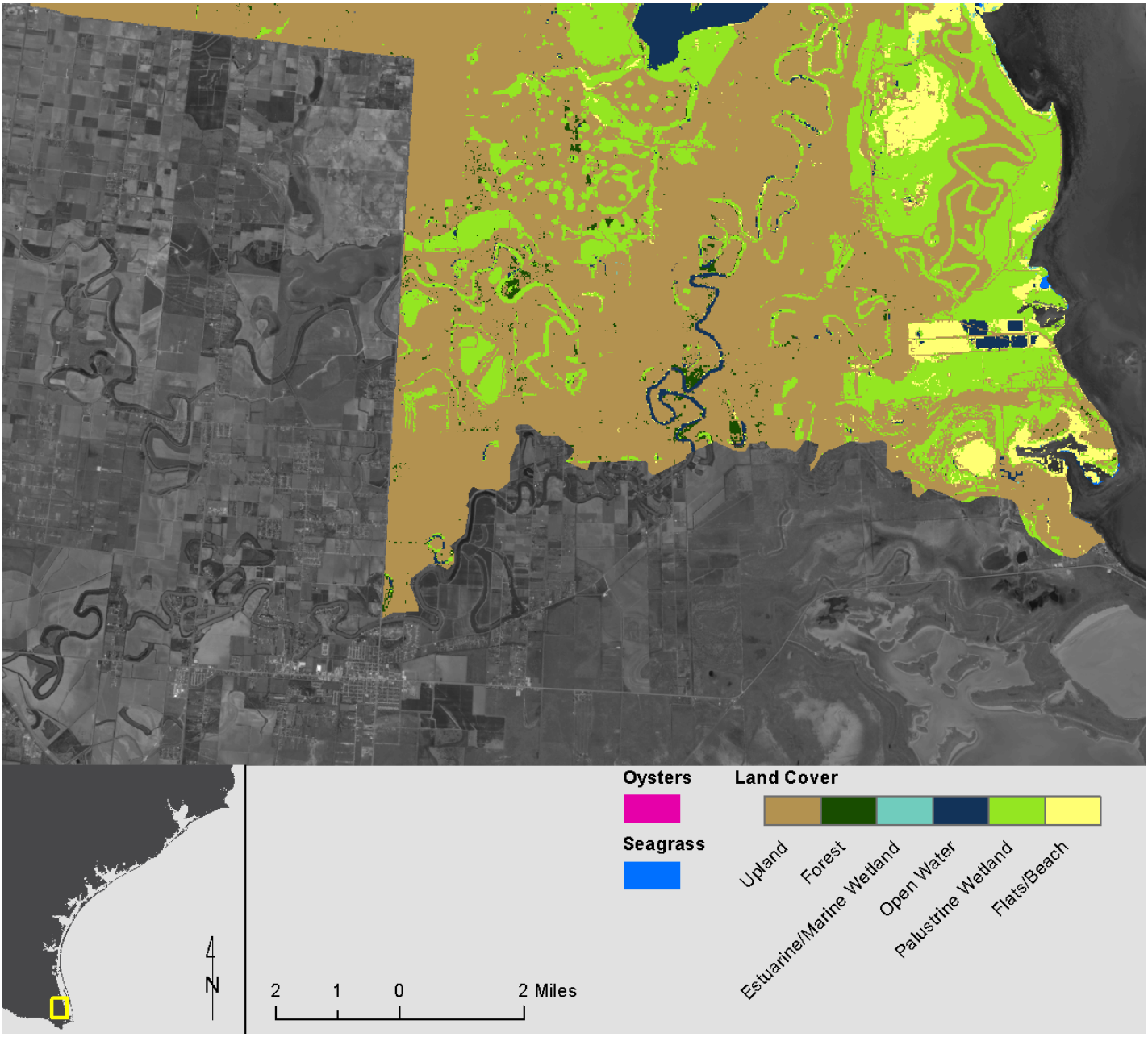


Figure 3: Coverage of marine, estuarine, palustrine, and upland environments from C-CAP, oysters compiled by HRI from multiple sources, and seagrass from NOAA and TPWD .

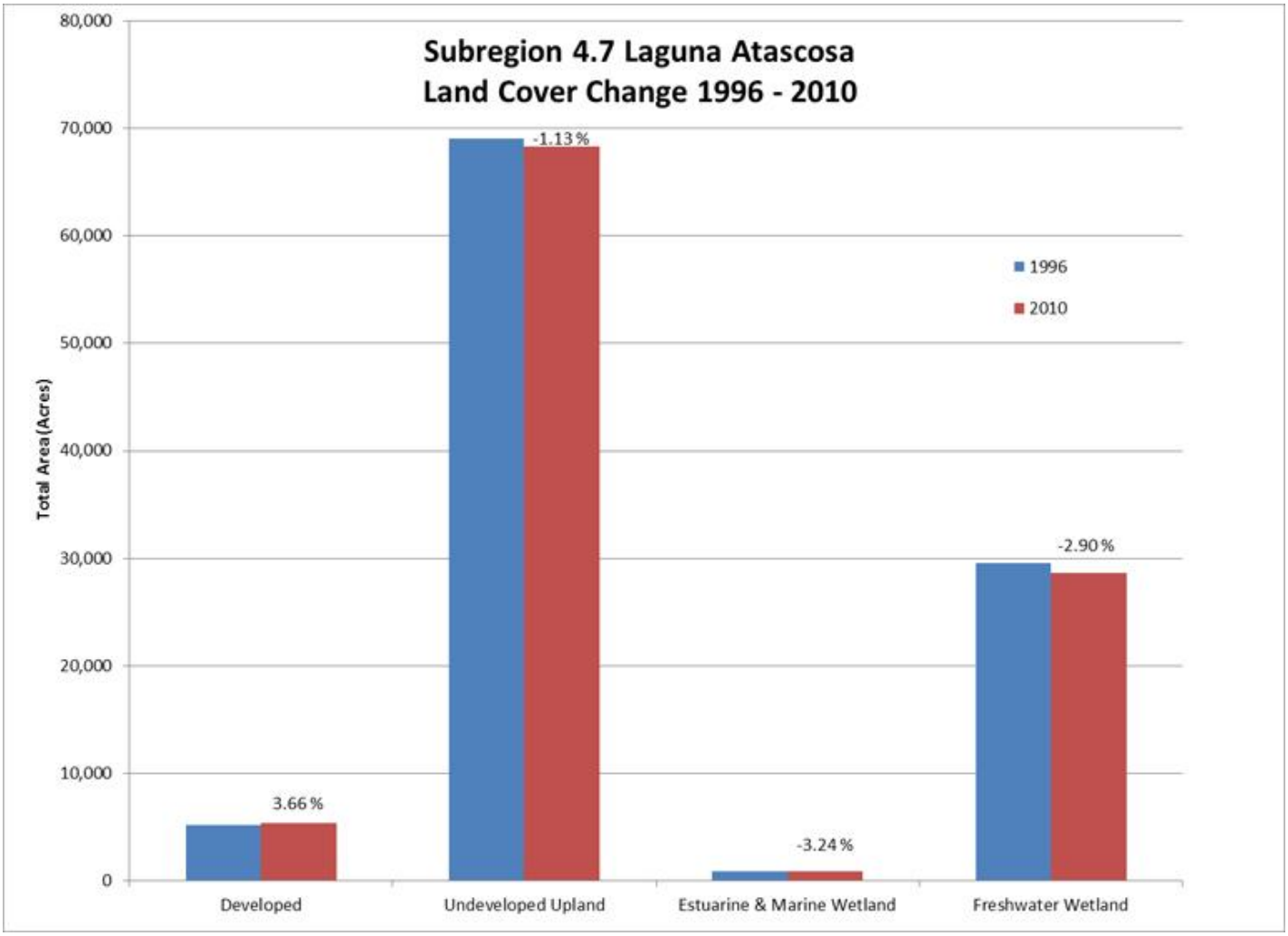


Figure 4: Total area (acres) for four land cover categories in the subregion in 1996 (blue bars) and 2010 (red bars). Percentages indicate the change in each land cover type from 1996-2010. Data from NOAA's Coastal Change Analysis Program (C-CAP) land cover database.

Table 1: Regional Ocean Economy Data for Region 4. NOAA Economics: National Ocean Watch (ENOW) data for 3 counties (Cameron, Kenedy, and Willacy) located in Region 4. Data shown are from 2013. For more information on NOAA ENOW data, please see https://coast.noaa.gov/enowexplorer/#/employment/total/2013/48000.

REGION 4 (3 COUNTIES)					
Total Ocean Economy					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
8519	407	$203,400,000	$23,876	$539,800,000	$63,364
Tourism and Recreation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
5633	274	$84,400,000	$14,983	$187,000,000	$33,197
Living Marine Resources					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
64	47	$1,500,000	$23,438	$7,400,000	$115,625
Marine Construction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
28	4	$900,000	$32,143	$1,800,000	$64,286
Offshore Mineral Extraction					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a
Marine Transportation					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
589	47	$20,600,000	$34,975	$42,600,000	$72,326
Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
n/a	n/a	n/a	n/a	n/a	n/a

Q200.

The following table lists eight issues of concern in this subregion with the current level of concern, if previously evaluated, shown in parenthesis as (red bold numbers).

Please indicate if you agree (A) with the current level of concern, if you do not have enough knowledge to evaluate (?) the current level of concern, or use the following scale to provide your level of concern regarding the issue:

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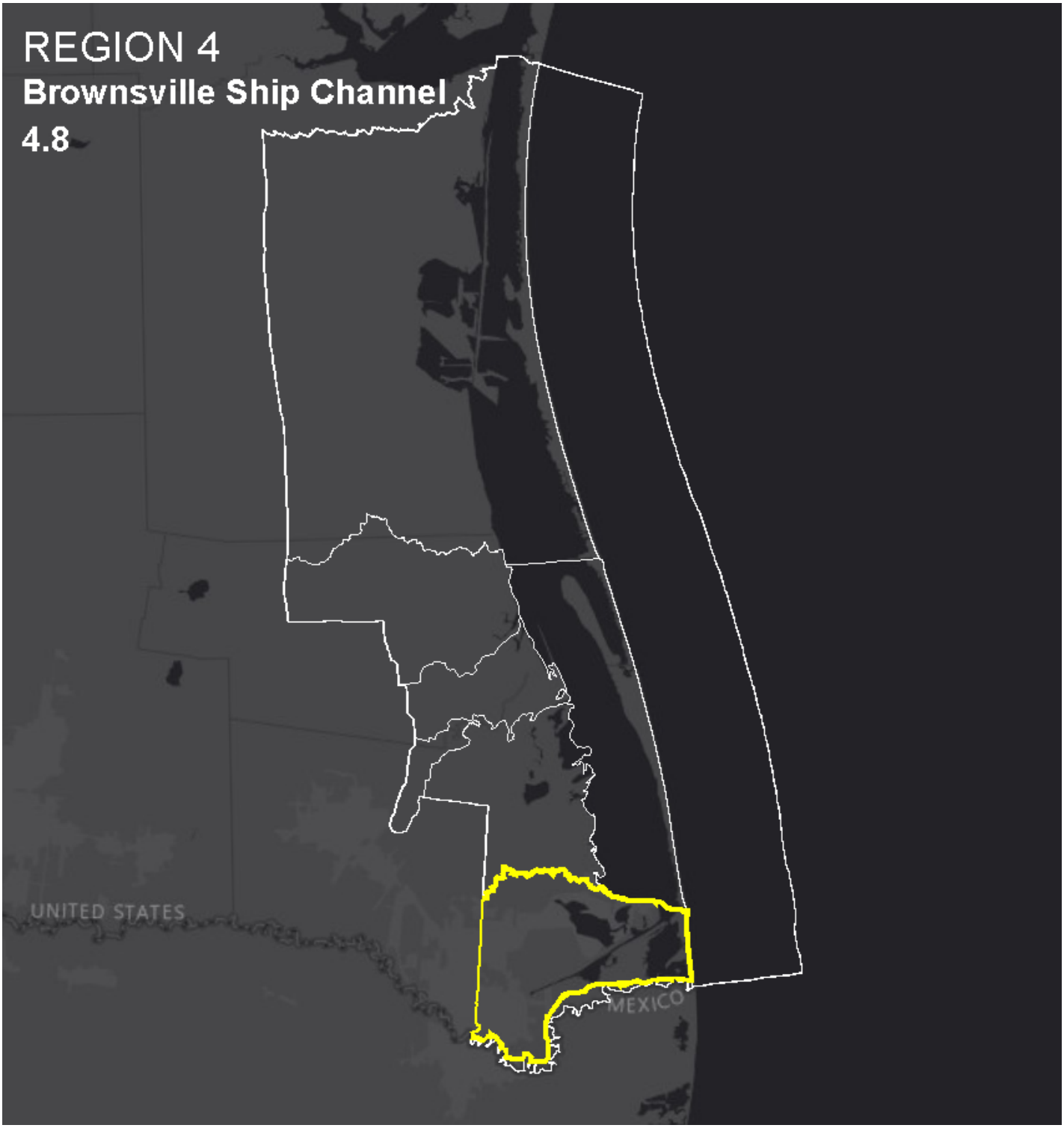
	A	?	0	1	2	3	4
Altered, degraded, or lost habitat **(3.0)**	○	○	○	○	○	○	○

Gulf beach erosion and dune degradation **(0.0)**	○	○	○	○	○	○	○
Bay shoreline erosion **(2.2)**	○	○	○	○	○	○	○
Existing and future coastal storm surge damage **(1.9)**	○	○	○	○	○	○	○
Coastal flood damage **(1.9)**	○	○	○	○	○	○	○
Impact on water quality and quantity **(2.3)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.5)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(0.8)**	○	○	○	○	○	○	○

Q201. Please provide any additional information to support the assessment of issues of concern in this subregion.

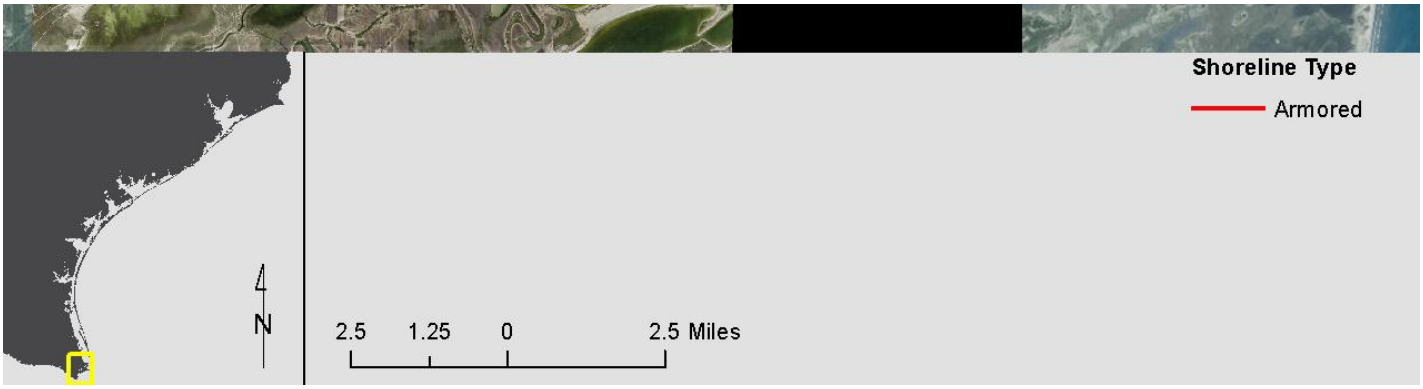
Subregion 4.8 Brownsville Ship Channel

Q202. **Subregion 4.8 Brownville Ship Channel**



- Includes the Port of Brownsville on the southernmost tip of Texas, which facilitates trade between the U.S. and Mexico
- Includes the cities of Los Fresnos, Port Isabel and the eastern portion of Brownsville
- Includes the estuaries of Bahia Grande, South Bay, and portions of the lower Laguna Madre

Maps and Data



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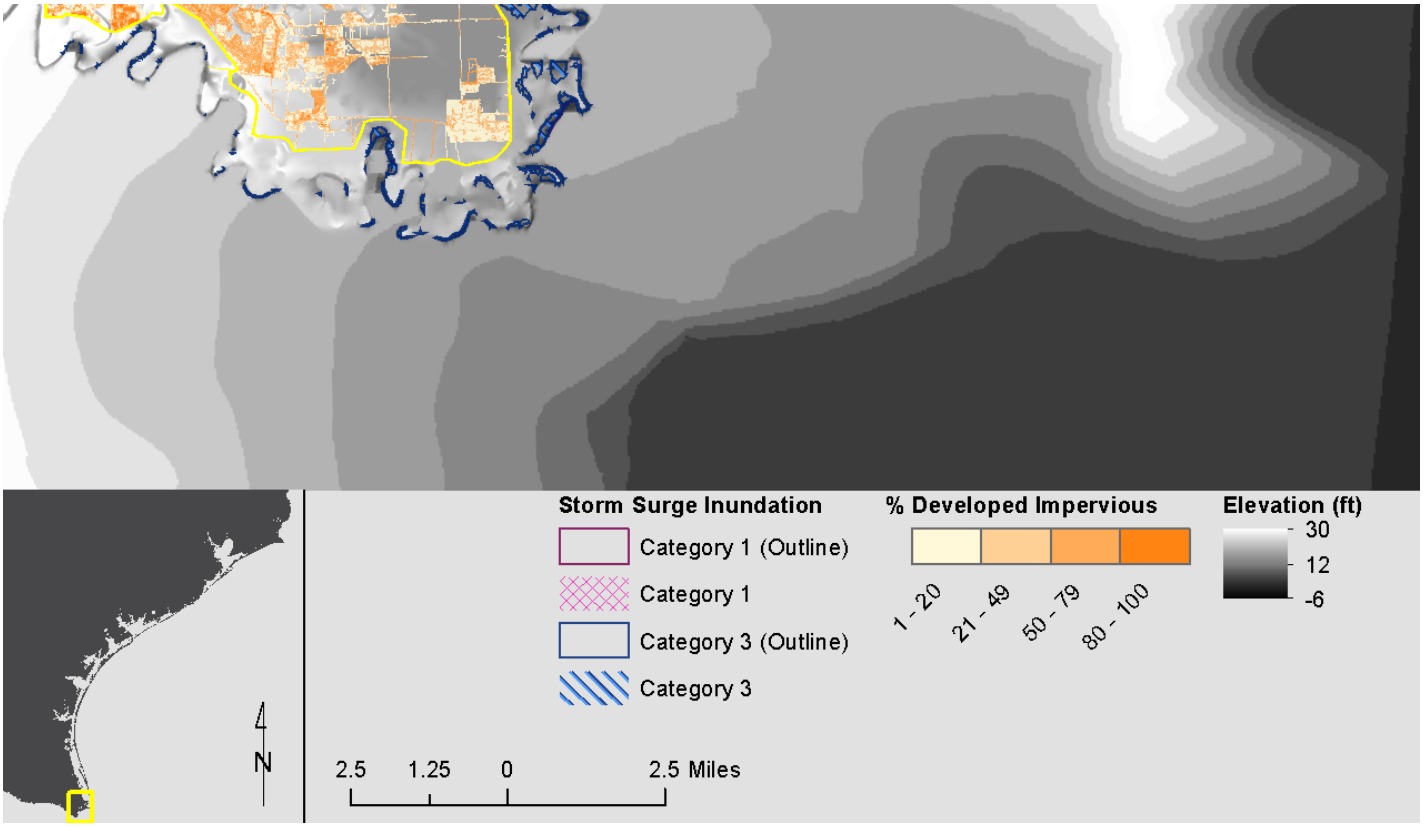

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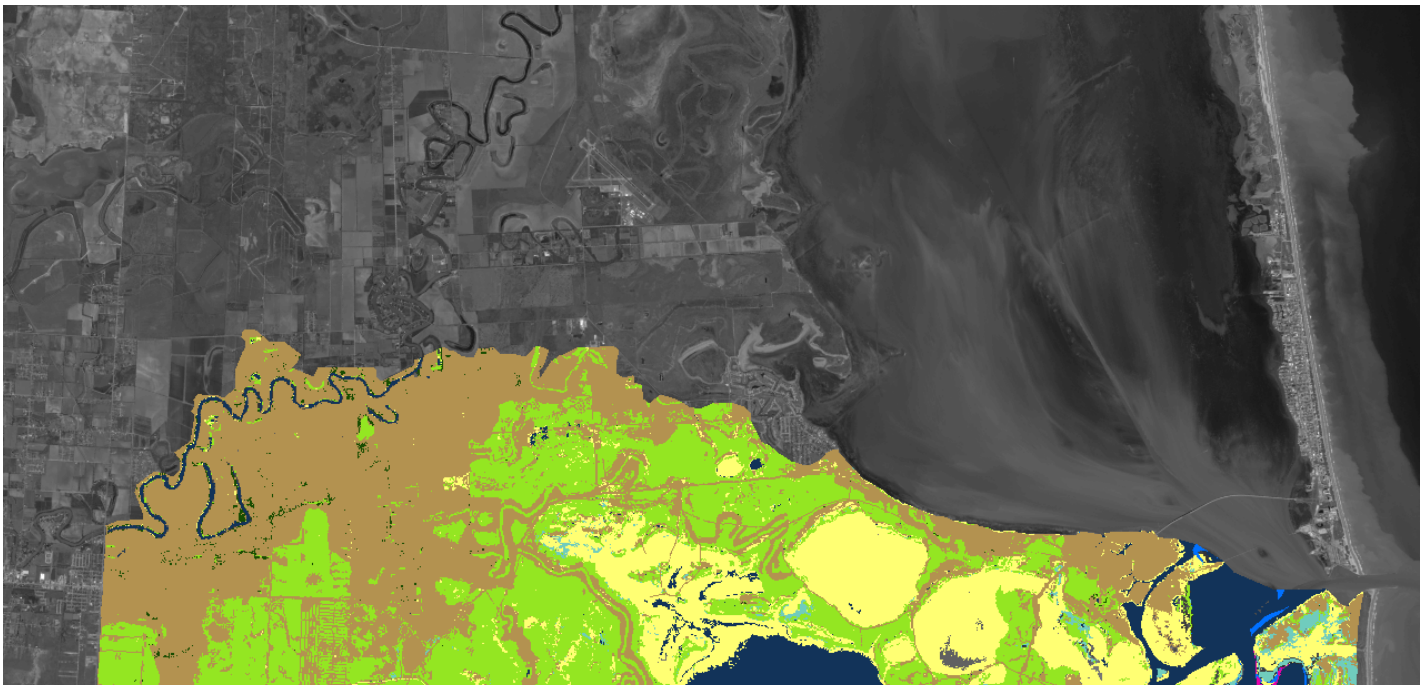

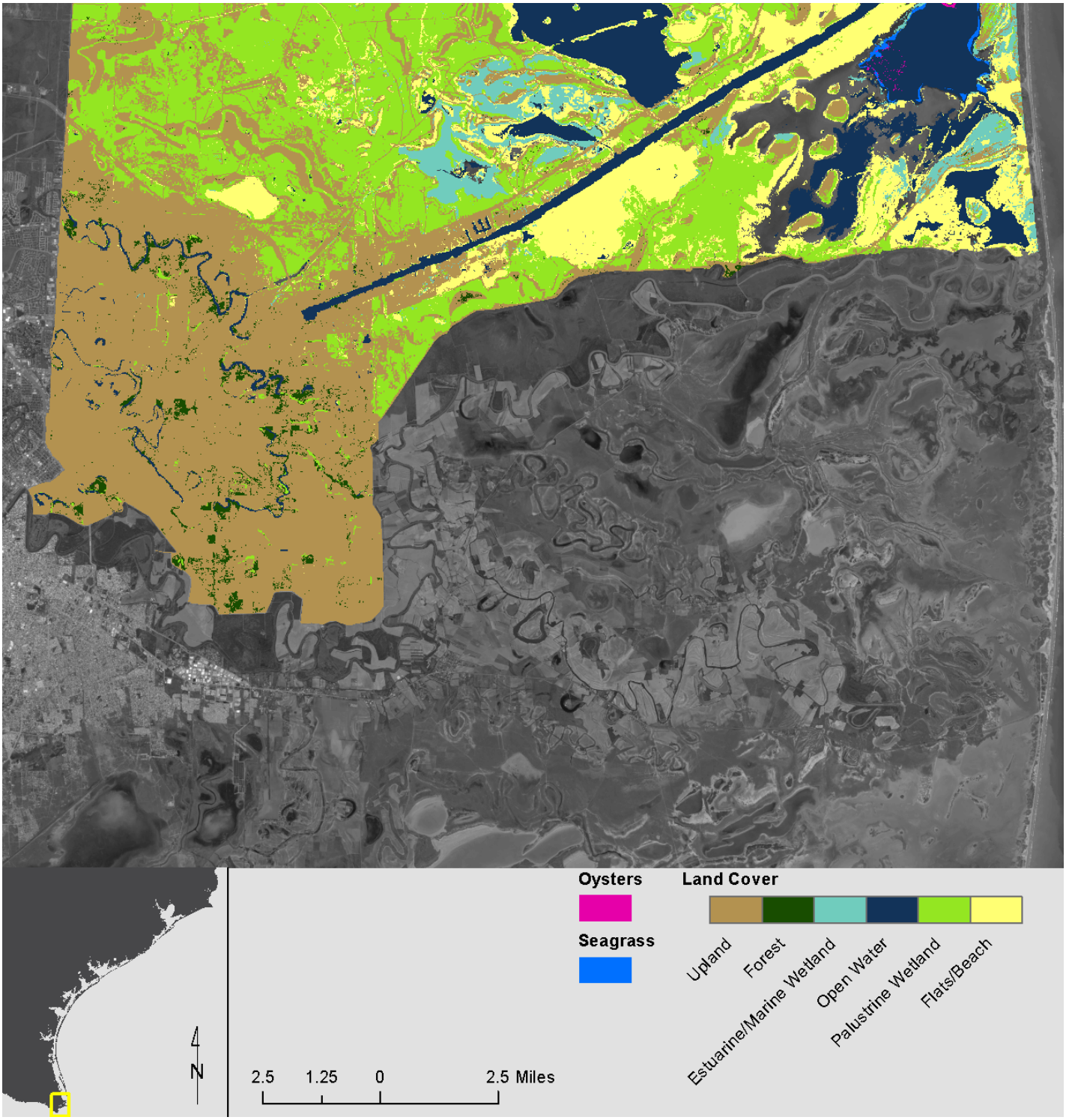

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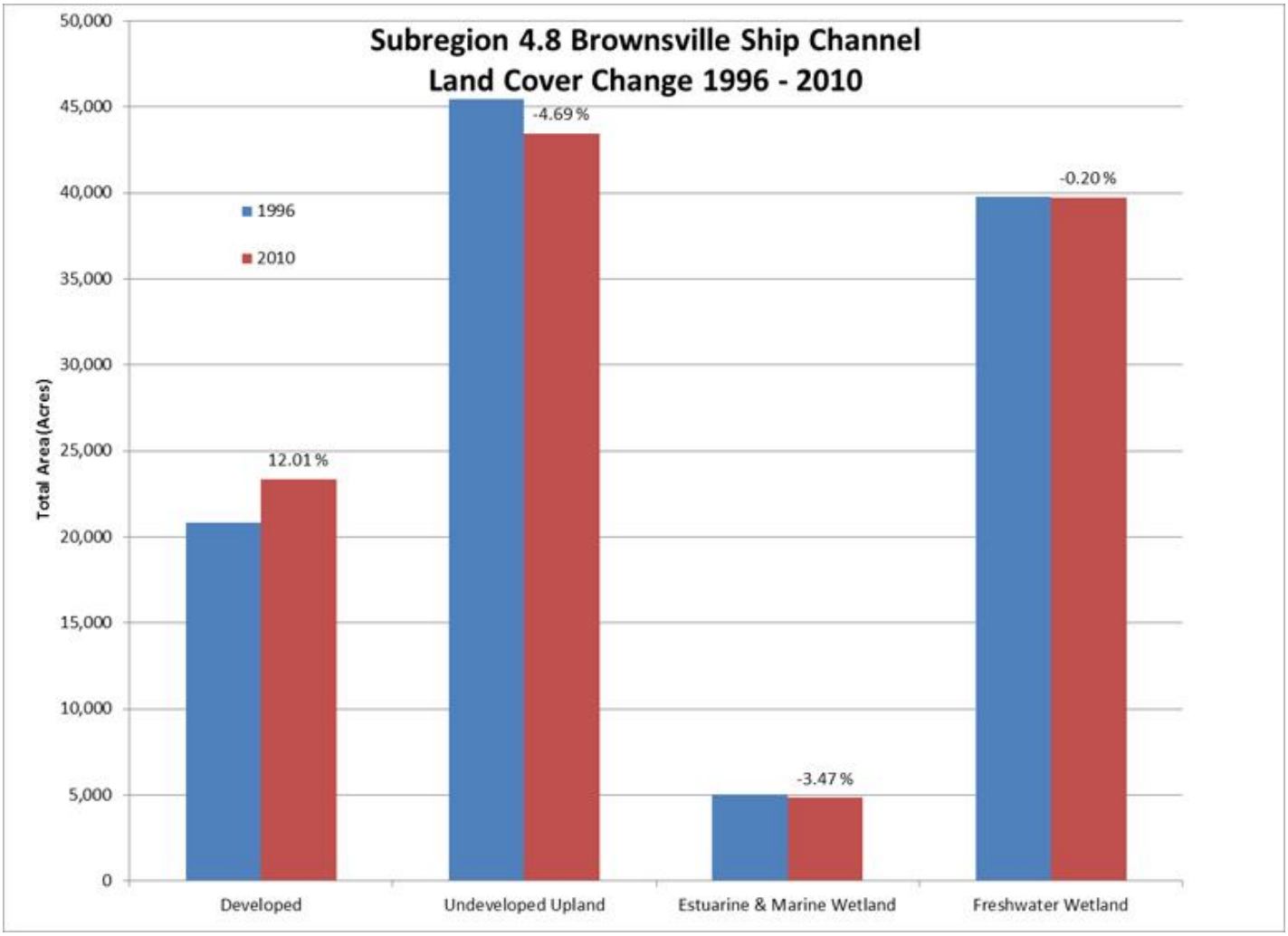

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Ship and Boat Building					
Total Employment	Number of Establishments	Wages	Wages per Employee	Total GDP	GDP /employee
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Q203.

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Impact on water quality and quantity **(2.3)**	○	○	○	○	○	○	○
Impact on coastal resources **(2.5)**	○	○	○	○	○	○	○
Abandoned or derelict vessels, structures, and debris **(0.8)**	○	○	○	○	○	○	○

Q204. Please provide any additional information to support the assessment of issues of concern in this subregion.

Subregion 4.9 Outlet Rio Grande

Q205. **Subregion 4.9 Outlet Rio Grande**