# Texas Coastal Management Program
# Section 309 Assessment and Strategies Report
# 2011-2015

Prepared by The Harte Research Institute for the Gulf of Mexico Studies
for The Texas General Land Office

Table of Contents

# Introduction

This document is an assessment of progress made from 2006-2010 and strategies for achieving the goals of the Texas Coastal Management Program (TCMP) pursuant to Section 309 of the Coastal Zone Management Act (CZMA) of 1972, as reauthorized in 1990. The TCMP is administered by the Texas General Land Office (GLO). This document was developed by staff of the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University – Corpus Christi (HRI) and the GLO. The Assessment and Strategies Report is organized according to Section 309 Program Guidance provided July 2009 by the National Oceanic and Atmospheric Administration, National Ocean Service, Office of Ocean and Coastal Resource Management (OCRM).

The Assessment portion begins by summarizing TCMP improvement efforts to the enhancement areas identified by the OCRM (Wetlands, Coastal Hazards, Public Access, Marine Debris, Cumulative and Secondary Impacts, Ocean Resources, Energy and Government Facility Siting, and Aquaculture) since 2006. Next, a characterization of problems and opportunities that exist in each enhancement area are provided along with the effectiveness of existing efforts to address them. Program gaps/needs are identified and a priority for improvement is established for each enhancement area. Areas identified in the Assessment as high priority for future funding from years 2011-2015 were Wetlands, Coastal Hazards, Public Access, Cumulative and Secondary Impacts, and Energy and Government Facility Siting. Marine Debris and Ocean Resources received a medium prioritization. Aquaculture was identified as a low priority. The Assessment is the basis for development of a strategy to direct future program changes to improve identified priority areas. The Strategy section describes a coast-wide planning effort that addresses needs in all high and medium priority areas. Projects for this planning effort will be carried out throughout the five-year funding period.

In order to provide the public an opportunity for input on the future needs of the TCMP, a notice of public comment/review was distributed along with a copy of the Assessment draft through multiple organizations, websites, and listserves including: HRI, TGLO, CBBEP, GBEP, MANERR, and Texas Sea Grant. Public comment hearings were held in Corpus Christi, Texas on April 29, 2010 and in Galveston, Texas on May 5, 2010. Additionally, a link to an online survey was available for those unable to submit comments at the public hearings. Advisory meetings were conducted to review and gain input on the Assessment (June, 2 2010) and Strategy (September 29, 2010) portions of the draft. These meetings included a core group comprised of representatives for the public as well as state agencies. The final Draft Assessment and Strategies Report was made available through the Texas Register for a 30-day comment period. A summary of public comments and responses received can be found in Appendix A.

# List of Acronyms

AAB: Adopt-a-Beach Program
ADCIRC: Advanced Circulation Model
BEG: Bureau of Economic Geology
BOEMRE: Bureau of Ocean Energy Management, Regulation and Enforcement
CAD: Computer-aided Design
CBBEP: Coastal Bend Bays and Estuaries Program
CCF: Capacity Conversion Factor
CELCP: Coastal and Estuarine Land Conservation Program
ChaRT: Chambers Recovery Team
CMP: Coastal Management Program
CMSP: Coastal and Marine Spatial Planning
CNRA: Coastal Natural Resource Area
COL: Combined Operating License
CSI: Cumulative and Secondary Impacts
CZ: Coastal Zone
CZM: Coastal Zone Management
CZMA: Coastal Zone Management Act
CZMAPMS: Coastal Zone Management Act Performance Measurement System
DoD: U.S. Department of Defense
DOT: U.S. Department of Transportation
DSIRE: Database of State Incentives for Renewables and Efficiency
ECRMs: Energy Cost Reduction Measures
EPA: Environmental Protection Agency
ERCOT: Electric Reliability Council of Texas
ESP: Early Site Permit
FEMA: Federal Emergency Management Agency
FERC: Federal Energy Regulatory Commission
GBEP: Galveston Bay Estuary Program
GBF: Galveston Bay Foundation
GCOOS: Gulf of Mexico Coastal Ocean Observing System
GIS: Geographic Information System
GLO: Texas General Land Office
GPS: Global Positioning System
GTRI: Geo Technology Research Institute
GW: Gigawatt
HARC: Houston Advanced Research Center
HRI: Harte Research Institute
HRRC: Hazard Reduction and Recovery Institute
IGCC: Integrated Gasification Combined Cycle
kW: Kilowatt
kWh: Kilowatt hour
LIDAR: Light Detection And Ranging
LNG: Liquefied Natural Gas
LTCR: Chambers County Long Term Community Recovery
MANERR: Mission-Aransas National Estuarine Research Reserve
MOU: Memorandum of Understanding
MW: Megawatt
MWh: Megawatt hour
NAS: Naval Air Station

NASEO: The National Association of State Energy Officials
NCMP: National Coastal Management Program
NCMPPMS: National Coastal Management Program Performance Measurement System
NEPA: National Environmental Protection Act
NMDMP: National Marine Debris Monitoring Program
NOAA: National Oceanic and Atmospheric Administration
NPS: Non-point source
NRC: The National Research Council
OCS: Outer Continental Shelf
OCSLA: Outer Continental Shelf Lands Act
OTEC: Ocean Thermal Energy Conversion
PACE: Property-assessed Clean Energy
PAG: Permit Assistance Group
PINS: Padre Island National Seashore
PS: Point source
PUC: Public Utility Commission of Texas
REC: Renewable Energy Credit
REDPP: Renewable Energy Demonstration Pilot Program
RPS: Renewable Portfolio Standard
RRC: Texas Railroad Commission
SECO: Texas State Energy Conservation Office
SNG: Synthetic Natural Gas
SWANCC: Solid Waste Agency of Northern Cook County
TAA: Texas Aquaculture Association
TAMU: Texas A&M University
TCEQ: Texas Commission on Environmental Quality
TCMP: Texas Coastal Management Program
TCP: Texas Coastal Partners
TDA: Texas Department of Agriculture
TDRA: Texas Department of Rural Affairs
THMP: Texas Hazard Mitigation Plan
TNRCC: Texas Natural Resource Conservation Commission
TNRIS: Texas Natural Resources Information System
TPL: Trust for Public Land
TPWD: Texas Parks and Wildlife Department
TSS: Total suspended solids
TSV: Taura Syndrome Virus
TxDOT: Texas Department of Transportation
USACE: United States Army Corp of Engineers
USCG: United States Coast Guard
USDOI: United States Department of the Interior
UTMB: University of Texas Medical Branch
WSSV: White Spot Syndrome Virus

# Summary of Past 309 Efforts for Grant Cycles 11, 12, and 13:

## Wetlands

### *Status and Trends of Inland Wetlands and Aquatic Habitats*

The Status and Trends of Inland Wetlands and Aquatic Habitats is a 5-year project to build upon a coast-wide effort to study the status and trends of wetlands and aquatic habitats on barrier islands by extending that effort to inland environments on the Texas coast. The BEG determined spatial and temporal changes in marshes, mangroves, tidal flats, forested and riparian wetlands, water bodies, and inland areas in Corpus Christi-Coastal Bend, Beaumont-Port Arthur, Matagorda Bay, Freeport and San Antonio Bay, and the Brownsville-Harlingen areas. Research in the Corpus Christi area (funded in grant cycle 11) and the Beaumont-Port Arthur areas (funded in grant cycle 12) is complete. The Matagorda Bay area (funded in grant cycle 13) is ongoing. The Freeport and San Antonio Bay area contract began October 1, 2009.

### *Corpus Christi Area*

The Corpus Christi phase of the Status and Trends of Inland Wetlands and Aquatic Habitats was completed in July 2008. The BEG determined the current status and historical trends of wetlands and associated aquatic habitats in the Corpus Christi area from Lamar Peninsula to Encinal Peninsula. The areas of interest included the mainland between the Gulf Intracoastal Waterway and the CMP boundary in the counties of Refugio, Aransas, San Patricio, and Nueces. Current (2004) and past (1950s to 2004) status and trends were determined using color infrared photographs taken in 2004, and historical black-and-white and 1979 color infrared photographs. The photographs were displayed and analyzed using GIS software.

The results indicated that in 2004 the wetland and aquatic habitats were dominated by estuarine marshes (26,739 acres), followed by seagrass beds (24,649 acres) and palustrine marshes (13,912 acres). The area of tidal flats, including algal mats, totaled 7,512 acres, palustrine forest (including scrub/shrub) had an area of 2,187 acres, and palustrine open water/flats and lacustrine habitats totaled 9,274 acres. The most extensive estuarine emergent wetlands occurred on the Nueces River Delta (8,100 acres) followed by the Aransas-Chiltipin system (4,142 acres), Port Bay (3,363 acres), the Copano mainland (2,921 acres), and the Mission River (2891 acres). Corpus Christi Bay consisted of the largest area (10,050 acres) of seagrass, followed by Redfish Bay (9,726 acres), Port Bay (1,497 acres), and Oso Creek (993 acres). Palustrine marshes were equally abundant adjacent to Copano Bay (3,104 acres) and within the Mission River valley (3,054 acres) followed by the Aransas River (1,631 acres), Nueces River Delta (1,599 acres), Live Oak Peninsula (1,581 acres), and Port Bay (1,386 acres). Palustrine forest and scrub/shrub habitat were relatively scarce, with the largest amount found in the Mission River valley (665 acres), followed by the Copano mainland (566 acres), and the Aransas River (361 acres).

Past trend analysis indicated that from the 1950s to 2004 estuarine marshes, and scrub/shrub increased in total area from 1950s-1979 and decreased in total area during 1979-2004. There was a total net gain of 4,831 acres, or approximately 101 acres/yr. A significant proportion of the increase in estuarine marsh in river systems resulted from reclassification from

palustrine marsh as a result of the landward movement of the fresh-to-saltwater boundary. In other areas, the primary change was the result of relative sea-level rise, where marshes spread into areas previously occupied by tidal flats. Approximately 43% of the increase in estuarine marsh resulted from spread of marsh into former tidal flats. Seagrasses increased in total area from the 1950s-2004 by 5,777 acres with an overall change rate of 120 acres/yr. Tidal flat habitats lost the most area, with a total decrease of 12,150 acres from the 1950s -1979, and 4,031 acres from 1979-2004. Roughly (-)30% of tidal-flat change occurred where estuarine marsh spread into areas previously mapped as tidal flats. The same scenario took place in other areas but was compounded by residential development. Corpus Christi Bay lost large amounts of flats when industrial areas adjacent to Tule Lake Channel were filled. In some areas, seagrasses spread into former flat areas, and dredge material was deposited on other flats. Palustrine marsh declined from 20,968 acres in the 1950s to 13,906 acres in 2004, with an average loss rate of 148 acres/yr. Palustrine open water and flats increased over time at rates of 25 acres/yr and 30 acres/yr. More specifically, on the Live Oak Peninsula, palustrine open-water increased by 280% between the 1950s and 1979. Much higher precipitation levels most likely accounted for the 1979 increase. Topography of the Pleistocene sand ridge is unique, characterized by hundreds of potholes that have fluctuating seasonal and annual water regimes dependent upon precipitation. Many more pothole wetlands were mapped in the 1950's, whereas fewer, but larger, individual potholes were mapped in 1979. Palustrine forest and scrub/shrub habitats decreased by 499 acres from the 1950s to 2004 (23% loss).

***Beaumont – Port Arthur Area***

The BEG determined spatial and temporal changes in inland marshes, mangroves, tidal flats, forested and riparian wetlands, and water bodies in the Beaumont-Port Arthur area. The Beaumont-Port Arthur area includes Sabine Lake, and Orange, Jefferson, and Chambers Counties. Current (2004) and past (1950s to 2004) status and trends were determined using color infrared photographs (pixel resolution of 1 m) taken in 2004 and historical black-and-white and 1979 color infrared photographs. The photographs were displayed and analyzed using GIS software. The historical GIS maps were obtained from the U.S. Fish and Wildlife Service, which obtained information from interpreting and delineating habitats using aerial photographs, field checking delineations, and transferring delineations to 1:24,000-scale base maps using a zoom transfer scope. Wetlands were classified as marine, estuarine, riverine, palustrine, and lacustrine systems. Subsystems and classes (descriptive of vegetation and substrate) were also included.

The current status analysis confirmed the presence of freshwater marshes, open water (primary habitat was lacustrine) palustrine habitats, and estuarine marshes. In 2004, palustrine marshes totaled 88,652 acres, estuarine open water totaled 44,585 acres, forest/scrub-shrub totaled 30,433 acres, estuarine marsh covered 21,644 acres, lacustrine flats and open water covered 10,349 acres, and rivers covered 8,626 acres. The most extensive palustrine emergent wetlands occurred in Taylor Bayou (40,604 acres), followed by Spindletop Marsh (21,590 acres). With regard to palustrine marsh habitat, Anahuac had 11,152 acres, Neches River had 10,574 acres, and Sabine Lake had 2,595 acres. Neches River (416 miles) was the area that contained the largest amount of open water (19,773 acres), with 64% of the open water being estuarine. Taylor Bayou contained 10,734 acres of open water and freshwater comprised 92% of the resource within the Bayou. Sabine River (555 miles) also was comprised of freshwater, approximately 67% of the 3,961 acres. The Neches River valley consisted of 13,665 acres of forests (wetland with trees and shrubs), followed by Taylor Bayou (8,977 acres) and Sabine

River (7,327 acres). Anahuac had the highest amount of estuarine marsh (9,743 acres), followed by the Neches River (9,138 acres) and the Sabine River (2,523 acres).

Past analyses (1956 through 2004) indicated an increase in emergent wetlands from 108,983 acres to 110,295 acres. Marsh areas and estuarine open water/flats increased in area from the 1950's to the 1980's, but lost area from the 1980's to the 2000's. From 1956 to 1979 marsh area increased by approximately 138 acres/yr, but from 1979 to 2004 marsh area declined by approximately 74 acres/yr. From 1956 to 1979 open water increased at a rate of 343 acres/yr, while from 1979 to 2004 open water decreased by 111 acres/yr. In total, there was a net increase of estuarine open water habitat of 5,125 acres. The forest and scrub/shrub habitats decreased from 48,200 acres in 1956 to 30,434 acres in 2004, with decreases averaging 877 acres/yr from 1956 to 1979 and increases of 96 acres/yr from 1979 to 2004. There was an increase in freshwater and flats from 25,692 acres in 1956 to 26,144 acres in 2004.

The results indicated that the increase in estuarine open water since 1956 was from the effects of subsidence and relative sea level rise. In addition, it was stated the conversion of marsh to open water occurred where artificial levees, roads, and dikes created dams. Past analyses indicated that approximately 78% of the area (from 1956 to 2004) of increase in estuarine marsh habitat was in areas previously mapped as palustrine marsh. The loss of forest habitat was due to agricultural and residential development.

***Matagorda Bay Area***

The status and trends of Matagorda Bay area that were analyzed by the BEG to determine spatial and temporal changes in inland marshes, mangroves, tidal flats, forested and riparian wetlands, and water bodies will be completed in Spring 2011. This phase will be accomplished in a similar fashion to the status and trends studies for the Corpus Christi and Beaumont-Port Arthur areas. The results of this study will address the probable causes for rates and locations of change in the area.

Results from those ***Status and Trends of Inland Wetlands and Aquatic Habitats*** studies completed at the time of this report have provided valuable data upon which better coastal management decisions could be made as well as improving the science based reservoir of knowledge upon which Texas' coastal management community relies. The following program change contributions identified in the 2006-2010 Section 309 Assessment and Strategies Report have been realized; results have been incorporated into Texas' CELCP Plan, results have been utilized in evaluating the merit of projects submitted for TCMP funding, and the results have been utilized by Texas' Coastwide Erosion Response Plan (ERP) and in support of Coastal Wetlands Planning Protection, and Restoration Act (CWPPRA) grant application.

***Water Quality Protection and Storage Characteristics of Freshwater Wetlands in the Galveston Bay Watershed***

According to a recent GBEP study, wetland loss continues at a rapid rate, posing the greatest single threat to the Galveston Bay ecosystem. The study revealed that the watershed lost over 9,004 acres of freshwater wetlands between 1992 and 2002. Current USACE definitions afford jurisdictional status to only those wetlands closely associated with navigable waters, leaving many formerly jurisdictional wetlands with non-jurisdictional status. Up to 80% of the watershed's freshwater wetlands are currently unprotected under Section 404 of the Clean Water

Act (Jacob and Lopez 2005). Consequently, as there is no indication that the rate of wetland loss will slow, the watershed will likely experience a significant net loss of its freshwater wetlands in the near future.

The purpose of the project was to secure scientific data that demonstrates the ecological and economic value of freshwater wetlands in the Galveston Bay watershed. Freshwater wetlands are recognized for their value in mitigating high peak flows during flooding and in filtering pollutants carried in runoff. Studies evaluating the capacity of freshwater wetlands to store and remove water through evaporation/transpiration during storm events and their capacity to process pollutants will provide a scientific basis for resource management decisions regarding freshwater wetlands protection.

GBEP evaluated the capacity and role of freshwater wetlands in providing floodwater storage and in processing pollutants in the Galveston Bay system. Overall, this project resulted in an evaluation of the water quality characteristics and flood storage capacity of freshwater wetlands.

The ***Water Quality Protection and Storage Characteristics of Freshwater Wetlands in Galveston Bay Watershed*** study was completed in March 2010 and the results provide valuable data for coastal management decisions related to wetland function and contaminant reduction as well as hydraulic interconnectivity as it relates to the regulatory definition and interpretation of isolated wetlands. Results from the study have been cited by Texas Sea Grant (Texas A&M University) as one of two studies that support drafting a letter to the U.S. Army Corps of Engineers and EPA to consider placing Coastal Prairie Pothole Wetlands under their jurisdiction based on a demonstrated hydraulic connectivity to regulated waters. The following program change contributions identified in the 2006-2010 Section 309 Assessment and Strategies Report are anticipated using final study data or have utilized interim data; Texas' CELCP Plan, the evaluation of projects submitted for CMP funding, and updating the Galveston Bay Foundation's Galveston bay Habitat Conservation Blueprint. Active dissemination of data results has been pursued as identified in the 2006-2010 Report through avenues such as the 9$^{th}$ Biennial State of the Bay Symposium in Galveston, Texas' publication in Wetlands Science and Practice Bulletin No 3, Vol. 26; the Society of Wetlands Science 2009 Annual Meeting in Madison, Wisconsin; and through multiple meetings of the Wetland Work Group inter-academic and agency forum.

## Public Access

***Saving our Coastal Heritage – Texas Rural County Demonstration Project, Phase 1, 2, 3***

Phase 1 was funded in Grant Cycle 11, phase two was funded in Grant Cycles 12, 14, and 15 and phase three will be partially funded under Grant Cycle 15; all with Texas CMP 309 funds. Phase 1 was completed in June 2008. Implementation (Phase 2) has required an extension of the time line across multiple funding Cycles given the number of stakeholders and variables outside of the projects' control.

As GLO implements the Texas Coastal Management Program, there is a need for a framework to effectively guide and evaluate this progress with respect to conserving coastal natural resource areas and increasing public access to the coastal zone. The Saving Our Coastal Heritage – Texas Rural County Demonstration Project is an initiative with the Trust for Public

Land (TPL) and subsequently Texas Coastal Partners (TCP), Inc. that will provide guidance for Texas coastal communities in accomplishing conservation on a local watershed or county level for multiple benefits, such as indentifying threats and opportunities that stakeholders face for conservation.

Coastal needs, and the public awareness of them, are increasing and there is a concomitant growing need to consider how best to use scarce resources to accomplish the goals of the TCMP. There is a need for increased CMP assistance to local governments, especially when counties must compete for state or federal funding. This project developed short- and long-term evaluation techniques to determine if these types of planning efforts are meritorious in terms of coastal planning and whether they are replicable. This project has also allowed comparisons with the urban/suburban modeling that TCP has currently underway for the Armand Bayou watershed with the city of Pasadena.

The project consists of analysis, implementation, and evaluation phases where the TCP used GIS mapping to identify high priority areas for public access, habitat conservation and restoration, and other community identified priorities for Chambers County, a rural county in the lower watershed of Galveston Bay. Chambers County has substantial federally owned land, as is true with a number of other rural coastal Texas counties. It shares with all other rural counties the need for more opportunities for public access and for increased revenues from economic development that protects its resources, such as nature tourism.

The overall goals of phase 1 and 2 were to 1) summarize characteristics of Chambers County and the people that live, work, and play there, 2) identify the threats and opportunities that the Chambers County Stakeholders face as they work to shape their community future through conservation and, 3) assess and prioritize community needs. The Chambers County Comprehensive Recreation, Conservation and Economic Development Master Plan (Public Management, Inc., 2006); Galveston Bay Habitat Conservation Blueprint, (GBF, 1998); The State of the Bay: A Characterization of the Galveston Bay Ecosystem, second edition; (Galveston Bay National Estuary Program, August 2002; and the Texas Handbook Online documents, data and plans were used to obtain the needed information.

The Saving Our Coastal Heritage — Texas Rural County Demonstration "greenprinting" project will build on ongoing and past planning efforts, such as the Saving Our Coastal Heritage — Armand Bayou greenprinting project, which is being conducted in a suburban/urban area of Harris County. It will also allow an opportunity to coordinate with other programs.

Results from the ***Saving Our Coastal Heritage – Texas Rural County Demonstration Project*** work completed at the time of this report have provided critical access and resource protection planning and expertise to improve coastal management decisions at the local level. The Chambers County GIS-based plan is listed as one of the plans incorporated in Texas statewide CELP Plan and continues as a local "greenprint" tool for land conservation and public access as specified in the 2006-2010 Assessment and Strategies Report. Closing project work will ensure the GIS based plan is current and effectively implements local priorities for rural Texas into acquisition initiatives as well as strengthening scoring criteria for state and federal programs that share common community-based natural resource and public access planning goals.

This project is in the final implementation phase. However, over the course of conducting several Greenprint projects in southeast Texas through The Trust for Public Land, it has become apparent that completing the projects - the Greenprint maps, the strategy exchange, the reports, and the action plans - even with significant stakeholder involvement, does not necessarily result in ongoing projects for land conservation, or implementation of other aspects of the action plans. Typically, some community stakeholders remain committed to the concepts of the Greenprint projects, but they generally lack the time, resources, or expertise to pursue implementation.

A second lesson learned from these greenprinting projects, as well as from other conservation programs in the region, is that it takes more than one year of implementation to see results from a land conservation initiative. Grant funding cycles alone are generally a 12-to-18-month process. Identifying and cultivating landowners or developing support for a policy change can also be a lengthy undertaking.

The initial Cycle 14 application for ongoing support didn't fully anticipate the time needed for recovery from Ike or the time needed for implementation activities to come to fruition.

The enhanced Cycle 14 project will bolster implementation of the Chambers County Greenprint by: continuing the stakeholder process to guide implementation, identifying funding sources and helping pursuit of them, and coordinating more outreach to landowners.

***Texas Coastal Management Performance Measurement System, Phase 2, 3, 4***

The CZMAPMS consists of a framework of measures developed to quantify management outcomes related to the CZMA implemented at the state and federal level. Measures of the CZMAPMS assess: 1) contextual variables that influence coastal program actions: socioeconomic, water quality and quantity, coastal development, public access, coastal hazards, coastal habitat; and 2) performance of the TCMP in six categories: coastal habitats, coastal hazards, coastal water quality, coastal dependent uses and community development, public access, and government coordination and decision-making.

In fiscal year 2007 the CMP contracted with the GTRI, to implement Phase 2 of the NCMPPMS. The Phase 2 work consists of obtaining input on the NCMPPMS from the Texas coastal management community via a series of NCMPPMS workshops, updating data for the Phase 1 measures (Government Coordination and Decision-Making and Public Access), collecting data for Phase 2 measures (Coastal Habitat and Coastal Water Quality), and converting the Phase 1 data management system into a relational database. In Fiscal Year 2008 (Phase 3), GTRI continued to work with the Texas CMP to update Phase 1 and Phase 2 performance measure data for reporting to NOAA. GTRI also upgraded the performance measure data entry system relational database to a fully scalable data entry system designed using Adobe Flex, ColdFusion, and SQL technologies. GTRI will support the TCMP in implementing Phase 3 of the CZMAPMS in Texas. Phase 3 will implement the data collection and reporting process for the final two categories. GTRI is assisting the TCMP with data collection and the development of a data management system.

GTRI will implement Phase 4 of the NCMPPMS in Texas. Phase 4 will focus on meeting the objectives of updating Phase 1 and Phase 2 contextual and performance measures and supporting data describing Public Access, Government Coordination and Decision Making,

Coastal Habitat, Coastal Water Quality, and stakeholder-identified performance and contextual measures added by the CMP; gather supporting data sets for Phase 3 contextual and performance measures addressing Coastal Hazards and Coastal Dependent Uses and Community Development and stakeholder-identified performance and contextual measures added by the CMP; disseminate results of the Texas Coastal Management Performance System by developing a Texas Coastal Performance Measure website displaying queriable performance measure data, and providing outreach presentations to the Texas coastal management community and; facilitate future updates of the Texas Coastal Management Performance System by working with the Coastal Coordination Council to design a CMP Grant closeout form template.

The ***Texas Coastal Management Performance Measurement System*** (TCMPMS) is in its final development stage and achieves the following aims identified in the 2006-2010 Assessment and Strategies Report. The TCMPMS will provide a tool by which; categories that should be modified or added for program use can be identified, existing data can be analyzed and needs to modify data collection can be identified, and data collection methodologies in need of change can be identified. The TCMPMS (database) will also be used by the GLO to evaluate coastal needs and guide programs, policies, and efforts that address those needs in support of CMP policies and goals as well as effectively report data and analyze trends in support of the National Coastal Zone Management Act Performance Measurement System (CZMAPMS). The effective collection and tracking of data in an organized database for CZMAPMS reporting represents a key component to support statutory and administrative proposals.

***City of Clute Comprehensive Recreation, Conservation, and Economic Development Plan***

Section 309 Funds from TCMP Grant Cycle 13 were used to work with the city of Clute, the public, and various state and federal agencies to develop a comprehensive plan to protect and enhance the natural areas within and immediately surrounding the city from the outgrowth of commercial, industrial, and residential development. The city solicited input from local residents through public hearings and workshops. There are five major tasks. Task 1 was completed in March 2009, tasks 2 and 3 were completed September 2009, and task 4 was completed December 2009. Task 5 was completed in March 2010.

Clute procured the services of a qualified consultant through a RFP process. The city utilized computer-aided mapping software to prepare a base map including the corporate limits for the city, the extraterritorial jurisdiction and other areas of interest. The city then utilized data from fieldwork, the United States Census, the Soil Conservation Service, the local library and participating state and federal agencies in order to develop the baseline studies. Throughout the process the city solicited input from local residents through public hearings and workshops. These public meetings served as the needs assessment. The public was presented the data and asked to comment on the direction of the plan. Adjoining municipalities were invited to participate. The development of goals was based on information gathered at the public meetings and presented to various government agencies for guidance on funding opportunities and technical assistance. Upon receiving input from the various agencies, the plan was finalized and sent back to the city for public comment. Upon recommendations from the city, the plan was finalized and submitted to the various agencies, including the GLO for comment. Upon receiving comments from the various agencies, the city made necessary revisions and then adopted the plan.

Results from the ***City of Clute Comprehensive Recreation, Conservation, and Economic Development Plan*** have aided the community in providing a comprehensive tool and means by which to manage future growth, natural resource conservation, and public access at the local level incorporating local priorities. Program change identified in an amendment to the 2006-2010 Section 309 Assessment and Strategies Report included; new and/or improved land use ordinances that incorporate resilient community practices to mitigate storm events, a model for other coastal community planning efforts that demonstrates the benefits of state-local partnerships, and new priorities and/or programs within the TCMP that provide coastal communities with financial and technical resources to conduct effective growth planning. The first change was realized through formal adoption of the master plan by the Clute City Council. The benefits of state and local partnership in formal planning for future growth have also been realized with an additional technical and financial partnership in public access planning being conducted with Calhoun County. The master plan will also be relevant to the TCMP through its submittal in future city CMP grant requests to demonstrate the city's commitment to public access and natural resource goals.

## Coastal Hazards

### *Status and Trends of Dune Volume, Morphology, and Vegetative cover along the Texas Gulf Shoreline*

University of Texas' BEG began the first year (baseline) of a five year study to evaluate the status and trends of dune volume, morphology, and vegetative cover along the more developed portions of the Texas Gulf shoreline. This project was conducted and analyzed using airborne topographic LIDAR surveys, in combination with new and historical optical imagery and ground surveys. Overall, the goal of the project was to provide more information to better understand the status and trends of the beach/dune system and to monitor the susceptibility of the coast to storm damage.

Results from year one on the ***Status and Trends of Dune Volume, Morphology, and Vegetative cover along the Texas Gulf Shoreline*** study has provided valuable data to assist in addressing the nexus between state and local regulatory and recommended practices and coastal management decision. The study, as currently implemented, is more limited in its temporal scope from that originally identified in the 2006-2010 Assessment and Strategies Report and forms the principle baseline from which future work will benefit. The following program change contributions identified in the 2006-2010 Assessment and Strategies Report were nevertheless realized; the results have been utilized in evaluating the merit of projects submitted for CMP funding, the results have been utilized by Texas' Coastwide Erosion Response Plan (ERP), and the results have been employed in the development of Texas' Beach Dune rule revisions in support of Texas' Dune Protection Act and the Open Beaches Act, The results have also been utilized by the City of Galveston in the local government's decisions related to coastal access and resource management.

### *Status and Trends of Coastal Vulnerability to Natural Hazards, Phase 1, 2, 3*

The purpose of this project is to evaluate the State of Texas Mitigation Plan for applicability to the TCMP by assessing local, state, and federal resources available for mitigation, preparedness, response, and recovery. Phase 1 was funded with CMP Grant Cycle 11

monies, phase 2 was funded with CMP Grant Cycle 12 monies and phase 3 was funded with CMP Grant Cycle 13 monies. The final report for phase 1was received in July 2008 and the report for phase 2 in October 2009. The final report for phase 3 is expected March 2011. Phases 4 (Cycle 14) and 5 (Cycle 15, contract execution pending) has not yet begun.

Texas A&M University's HRRC will evaluate a myriad of issues related to coastal vulnerability to natural hazards in Texas: local, state, and federal resources available for mitigation, preparedness, response, and recovery and their application to the CMP; regulatory regime and effectiveness of construction codes and land use planning policies; best practices and emerging technologies related to building code and land use planning; physical and social vulnerabilities of coastal populations; adoption of hazard mitigation technologies; and applicability of the State of Texas Mitigation Plan to the TCMP.

The second phase of a five phase strategy to evaluate a myriad of issues related to assessing the vulnerability of coastal areas to natural hazards, including: local, state, and federal resources available for mitigation, preparedness, response, and recovery and their application to the TCMP; regulatory regime and effectiveness of construction codes and land use planning policies; best practices and emerging technologies related to building code and land use planning; physical and social vulnerabilities of coastal populations; adoption of hazard mitigation technologies; and applicability of the State of Texas Mitigation Plan to the TCMP.

Work on the remaining phases will continue, and will include: completion of an survey of local officials and other relevant stakeholders and an environmental scan to inventory and assess regulatory regimes related to building codes and land-use planning policies for the target area counties; completion of a random survey of planners and initiation of a random survey of households to facilitate the development of public outreach programs to enhance coastal management planning; identification of best practices related to building codes and land-use; identification of local, state, and federal resources (e.g. funding) that might be employed to meet mitigation, preparedness, response, and recovery needs; and collection, analysis, and display of physical, political, and socioeconomic geospatial data related to coastal hazards on the Coastal Communities Planning Atlas (http://coastalatlas.tamug.edu/atlas.htm.)

The research outlined above will generate policy and programmatic recommendations related to coastal programs, management, and regulations. In addition, the research will develop tools for assessing programmatic and policy weaknesses and provide information on best practices that can be modified and potentially adopted along the Texas coast.

The ***Status and Trends of Coastal Vulnerability to Natural Hazards*** is in its final development stage and achieves the following goals identified in the 2006-2010 Assessment and Strategies Report; evaluation of the State of Texas Mitigation Plan and application of the results and corresponding TCMP priorities through GLO representation on the multi-agency Hazard Mitigation Team lead by Texas' Department of Emergency Management, development, communication of, and guidance relating to hazard evaluation tools (Texas Sustainable Coast Initiatives Vulnerability Atlas), best hazard reduction practices, social and physical vulnerability analysis, and dissemination of those tools and findings to state and local government officials through Texas A & M University's Hazard Reduction Institute web site, the Texas Storm Smart Coast (part of the Storm Smart Coast Network) web site, hazard related conferences such as Caring for the Coast (Galveston 2009) and the Coastal Resiliency Symposium (Houston 2010), and professional exchange. Workshops will be held by Texas A&M and targeted to local

stakeholders to convey the complex hazard analysis results and provide training in the practical application of the Texas Sustainable Coast Initiatives Vulnerability Atlas tool.

### *Geohazards Mapping of North Padre and Mustang Islands*

The Coastal Bend Bays and Estuaries Program, in partnership with the Harte Research Institute (HRI), will initiate a new strategy to develop a geohazards map of North Padre and Mustang Islands. The main objective of this project is to provide information to the planning process and to serve to increase public awareness of the natural physical process acting on the islands. The map will consider the spatial and temporal patterns of geological processes, geomorphology, and geoenvironments (e.g. wetlands and dunes) that contribute to create potentially hazardous conditions and incorporate model projections demonstrating how the island will change over the next 60 years. Phase 1 of the project consists of constructing a model that projects how wetland environments will transition during expected relative sea level rise and shoreline retreat. Phase 2 will combine the maps generated in phase 1 with maps of current geoenvironment distribution.

Moreover, data sets such as historical storm washover locations, land use, erosion control structures, and foredune characteristics will be combined to map the island in units ranked according to their susceptibility to geohazards or their mitigating effects of geohazards. The final report is not yet complete.

The study, ***Geohazards Mapping of North Padre and Mustang Islands,*** will be completed summer 2011 and will provide valuable data upon which better coastal management decisions can be made with respect to projected sea-level rise and associated impacts. The intended goal of the mapping is to provide information to the planning process, serve to increase public awareness of the natural physical processes acting on the islands, and influence future development patterns and the creation of new ordinances to protect critical features such as dune ridges and wetlands in the North Padre and Mustang Island areas. The results will offer a tool to better plan for restoration and acquisition initiatives.

### *Geohazards Mapping of South Padre Island*

HRI is developing a geohazards map of South Padre Island. The map will delineate critical environments and features (e.g. wetlands, dunes, and washover channels) that protect against and/or are vulnerable to certain geological processes or geohazards, such as hurricanes and sea level rise. The map will also project where these critical environments and features are likely to be in 60 years, as sea level rise and shoreline retreat continue. The goal of this project is to allow for more effective planning and increase public awareness of the natural processes acting on the island. The project is being accomplished in three tasks. The overall goal of task 1 is to acquire research-quality lidar data and to develop digital elevation models. This task was accomplished by the BEG, University of Texas at Austin and the HRI, Texas A&M University-Corpus Christi. HRI is currently using the lidar data to 1) quantify how vegetation assemblages are correlated with elevation, 2) map habitats in conjunction with aerial photography, 3) track shoreline change, 4) map storm overwash areas, and 5) provide the basis for a sea level rise model of geoenvironments. The overall goal of task 2 is modeling and projecting geoenvironmental change caused by sea level rise. More specifically, task 2 will determine the likely future distribution of estuarine wetland habitats and uploads under various sea level rise

scenarios. Task 3 will use previously available datasets and datasets developed during Tasks 1 and 2 to create a geohazards map..

The ***Geohazards Mapping of South Padre Island*** project has been extended thru 8-31-2011 and is expected to provide the same benefits as its sister project conducted on North Padre and Mustang Islands; valuable data upon which better coastal management decisions can be made with respect to projected sea-level rise and associated impacts. In addition, the potential impacts to human infrastructure at South Padre Island provide an added dimension in which to view sea-level rise and associated habitat and geomorphologic changes, The intended goal of the mapping is the same as that for the North Padre and Mustang Island study; to provide information to the planning process, serve to increase public awareness of the natural physical processes acting on the islands, influence future development patterns and the creation of new ordinances to protect critical features such as dune ridges and wetlands in the North Padre and Mustang Island areas, and offer a tool to better plan for restoration and acquisition initiatives.

# Assessment - Enhancement Area Analysis

## *Wetlands*

**Section 309 Enhancement Objective**

Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Please indicate the extent, status, and trends of wetlands in the coastal zone using the following table:

| Wetlands Type | Estimated historic extent (1950's acres) | Current extent (2001-2004 acres) | Trends in acres 1980's-2004 (Net acres gained & lost) | Acres gained through voluntary mechanisms since 2006 | Acres gained through mitigation since 2006 | Year and sources(s) of Data |
|---|---|---|---|---|---|---|
| Tidal (Great Lakes) vegetated | 212,099 | 216,704 | -4,348 | 12,932 | Implementation of tracking metrics pending | Tremblay et al. 2008, Tremblay et al. 2009, White et al. 2002, White et al. 2004, White et al. 2005, White et al. 2006, White et al. 2007, GLO, TPWD, GBEP, Ocean Trust, NFWF, EPA, TCEQ |
| Tidal (Great Lakes) non-vegetated | 693,729 | 609,502 | -38,924 | 10,071 | Implementation of tracking metrics pending | |
| Non-tidal/freshwater | 207,590 | 193,415 | -10,235 | 9,433 | Implementation of tracking metrics pending | |
| Submerged aquatic vegetation | 56,617 | 114,392 | +18,478 | N/A | N/A | |

2. If information is not available to fill in the above table, provide a qualitative description of information requested, including wetlands status and trends, based on the best available information.

The Status and Trends of Wetlands and Aquatic Habitat 309 funded projects were used to determine historical and current extent in the table above. However, it has been discovered that there is no tracking of mitigation projects. Since 2006, there has only been limited ground truthing of 2004 areal data in the Corpus Christi and Beaumont-Port Arthur areas. Therefore, it is impossible to estimate trends in net acres lost or gained since 2006. There is no doubt that some wetland acres have been lost due to erosion and coastal development, but there is no way to estimate that number given the lack of mitigation tracking and the lack of statewide area estimation since 2004. Therefore, current trends were calculated from net changes in the 1980's

and 2000's area estimations in the Status and Trends of Inland Wetlands and Aquatic Habitat projects. A recently completed 309 project in Matagorda County uses a 2008 dataset. Projects funded in Cycle 15 in Freeport/San Antonio Bay and Brownsville-Harlingen will incorporate 2009 wetlands imagery data. These projects will be complete spring 2011 and 2012 respectively and should provide better insight to recent wetland trends.

3. Provide a brief explanation for trends.

As described above, while there has been 32,436 acres of tidal and non-tidal wetland habitat gained through voluntary mechanisms since 2006, it is not known what the losses might be during that period. In general, total tidal and non-tidal wetland habitat estimates decreased by 53,507 acres from the 1980's to 2004. While it is unknown exactly why this loss occurred the likely causes are erosion, loss of sediment supply, subsidence, and coastal development.

One area of concern is the redefinition of wetlands as a result of the 2001 decision by the U.S. Supreme Court. This decision removed wetlands isolated from navigation corridors from the USACE regulatory process. Thus, there is no longer a federal requirement for permits for development of many of the wetland areas that are the subject of this assessment. While there is currently a gap in the management of wetlands, it is unknown what impact this might have had (or is having) on wetland losses.

Submerged aquatic vegetation shows an increase of 18,478 acres from the 1980's to 2004. However, much of this can be attributed to the submersion of tidal flats by relative sea level rise. Through this process, topographically low tidal flats are converted to open water, marsh, or submerged aquatic vegetation beds. This has been reported in many areas of the coast including Matagorda, Mustang, and San Jose Islands. Therefore, this trend can be deceiving due to an increase in potential habitat for seagrass. The Texas Seagrass Management Plan notes that seagrass acreage fluctuates with freshwater inflows, but general trends indicate decreasing acreage in most Texas Bays.

4. Identify ongoing or planned efforts to develop monitoring programs or quantitative measures for this enhancement area.

As part of ongoing efforts to identify quantitative measures for wetlands, GLO is modifying its current database to track acres of wetland area affected, acres mitigated, open water projects, tidal projects, submerged lands projects, coastal wetland projects, oyster reef projects, shoreline projects, beach projects, and dune projects many of which are unavailable for reporting currently. As mentioned above, current and future wetland habitat projects will provide quantitative measures to more accurately track recent trends.

5. Use the following table to characterize direct and indirect threats to coastal wetlands, both natural and man-made. If necessary, additional narrative can be provided below to describe the threats.

| Type of Threat | Severity of impacts (H,M,L) | Geographic scope of impacts (extensive or limited) | Irreversibility (H,M,L) |
|---|---|---|---|
| Development/Fill | H | L | H |
| Alteration of hydrology | H | E | H |
| Erosion | H | E | H |
| Pollution | L | L | L |
| Channelization | L | L | H |
| Nuisance or exotic species | L | E | M |
| Freshwater input | H | E | H |
| Sea level rise | H | E | H |

The main threats to wetlands within the CMP boundary are coastal development, erosion, sea level rise, and hydrology alteration (i.e., freshwater input), therefore each of these threats are categorized as having a high severity of impacts.

Coastal development is unique because the geographic scope is limited due to approximately 50% of the 373 miles of coastline being set aside (e.g. Padre Island National Seashore and Matagorda Island) or unavailable for development (e.g. San Jose Island). Additionally, the footprint of coastal development projects is small relative to the entire coastline. Due to the economic downturn many coastal developments have stalled (e.g. Turtle Cove and Newport Dunes on Mustang Island). However, the impact is moderate because the irreversibility of coastal developments is high.

The extraction of groundwater and hydrocarbons is associated with development, and can cause subsidence that will threaten wetlands with drowning. The threats of altered hydrology and freshwater input are linked because typically hydrology is altered by water supply infrastructure. This changes the amounts of freshwater inflow to the CZ, which generally causes salinities to rise and soils to dry, and consequently wetland habitat loss. Because much of the Texas coast is relatively dry and subject to extreme, punctuated droughts, the threat is very high.

Linked to altered hydrology is the loss of sediments flowing to the coast, which in turn can play an important role in erosion because sediment budgets are altered by reduced sediment sources. Thus, the loss of sediment by erosion is not counterbalanced by the supply of sediment from rivers. It is possible that dredge material could be used to supplement sediment supply to wetlands in lieu of the sediment that is lost to reduced inflows, but this might not be feasible because sedimentation occurs mainly in secondary bays while dredging typically takes place in primary bay systems. The net effect of combining altered hydrology and erosion is that the severity of impact is very high.

Sea level rise is no doubt a great threat to wetlands. The key issue is the rate of horizontal spread of wetland habitats in the face of the rate of rising sea level. It is likely that plant communities will simply migrate with sea level rise. However, once a barrier is encountered (such as a sea wall, bulkhead, or road) the wetland cannot migrate and will be drowned. Thus, areas where coastal development is not a problem today could be a problem with different sea levels.

Pollution, channelization, and exotic species are all designated as having low severity of impacts. Pollution occurs mainly in the developed areas as point and non-point source runoff. It

is not thought that pollution is a major driver of wetland loss. Channelization occurs mainly in the deeper navigation areas of the primary bays, whereas wetlands occur primarily in the secondary bays. One exception is seagrass habitats, which do occur in primary bays and can be affected by turbidity that can occur with maintenance dredging. The only new project to be completed within the assessment period was opening of Packery Channel in Nueces County in 2006.

We are not currently aware of nuisance or exotic wetland plant species invading Texas wetlands to any great extent. However, one interesting change is the spread of black mangrove and invasion of red mangrove in the primary bays and lagoons of the lower coast. The change in mangrove species distribution is thought to be driven by water temperature increases that have occurred over the last 30 years. It is not known what impact the changing character of the marine wetlands could have on coastal ecosystems.

6. Indicate whether the Coastal Management Program (CMP) has a mapped inventory of the following habitat types in the coastal zone and the approximate time since it was developed or significantly updated.

| **Habitat Type** | **CMP has mapped inventory** (Y or N) | **Date completed or substantially updated** |
|---|---|---|
| Tidal (Great Lakes) Wetlands | Y | 2004 (current/proposed projects utilize 2008-2009 data) |
| Beach and Dune | N | ongoing study |
| Nearshore | Y | 2004 (current/proposed projects utilize 2008-2009 data) |
| Other (seagrass) | Y | 2009 (TPWD) |

7. Use the table below to report information related coastal restoration and protection. The purpose of this contextual measure is to describe trends in the restoration and protection of coastal habitat conducted by the State using non-CZM funds or non Coastal and Estuarine Land Conservation Program (CELCP) funds. If data is not available to report for this contextual measure, please describe below the actions the CMP is taking to develop a mechanism to collect the requested data.

| **Contextual measure** | **Cumulative acres for 2004-2010** |
|---|---|
| Number of acres created or restored using non-CZM or non-Coastal and Estuarine Land Conservation Program (CELCP) funds | 6,240 |
| Number of acres protected through acquisition or easement using non-CZM or non-CELCP funds | 120 |

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

For each of the wetland management categories below, indicate if the approach is employed by the state of territory and if significant changes have occurred since the last assessment:

| **Management categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Wetland regulatory program implementation, policies, and standards | Y | Y |
| Wetland protection policies and standards | Y | N |
| Wetland assessment methodologies (health, function, extent) | Y | N |
| Wetland restoration or enhancement programs | Y | N |
| Wetland policies related public infrastructure funding | Y | N |
| Wetland mitigation programs and policies | Y | N |
| Wetland creation programs and policies | Y | N |
| Wetland acquisition programs | Y | N |
| Wetland mapping, GIS, and tracking systems | Y | Y |
| Special Area Management Plans | N/A | N/A |
| Wetland research and monitoring | Y | N |
| Wetland education and outreach | Y | N |
| Environmental Flows | Y | Y |

1. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
    c. Characterize the outcomes and effectiveness of the changes.

*Wetland regulatory program implementation, policies, and standards –environmental flows*

Environmental flows, which include flows in rivers and streams and freshwater inflows to bays and estuaries, had not previously been addressed in water development project planning and permitting in Texas. Senate Bill 3 (SB3), passed by the Texas Legislature in 2007, set out a new regulatory approach to protect such flows through the use of environmental flow standards developed through Texas Commission on Environmental Quality (TCEQ) rulemaking. Senate Bill 3 directed the use of an environmental flow regime in developing flow standards and defined an environmental flow regime as a schedule of flow quantities that reflects seasonal and yearly

fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats. This new state law was not driven by 309 or other CZM policies or regulations. The new law was driven by a desire of Texans to protect rivers and estuaries in the face of increasing demands for water for human uses.

The SB3 process is not yet complete. The process is composed of five steps: 1) stakeholder and science teams were appointed and began work, 2) science team make flow recommendations to stakeholders, 3) stakeholders makes flow recommendations to TCEQ, 4) TCEQ adopts environmental flow rules for the permitting process, and 5) stakeholders create a work plan for an adaptive management process.

The state was divided into three river basin and bay system tiers: 1) the Trinity and San Jacinto Rivers and Galveston Bay, the Sabine and Neches Rivers and Sabine Lake Bay; 2) the Colorado and Lavaca Rivers and Matagorda and Lavaca Bays, and the Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays; and 3) the Nueces River and Corpus Christi and Baffin Bays, the Rio Grande, the Rio Grande estuary, and the Lower Laguna Madre, and the Brazos River. As of January 2011, the tier 1 systems are in the fourth step of the process, the tier 2 systems are in first step of the process, and the tier 3 systems begin the process in Fall 2011. It is anticipated that SB will improve the quality of habitats influenced by environmental flows.

*Wetland mapping, GIS, and tracking systems*

Wetland mapping, GIS, and tracking systems have been significantly augmented since 2006 by the completion of the last four projects by the BEG to study the status and trends of wetlands and aquatic habitats along the Texas coast. As a whole, this 309 driven project provides insight into spatial and temporal changes among these habitats.

The status and trends of wetlands and aquatic habitats along the Texas coast studies are useful in developing priorities for acquisition of threatened areas/resources for the Texas Coastal and Estuarine Conservation Plan (CELCP). Under Section 501.14(h), the policy for development in critical areas, these studies show current locations of coastal wetlands which are also critical areas in the CMP. This helps guide development on the coast, as developers seek to mitigate adverse impacts to coastal wetlands. Also related to Section 501.14(h), the reports serve in accounting for how the policy is achieving the goal of no net loss of critical functions and values by identifying and quantifying critical areas and estimating functions and values of each based upon known values. The status and trends identified from these studies also provides justification of funding for CIAP, USFWS National Coastal Wetland Conservation Program, CEPRA, etc.

2. Indicate whether the CMP has a habitat restoration plan for the following coastal habitats and the approximate time since the plan was developed or significantly updated.

| **Habitat Type** | **CMP has a restoration plan** (Y or N) | **Date completed or substantially updated** |
|---|---|---|
| Tidal Wetlands | N | |
| Beach and Dune | N | |
| Nearshore | N | |
| Seagrass | Y | 1999 (TPWD) |

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the Coastal Management Program and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Select type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority (H,M,L)** |
|---|---|---|
| Mitigation tracking and enforcement | regulatory, data, capacity | H |
| Freshwater inflow standards – Indicators of biological response to inflow | data | H |
| Public support for Water resources conservation | communication, outreach | H |
| Habitat management plans | regulatory, data communication & outreach | H |
| Identify wetlands considered isolated or non-jurisdictional due to SWANCC | data | H |

*Mitigation Tracking and Enforcement*

One of the main barriers to determining the status and trends of wetland areas is that there is very little (and many cases no) permit monitoring. It is not known if the projects were successful or if they were built to the specification in the permit. Also, the permits themselves seldom contain adequate information to know exactly what habitat type of restoration or mitigation was proposed in the permit. A permit monitoring and project tracking system is highly desired to fill this void. In particular, the no net loss of wetlands program needs to be evaluated.

*Freshwater inflow standards*

The State of Texas now has in place a process to determine environmental flow needs for all State river basins and bays. This process, known as the Senate Bill 3 (SB3) process, is being used to identify instream and inflow standards so that they can be used in surface water permit applications and planning for the future. Freshwater flowing from the watersheds to coastal environments is one of the most important drivers of wetland habitat extent, so the SB3 process is key to conserving and enhancing wetland habitats. Yet, there is very little data available for recommending environmental flow standards based on our scientific understanding of hydroecology. In particular, we need indicators of biological response to inflow, indicators of integrity (diversity), and function (productivity). Because watershed-coastal connections are so important for maintaining the health and productivity of Texas bays, it is very important that this data gap is filled. Each bay and basin region will have an expert science team tasked with recommending environmental need-based flows using the best available science and reasonably available data. In addition, the teams will create a plan for an adaptive management process that includes monitoring and revisiting the flow recommendations for possible revisions. The work of

the science teams will identify both shortcomings of data and the need for more data to be used in water resource planning. For more information on the SB3 process refer to the section on Cumulative and Secondary Impacts.

*Water resources*

Across the State of Texas there is a strong climatic gradient from the wetter east to the dryer west. Consequently the western part of the State is short of water or will be in the future when populations increase. A sustainable water supply is likely the one limiting factor for municipal, agricultural and industrial growth in the State. While these three sectors have always driven water development needs, we now know that Texas will need substantial amounts of water for two other sectors: energy production and the environment. As mentioned above, the State Legislature has codified the need to include environmental flows in surface water planning and permitting, yet the general public is not aware of the importance for environmental flows or the current stress upon our existing water systems. With climate change and population growth, demands will be much higher in the future. There is a huge need for outreach to educate the public on water conservation issues.

*Habitat management plans*

There is a need for strategies to be developed that could be used to implement wetland enhancement and restoration. This is especially true because the definition of these critical habitats is under constant legal flux. In 2001, the U.S. Supreme Court decision in Solid Waste Agency of Northern Cook County (SWANCC) v. the Army Corps of Engineers eliminated Clean Water Act (CWA) jurisdiction over isolated waters that are intrastate and non-navigable, where the sole basis for asserting CWA jurisdiction is the actual or potential uses of the waters as habitat for migratory birds that cross state lines in migration. Thus, identifying wetlands on the Texas coast that are "non-jurisdictional" or "isolated" is an important data gap. This will allow for comprehensive planning to include management, protection, restoration, and enhancement found in other management plans (e.g. Texas seagrass habitat management plan)

There are beach and dune setback requirements on a county-by-county basis, but there are no State-wide beach or dune restoration plans per se. Galveston has put much effort into beach restoration because of the dual threats of storm erosion and subsidence. Galveston's efforts have been aided by other federal and state programs such as CIAP. The development of a framework for statewide beach/dune restoration plan would facilitate comprehensive management.

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

| | |
|---|---|
| **High** | __X__ |
| **Medium** | _____ |
| **Low** | _____ |

The wetland enhancement area has a high priority because wetlands are key to maintaining healthy and sustainable natural living resources in the CZ. Wetlands are a great risk

for many reasons including climate change, sea level rise, water resource development, and coastal development. The development of environmental flow standards through the SB3 process will be critical to conservation and enhancement. Due to the ever changing federal definition of wetlands, the State should make its own determination as to what wetlands are. Along with this, effective wetlands mitigation tracking and enforcement will aide in clearly assessing status and trends of the wetlands environment. It is vital that we have a greater understanding of the science and develop a strategy to fill data gaps for wetland conservation.

2. Will the CMP develop one or more strategies for this enhancement area?

**Yes** __X__
**No** _____

# *Coastal Hazards*

**Section 309 Programmatic Objectives**

Prevent or significantly reduce threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level change.

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Characterize the level of risk in the coastal zone from the following coastal hazards:

   (Risk is defined as: "the estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." (FEMA 2001)

| **Type of Hazard** | **General level of risk** (H,M,L) | **Geographic Scope of Risk** |
|---|---|---|
| Flooding | H | Coast-wide |
| Storm surge | H | Coast-wide |
| Geological hazards (including Earthquakes, tsunamis) | L | Coast-wide |
| Shoreline erosion (including bluff and dune erosion) | M-H | Locally Dependant |
| Sea level rise | H | Coast-wide |
| Great Lake level change and other climate change impacts | NA | NA |
| Land subsidence | M | Coast-wide |
| Climate change impacts | M-H | Locally Dependant |
| Tropical Storm | H | Coast-wide |

2. For hazards identified as a high level of risk, please explain why it is considered a high level risk. For example, has a risk assessment been conducted, either through the State or Territory Hazard Mitigation Plan or elsewhere?

Risk assessment was based primarily on the State of Texas Coastal Management Plan (2004), as well as the following mitigation plans: City of Houston Local Hazard Mitigation Plan (2006), Coastal Bend Mitigation Action Plan (2006), Guadalupe Blanco River Authority (2005), Harris County Mitigation Strategy, Houston-Galveston Area Council regional Hazard Mitigation Plan, Jackson County Hazard Mitigation Action Plan (2004-2009), South East Texas Regional Planning Commission Regional Hazard Mitigation Action Plan (2005), and the Texas Colorado River Floodplain Coalition Hazard Mitigation Action Plan for the Lower Colorado River Basin (2004-2009). Additional data were derived from the THMP which was developed in 2003 and updated by the Texas Geographic Society with support from FEMA

*Flooding*

Constituting 91% of the disaster damage in the state, floods are and continue to be, one of the most frequent destructive and costly natural hazards facing the State of Texas. On average, Texas experiences 400 floods annually, nearly double the number of the second highest state. Texas' vulnerability to floods is the result of several factors: its Gulf of Mexico coastline, proximity to the Pacific Ocean off of the west coast of Mexico, geographical location near the Rocky Mountains, and the high altitude jet stream. Also contributing is the West Texas "dry line", a shifting atmospheric separation of dry desert air from the moist Gulf air. Coastal flooding is a threat to public safety and natural resources along the Gulf, particularly because elevations along the Texas shoreline are generally lower than 10 feet above sea level. The only exceptions are Pleistocene bluffs around the bay margins and dune areas along the coastal bend and lower coast where elevations may reach 40 feet above mean sea level.

*Coastal Storms and Storm Surge*

Coastal storms present a major threat to people and property along the Texas coast and can have lasting impacts on the natural environment. With over one third of Texas Residents living in the coastal zone, coastal storms, including hurricanes and tropical storms are one of most devastating coastal hazards Texas faces. A wide continental shelf and gently sloping coastal zone makes Texas especially vulnerable to coastal storm damage. Since 1953, Texas has had 21 Presidential emergency declarations due to hurricane and tropical storm events. Most recently, the Texas coast has been impacted by Hurricane *Rita* and Hurricane *Ike*, both of which caused significant damage.

In September 2005, coastal evacuation plans were implemented in response to Hurricane *Rita* (category 3 at landfall). Serious logistical problems and long delays were experienced in direct relationship to the population growth and infrastructure development along the Texas coastal area. While landfall was east of the Houston-Galveston metropolitan area, the impacts of the storm relative to the coastal area evacuations created widespread disruptions throughout eastern Texas.

In September 2008, Hurricane Ike made landfall in the Galveston area as a Category 2 hurricane but had a Category 5 equivalent storm surge. Ike was responsible for extensive damage and many deaths across portions of the Caribbean and along the coasts of Texas and Louisiana. The Property Claim Services of the Insurance Services Office estimates that the insured damage (not including inland flooding or storm surge) from Ike in Texas, Louisiana and Arkansas was $10 billion dollars. The National Flood Insurance Program estimates that insured losses from inland flooding and storm surge were $2.5 billion in the same three states. There is a $250,000 cap on individual flood and storm surge claims, therefore, the $2.5 billion number does not reflect the actual losses. Using these figures, the Tropical Cyclone Report on Hurricane Ike (National Hurricane Center, 23 January 2009) estimates actual losses to be $24.9 billion. These estimates suggest that Ike is the third costliest hurricane to affect the United States.

*Geological Hazards (including tsunamis, earthquakes)*

Texas is at low risk for experiencing geologic hazards such as earthquakes or tsunamis. While Texas does face some earthquake hazard, this hazard is very small in comparison to that in many other states. In most parts of Texas earthquake hazard is also small compared to the hazard attributable from other natural phenomena, such as hurricanes, tornadoes, and floods.

*Shoreline Erosion (including bluff and dune erosion)*

Erosion is a serious hazard on the Texas coast. Many homes, highways, and commercial establishments along the coast are threatened by continual shoreline retreat. In Texas, coastal erosion is defined in Sec. 33.601, Natural Resources Code, which states: "Coastal erosion means the loss of land, marshes, wetlands, beaches, or other coastal features within the CZ because of the actions of wind, waves, tides, storm surges, subsidence, or other forces."

Several processes contribute to long-term (chronic) or short-term (storm-induced) shoreline erosion. These processes include climate, tides, relative sea level change, coastal storms, and the amount and rate of sediment dispersal. Coastal erosion affects both Gulf and bay shorelines, resulting in the loss of agricultural, industrial, and residential land and wetlands. Erosion is attributable to sea level rise and to the fact that sediment removal by wave energy exceeds that supplied to the beach. Approximately 66% of Texas bay shores are eroding at rates of two to nine feet per year. Approximately 62% of the Gulf facing shoreline is retreating at rates of two to ten feet per year with some areas having retreat rates greater than ten feet per year.

*Sea level rise and Land subsidence*

Coastal recession is directly related to relative sea level rise, which is the combined effect of global sea level rise and land subsidence. Due to a wide and flat coastal plain in Texas, any rise in sea level can result in significant impacts. Land subsidence is a significant contributor to relative sea level rise and causes shoreline retreat, loss of wetland habitat, and erosion. In some areas of Texas, groundwater pumping, oil and gas extraction and sediment consolidation have led to subsidence. Tide gauge data analyzed by NOAA shows that rates of relative sea level rise range from 1 to 2.24 ft per 100 years in Texas. Furthermore, dikes, dams, levees, and seawalls have altered the natural landscape in many places, sometimes affecting wetlands and beaches by diverting water and sediments from their natural course.

3. If the level of risk or state of knowledge of risk for any of these hazards has changed since the last assessment, please explain.

Levels of risk have not changed since the last assessment.

4. Identify any ongoing or planned efforts to develop quantitative measures of risk for these hazards.

Beginning in 2008, the CBBEP, in partnership with HRI, initiated a new strategy to develop a geohazards map of North Padre and Mustang Islands. The map will consider the spatial and temporal patterns of geological processes, geomorphology, and geoenvironments (e.g. wetlands and dunes) that contribute to create potentially hazardous conditions. The map will also incorporate model projections demonstrating how the island will change over the next 60 years.

In 2007, Texas A&M University's HRRC began to evaluate a myriad of issues related to coastal vulnerability to natural hazards in Texas including: local, state, and federal resources available for mitigation, preparedness, response, and recovery and their application to the CMP; regulatory regime and effectiveness of construction codes and land use planning policies; best practices and emerging technologies related to building code and land use planning; physical and

social vulnerabilities of coastal populations; adoption of hazard mitigation technologies; and applicability of the State of Texas Mitigation Plan (October 2004) to the CMP.

In 2007, Texas A&M University at Galveston received CMP funding to continue the functioning, growth, and expansion of the Texas Coastal Erosion Data Network and the Texas Oyster Reef Resource Network.

In 2008, TAMU began the parameterization of hurricane surge for the State of Texas coastline. By simulating storm surges hitting a representative portion of the Texas coast, Texas Engineering Experiment Station will provide an improved understanding of hurricane surge generation along the Texas coast, a simplified method for estimating surge as a function of hurricane size, strength, and geographic location where it comes ashore, and an assessment of the value of coastal natural resources in protecting against storm surges.

In 2010, the University of Texas BEG and the Harte Research Institute at Texas A&M University – Corpus Christi will begin determining the most recent long-term rates of shoreline change along the Gulf of Mexico shoreline of Texas by comparing previously determined past shoreline positions with positions interpreted from the most recent suitable aerial photographs available at the time the study. New shoreline position and change-rate data will be integrated into the GIS-based server for ready access by individuals and agencies, and a report summarizing most recent shoreline changes and possible causes of trends and changes in trends will be published to increase the value of the data to the general, regulatory, and scientific community.

In 2009, researchers at HRI began developing a geohazards map of South Padre Island. The map will delineate critical environments and features (e.g. wetlands, dunes, and washover channels) that protect against and/or are vulnerable to certain geological processes or geohazards, such as hurricanes and sea level rise. The map will also project where these critical environments and features are likely to be in 60 years, as sea level rise and shoreline retreat continue. The goal of this project is to allow for more effective planning and increase public awareness of the natural processes acting on the island.

5. Use the table below to identify the number of communities in the coastal zone (CZ) that have a mapped inventory of areas affected by the following coastal hazards. If data is not available to report for this contextual measure, please describe below actions the CMP is taking to develop a mechanism to collect the requested data.

| Type of Hazard | Number of Communities that have a mapped inventory | Date completed or substantially updated |
|---|---|---|
| Flooding | 51 | Refer to appendix B |
| Storm surge | 31 | Refer to appendix B |
| Geological hazards (including Earthquakes, tsunamis) | 19 | Refer to appendix B |
| Shoreline erosion (including bluff and dune erosion) | 17 | Refer to appendix B |
| Sea level rise | 5 | Refer to appendix B |
| Land subsidence | 10 | Refer to appendix B |
| Tropical Storm | 19 | Refer to appendix B |

To obtain information about coastal community mapped hazards inventories, two methods were employed, 1) a brief survey was developed and administered via the web to coastal communities and 2) communities were contacted directly and questioned about their mapped inventories for the above hazards. Prior to beginning this process however, a list of coastal communities was defined using definitions provided by both the GLO and NOAA. In all 63 communities within the CZ were solicited in reference to their mapped inventories for the above hazards. It should be noted that the above numbers do not necessarily provide a complete picture of a community's mapped inventory. The presence of a mapped inventory in a community does not imply that a community has an integrated management approach to coastal hazards. A complete list of these communities as well as their individual responses can be found in Appendix B.

**Management Characterization**

1. For each of the management categories below, indicate if the approach is employed by the state and if significant changes have occurred since the last assessment:

| **Management categories** | **Employed by state** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Building setbacks/restrictions | Y | Y |
| Methodologies for determining setbacks | Y | Y |
| Repair/rebuilding restrictions | Y | Y |
| Restriction of hard shoreline protection structures | Y | Y |
| Promotion of alternative shoreline stabilization methodologies | Y | Y |
| Renovation of shoreline protection structures | Y | N |
| Beach/dune protection (other than setbacks) | Y | Y |
| Permit compliance | Y | Y |
| Sediment management plans | Y | Y |
| Repetitive flood loss policies (e.g., relocation, buyouts) | Y | N |
| Local hazards mitigation planning | Y | Y |
| Local post-disaster redevelopment plans | Y | N |
| Real estate sales disclosure requirements | Y | Y |
| Restrictions on publicly funded infrastructure | Y | N |
| Climate change planning and adaptation | Y | N |
| Special Area Management Plans | N (Prohibited) | N (Prohibited) |
| Hazards research and monitoring | Y | Y |
| Hazards education and outreach | Y | Y |
| Mapping/GIS/tracking of hazard areas | Y | N |

2. For management, categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
    c. Characterize the outcomes and effectiveness of the changes

*Carol Severance v. Jerry Patterson, et al.*

The decision by the Texas Supreme Court in the *Severance v. Patterson* case has the potential to impact building setbacks/restrictions, methodologies for determining setbacks, repair/rebuilding restrictions, and restriction of hard shoreline protection structures. For more information, refer to the text in Public Access Resource Characterization, Question 2.

*Building setbacks/restrictions*

The 80th Legislature enacted House Bill (HB) 2819 (Act 2007, 80th Leg., Ch. 1256, eff. Sept. 1, 2007) which amended 61.011(d)(8) and 61.020(b) of the Open Beaches Act to authorize the Commissioner to establish rules for determining the line of vegetation (LOV) or natural LOV, and to provide that the Commissioner's determination of the LOV constitutes legally sufficient evidence of the landward boundary of the area subject to the public easement until a court adjunction establishes the line in another place. The amendments to 15.3(b) include procedures for insuring that identification of the LOV submitted by local governments and applications for beach construction certificates are verified by GLO in a manner consistent with the statutory requirements provided in section 61.016 and section 61.017 of the Open Beaches Act. These procedures will also require individuals seeking a LOV determination for the purpose of evaluating the suitability of a property for purchase or construction to submit LOV determination requests to the local government for review prior to submission to the GLO. Local government involvement in a preliminary determination is desirable because they have knowledge of local conditions. However, the preliminary determination by the local government must be submitted to the GLO for review and approval. A preliminary determination by the local government is unnecessary if the Commissioner has issued a temporary standard for demarcation of the landward boundary of the public beach as part of a disaster recovery order under section 15.13 of HB 2819. This is a CZM (306) driven change. It is important to note that setbacks only apply to gulf beaches. There are no setbacks restrictions along navigation channels.

The GLO adopted an amendment to section 15.3(f) of the Texas Natural Resources Code, Chapter 63, which ensures that a local government establishment or alteration of dune protection lines includes protection of critical dune areas from erosion caused by natural forces and development by placing it sufficiently landward to allow establishment and implementation of an erosion response plan that may include a building setback line. This is a CZM (306) driven change.

*Methodologies for determining setbacks*

Refer to the "Building setbacks/restrictions" section above for more information.

*Repair/rebuilding restrictions*

The GLO adopted an amendment to section 15.6 of the Texas Natural Resources Code, Chapter 63, which adds a new subsection allowing all local jurisdictions to permit the use of fibercrete in 4 foot by 4 foot sections, 4 inches thick separated by expansion joints beneath the footprint of a habitable structure located within 25 feet from the landward toe of the foredunes. In areas where dunes have been obliterated by storms or other causes, an alternative determining factor is needed to decide where fibercrete may be used. Where there are areas with no dunes, the amendment allows the use of fibercrete landward of 100 feet from the LOV or landward of an eroding area boundary established in the local dune protection and beach access plan, whichever distance is greater. This provision applies in jurisdictions whether or not a fibercrete variance has been adopted. This is a CZM (306) driven change.

*Promotion of alternative shoreline stabilization methodologies*

The GLO adopted an amendment to section 15.3(f) of the Texas Natural Resources Code, Chapter 63, which ensures that a local government establishment or alternation of dune protection lines includes protection of critical dune areas from erosion caused by natural forces and development by placing it sufficiently landward to allow establishment and implementation of an erosion response plan that may include a building setback line. This is a CZM driven change.

*Beach/dune protection (other than setbacks)*

Section 61.018(c) of the Open Beaches Act and section 63.181(b) of the Dune Protection Act of HB 2819 were amended to increase maximum civil penalties from $1,000 per day per violation to $2,000 per day per violation. The amendments also added the assessment of civil penalties for remedial orders for the removal of structures of the public beach under section 61.0183 of the Open Beaches Act and remedial orders for dune restoration under section 63.091 Dune Protection Act. This is a CZM (306) driven change.

*Permit compliance*

Section 63.121(b) (2) of the Dune Protection Act was amended to require certification by the Commissioner of local government procedures and requirements governing the review and approval of dune protection permits. Prior to amendment by HB 2819, the Open Beaches Act and the Dune Protection Act limited the GLO to a review period of ten working days for beachfront construction certificates and dune protection permits for both large- and small- scale construction. HB 2819 amended section 61.015(c) of the Open Beaches Act and section 63.056(a) of the Dune Protection Act to require the commissioner's court or governing body of a municipality to send the Commissioner notice of the hearing and a copy of the certificate or permit application for large-scale construction for review and comment not less than 30 working days before the date of the public hearing. Section 15.3(s) is amended to incorporate the new 30 working day comment period by the GLO for beachfront construction certificates and dune protection permits applicable to large-scale construction. This is a CZM (306) driven change.

*Sediment management plans*

Section 63.181(b) was amended and section 63.1813 was added to the Dune Protection Act by amending to authorize the Commissioner to order restoration of damage, destruction, or removal of a sand dune or a portion of a sand dune or the killing, destruction, or removal of vegetation growing on a sand dune seaward of the dune protection line in violation of the Dune Protection Act, or any rule, permit, or order issued there under. This is a CZM (306) driven change.

*Local hazards mitigation planning*

Texas Natural Resource Code section 33.607 as amended by the HB 2819 and HB 2073 (Acts 2009, 81st Leg., ch14, section 2 effective Sept. 1, 2009) authorizes local governments subject to Chapters 61 and 63 to establish and implement a plan for reducing public expenditures for erosion and storm damage losses to public and private property that may include the establishment and implementation of a building setback line at the discretion of the local government. Section 33.607(f) (3) provides that the building set-back line be established no further landward than the dune protection line established under the Texas Natural Resource Code, Chapter 63. This is a CZM (306) driven change.

*Local post-disaster redevelopment plans*

Refer to the "Building setbacks/restrictions" section above for more information.

*Real estate sales disclosure requirements*

Section 61.011(d) (10) of the Open Beaches Act and section 2210.004 of the Texas Insurance Code were amended under HB 2819 in 2009 to authorize the Commissioner to establish rules for determining whether a structure is ineligible for coverage under the state-subsidized Texas Windstorm Insurance Program because of its location on the public beach. HB 2819 also added new section 61.0184 to the Open Beaches Act, which provides requirements for notice to affected property owners, an opportunity for hearing, and notification to the Texas Windstorm Insurance Association concerning the status of the property. This is a CZM (306) driven change.

*Hazards research and monitoring*

HB 2819 added new section 61.0183 and 61.0184 to the Open Beaches Act to authorize the Commissioner to remove certain structures, improvement, obstructions, barriers, and hazards on the public beach when such structures present a public health and safety hazard or are placed on the beach in a manner inconsistent with the local governments beach access and use plan. This is a CZM (306) driven change.

*Hazards education and outreach*

In 2007, SB1436 transferred the responsibility for the National Flood Insurance Program (NFIP) from the Texas Commission on Environmental Quality to the Texas Water Development Board. The Texas Water Development Board (TWDB). The NFIP coordinator acts as the liaison between the federal component of the program and the local communities, with the primary duty

to provide guidance and education to the communities to assist in meeting the federal eligibility requirements for entrance into the NFIP, and also assist the communities with maintaining their participating status in the NFIP. In addition to coordinating the NFIP in Texas, the TWDB also provides funding assistance in the form of grants and loans for flood mitigation planning, as well as flood control projects. The program is state funded outside of the CZM.

3. Use the appropriate table below to report the number of communities in the coastal zone that use setbacks, buffers, or land use policies to direct development away from areas vulnerable to coastal hazards. If data is not available to report for this contextual measure, please describe below the actions the CMP is taking to develop a mechanism to collect the requested data.

| **Contextual measure** | **Number of communities** |
|---|---|
| Number of communities in the coastal zone required by state law or policy to implement setbacks, buffers, or other land use policies to direct develop away from hazardous areas. | 25 |
| Number of communities in the coastal zone that have setback, buffer, or other land use policies to direct develop away from hazardous areas that are more stringent than state mandated standards or that have policies where no state standards exist. | 1 |

In all, 25 communities have setback, buffer, or other land use policies to direct develop away from hazardous areas. Data for these communities was obtained through the GLO at http://www.glo.state.tx.us/OC/Beach_Access/plans.html. Also several administrative codes (Texas Administrative Code, Title 31 Chapter 15) and Texas legislative bills (House Bill No. 2819, Acts 2007, 80th Leg., R.S., Ch. 1256, Sec. 11) were used to compile information. In addition to communities that were required by state law to implement setbacks, buffers, or other land use policies to direct develop away from hazardous areas, there was one community that had setback, buffer, or other land use policies to direct develop away from hazardous areas that were more stringent than state mandated standards. This community was Nueces County. For a complete list of community data please refer to Appendix C.

## Priority Needs and Information Gaps

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Adjustment in regulatory powers to affect hazard mitigation | regulatory | H |
| Staff shortfalls | fiscal, capacity | H |

| | | |
|---|---|---|
| Input from citizens | communication and outreach | H |
| Public education about hazards | communication and outreach | H |
| Geospatial data in coastal areas | data, fiscal | M |
| State wide sea level rise assessment | data | H |
| Integrated coastal hazards information on vulnerability, impacts, and inundation | data | H |
| Tiered coastal hazards training for local communities (decision makers, staff, and public) | communications and outreach and training capacity | M |
| Storm surge information | data | M |

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

**High** _X__
**Medium** _____
**Low** _____

The Coastal Hazards enhancement area has a high priority because of the ongoing population increase and development in a coastal zone that is eroding, subsiding, and impacted by hurricanes. Currently, coastal communities do not have the authority or use their existing authority to plan for development or redevelopment following storms in a way to lessen impacts from the next storm or ongoing sea-level rise and erosion. Nor do coastal communities have the expertise or required staff to manage growth or develop plans that lead to more resilient communities. Increasing community resilience begins with educating the public regarding the character of the risks and how to lessen those risks. One must also gather and organize the information, wisdom, and priorities from the citizenry to combine with data and model results on hazards. Then plans and implementation strategies may be developed that will increase resiliency. After plans are formed, different levels of training appropriate for the public, decision makers, and staff facilitate implementation. This integrated approach to mitigating coastal hazards is much needed along the Texas coast. It requires addressing the regulatory, fiscal, data, and communications needs listed in the table above.

2. Will the CMP develop one or more strategies for this enhancement area?

**Yes** _X__
**No** _____

# *Public Access*

**Section 309 Enhancement Objective**

Attain increased opportunities for public access, taking into account current and future public access needs, to coastal areas of recreational, historical, aesthetic, ecological, or cultural value

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Characterize threats and conflicts to creating and maintaining public access in the coastal zone:

| **Type of threat or conflict causing loss of access** | **Degree of threat** (H,M,L) | **Describe trends or provide other statistics to characterize the threat and impact on access** | **Type(s) of access affected** |
|---|---|---|---|
| Private residential development (including conversion of public facilities to private) | H | Efforts have been made by private industry to turn public shoreline into private use only by conversion of public lands to private by purchase. Examples of this are beach condominiums built in Galveston | Beach/shoreline access sites, recreational boat access sites, fishing access points |
| Non-water dependent commercial/industrial uses of the waterfront (existing or conversion) | L | Efforts from non-water dependent commercial/industrial uses affects public access in major metropolitan areas | Beach/shoreline access sites, recreational boat access sites, fishing access points |
| Erosion | H | Erosion of public land is occurring due to sea level rise, lack of sedimentation, and natural disasters | Beach/shoreline access sites, recreational boat access sites, fishing access points, state/county/local parks |
| Sea level rise/ Great Lake level change | H | Sea level is expected to rise approximately 1.9 to 6.8 mm/yr | Beach/shoreline access sites, recreational boat access sites, fishing access points, state/county/local parks |

| Type of threat or conflict causing loss of access | Degree of threat (H,M,L) | Describe trends or provide other statistics to characterize the threat and impact on access | Type(s) of access affected |
|---|---|---|---|
| Natural disasters | H | Hurricane *Rita* and Hurricane *Ike* caused severe damage to structures and limited public access | Beach/shoreline access sites, recreational boat access sites, fishing access points, state/county/local parks access, structures |
| National security | L | Possible closure to all access sites due to national security issues. | Beach/shoreline access sites, recreational boat access sites, fishing access points, state/county/local parks access, structures |
| Encroachment on public land | M | Occurs due to purchase of public land by private industry | Beach/shoreline access sites, recreational boat access sites, fishing access points, state/county/local parks access, structures |

2. Are there new issues emerging in your state that are starting to affect public access or seem to have the potential to do so in the future?

*Statutory and Common Law Protections of Beach Access*

Public use of State beaches is rooted in a longstanding Texas tradition of using the beaches along barrier islands facing the Gulf of Mexico for transportation, camping, fishing, swimming and other public uses. Prior to 1958, it was unclear whether the state had title to the land between mean high tide (MHT) and the line of vegetation (LOV). In 1958, the Texas Supreme Court in Luttes v. State, ruled that the state did not have title to the land between mean high water and the LOV. The Luttes case did not address the issue of beach access. However, title to the "dry beach" remained in private hands after Luttes. Thus, private landowners whose land was above the mean high tide line could prevent the public from trespassing on their property (Luttes 1958).

In response to Luttes, the Texas Legislature enacted the Open Beaches Act (OBA) in 1959. The Act specifically provides that it shall be the State's public policy that "the public shall have the free and unrestricted right of ingress and egress to the larger area extending from the line of mean low tide to the line of vegetation bordering on the Gulf of Mexico." Any public easement is conditioned upon a showing that the "public has acquired a right of use or easement to or over an area by prescription, dedication, or has retained a right by virtue of continuous right in the public." Additionally, the public's right of access is protected by prohibiting persons from "creat[ing], erect[ing], or construct[ing] any obstruction, barrier, or restraint" that interferes with the public easement. Over the years, courts have ruled that houses or other structures that are located on the public's easement must be removed.

The workability of the OBA has been due, in large, to the "rolling easement" concept. Several Texas courts have upheld the "rolling easement" which provides that the public beach easement "rolls" seaward or landward with natural movements of the shoreline.

In 2009, the State's citizens further strengthened the OBA when 77% of voters approved a referendum that incorporates the most important provisions of the Act into the State Constitution. As a direct consequence of the OBA, a long line of judicial decisions supporting the Act, and the constitutional amendments, the public has free access to the State's most popular beaches.

The long established line of judicial decisions upholding the OBA was called into question on November 10, 2010 by the Texas Supreme Court when it handed down its 6-2 decision in *Severance v. Patterson* (Severance 2010). The Texas Supreme Court found that rolling easements do exist under Texas law but only if the LOV—the landward boundary of the public beach easement moves by erosion. The Court stated that the LOV could not move by a sudden and rapid change known as "avulsion."

The Court decided that no public beach easement existed on West Galveston Island. That decision was based on a interpretation of an 1840 land grant from the Republic of Texas to Jones and Hall.

The decision has caused turmoil along much of the Texas coast and will likely subject the State to years of litigation. For example, a few days after the decision was handed down, the Texas Land Commissioner cancelled a $40 million beach renourishment project on West Galveston Island because state law prohibits the spending of public money to benefit private property (Rice 2010).

The Supreme Court provided no guidance about how to determine when the vegetation line has shifted due to erosion rather than by avulsion. Hurricanes, tropical storms, strong winds, and high tides are a common occurrence along the Gulf of Mexico. Interpreting the difference between erosion and avulsion under Severance will be a difficult task.

The Texas General Land Office has filed a motion asking the Texas Supreme Court to grant rehearing of *Severance* and to modify its ruling. By January, 2011 nearly two dozen amicus briefs have been submitted in favor of this request (Supreme Court of Texas 2011).

*Public Access and Natural Hazards*

Major storms may affect property owners and the location of public access, but they may also affect structures and associated businesses (economic impacts). The Texas City Dike is a levee located in Texas City that projects into the mouth of Galveston Bay (8.0 km). Galveston Bay is the most heavily accessed of Texas bays and activities along the dike contribute significantly to the local and regional economy. The purpose of the levee is to reduce the effects of sediment accumulation along the lower bay, but over time it evolved into much more than physical protection for the bay system. Boat ramps, fishing piers, and bait camps were located along the dike and provided a substantial amount of public access and supporting business for the area. Hurricane *Ike* destroyed the majority of the businesses and boat ramps that stretched the dike and most remained closed in 2010. The situation at Texas City Dike is emblematic of how natural disasters can significantly affect public access and points out the need to prioritize actions and funding to maximize the impact of restoration efforts. All public access areas are not equal and it is important to focus on those areas that serve the greatest numbers of citizens and contribute significantly to economic recovery.

Under cycle 14, FY 2009 the TCMP used $375,447 in 306A grant funding for four projects to assist with the long-term recovery and responsible redevelopment of coastal areas impacted by Hurricane Ike. The projects are: Quintana County Park Beach Access Improvements ($126,000), Brazoria County Dune Restoration ($81,111), Follet's Beach Access Point ($107,000) and Surfside Jetty Park Waterfront Revitalization ($61,336). These four projects are not yet complete.

3. Use the table below to report the percent of the public that feels they have adequate access to the coast for recreation purposes, including the following. If data is not available to report for this contextual measure, please describe below actions the CMP is taking to develop a mechanism to collect the requested data.

| Contextual | Survey data |
|---|---|
| Number of people that responded to a survey on recreational access | 394 |
| Number of people surveyed that responded that public access to the coast for recreation is adequate or better. | Beach Access: 227<br>Boat Ramps: 100<br>Trailer Parking at Public Boat Ramps: 74<br>Marinas: 127<br>Park Access: 203 |
| What type of survey was conducted (i.e. phone, mail, personal interview, etc.)? | Online survey using Survey Monkey |
| What was the geographic coverage of the survey? | All counties along the Texas Coast (Sabine Lake to Port Isabelle) |
| In what year was the survey conducted? | 2009-2010 |

Refer to Appendix D for a detailed summary of the results obtained from the public access survey.

4. Briefly characterize the demand for coastal public access within the coastal zone, and the process for periodically assessing public demand.

Results obtained from the public survey indicated that there is an ongoing demand for improving public access through additional boat ramps, marinas, and trailer parking at boat ramps. Although the survey indicated that beach access and park access ranked above average, there were numerous comments that indicated these areas could use improvements. The comments obtained also supported the idea that the demand for improving public access remains a significant issue for the public. This was the first survey conducted that we are aware of, and will provide a baseline for future assessments. In addition to public comment, TPWD coastal fisheries staff was asked to evaluate boat ramps within eight bay systems (Sabine Lake, Galveston, Matagorda, San Antonio, Aransas, Corpus Christi, Upper Laguna Madre, and Lower Laguna Madre) as part of the low-use creel survey. Staff regularly visit boat ramps and are well qualified to assess condition, use and need. Data obtained from the 2009-2010 low-use survey yielded a total of 245 ramps, with, 28 in Sabine Lake, 76 in Galveston, 37 in Matagorda, 19 in San Antonio, 21 in Aransas, 23 in Corpus Christi, 19 in Upper Laguna Madre, and 22 in the Lower Laguna Madre (there was one more ramp listed in the Lower Laguna Madre but no data were available; therefore, this ramp was omitted from all analysis (Figure 3). The survey conducted consisted of four questions: 1) Is the ramp adequate for the amount of traffic using it; 2) Is there adequate parking available; 3) Are associated structures (i.e. walkways, docks, breakwaters, parking areas, etc.) in adequate condition; and 4) Is the ramp safe to use (i.e. are there potholes, unexpected drop-offs, submerged debris, etc. present)? Data is presented in Appendix E.

5. Please use the table below to provide data on public access availability. If information is not available, provide a qualitative description based on the best available information. If data is not available to report on the contextual measures, please also describe actions the CMP is taking to develop a mechanism to collect the requested data.

| **Types of public access** | **Current number(s)** | **Changes since last assessment** (+/-) | **Cite data source** |
|---|---|---|---|
| **(CM)** Percent of acres open for public access in the coastal zone (report both the total number of acres in the coastal zone and acres open for public access in the coastal zone) | Total acres = 5,043,981 Public accessible acres= 719,781 (14.27%) | Was not included as part of the last assessment | HARC- based on state wide county coverage digitized by TCEQ |
| **(CM)** Miles of shoreline available for public access (report both the total miles of shoreline and miles available for public access) | Total miles = 404 Miles available for public access = 358 | Was not included as part of the last assessment | HARC- Data obtained from the "straight line" distance as measured by Texas GLO |
| Number of State/County/Local parks and number of acres | Number = 108 Number of acres = 284,816 | 0 | HARC |

| | | | |
|---|---|---|---|
| Number of public beach/shoreline access sites | 398 | +105 | GLO – Texas Beach and Bay Access Guide |
| Number of recreational boat (power or non-power) access sites | 249 | +49 | TPWD Low-Use Creel Survey |
| Number of designated scenic vistas or overlook points | Not tracked | Not tracked | GLO |
| Number of State or locally designated perpendicular rights-of-way (i.e. street ends, easements) | Unable to obtain at this time, last assessment reported 63. | N/A | Not able to obtain at this time. |
| Number of fishing access points (i.e. piers, jetties) | 315 | +220 | GLO – Texas Beach and Bay Access Guide |
| Number and miles of coastal trails/boardwalks | Limited information: Number of trails/boardwalks according to the Great Texas Wildlife Trails is 43 | +21 | Great Texas Wildlife Trials |
| Number of dune walkovers | Unable to obtain at this time, last assessment reported 55 but not clear of where that information was obtained. | N/A | This information is not available at this time. |
| Percent of access sites that are ADA compliant access | 37.44% (n=149) | +1% | GLO – Texas Beach and Bay Access Guide |
| Percent and total miles of public beaches with water quality monitoring and public closure notice | 36% & 145 Total miles | +1% | GLO Texas Beach Watch Program |
| Average number of beach mile days closed due to water quality concerns | Not tracked | Not tracked | GLO |

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

1. For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:

| **Management categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Statutory, regulatory, or legal system changes that affect public access | Y | Y |
| Acquisition programs or policies | Y | N |
| Comprehensive access management planning (including GIS data or database) | Y | Y |
| Operation and maintenance programs | Y | N |
| Alternative funding sources or techniques | Y | N |
| Beach water quality monitoring and pollution source identification and remediation | Y | N |
| Public access within waterfront redevelopment programs | Y | N |
| Public access education and outreach | Y | N |

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.
    a. Characterize significant changes since the last assessment;
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
    c. Characterize the outcomes and effectiveness of the changes

*Statutory, regulatory, or legal system changes that affect public access*

Legal protection of public access was enhanced by the successful adoption of Texas Constitutional Proposition 9 passed by the 81st legislature. However, *Severance v. Patterson* has put public access in jeopardy in some beach areas. For more information, refer to the text under the Resource Characterization, Question 2.

Changes to the Coastal Protection and Erosion Response Act (CEPRA), authorized by the 81st legislature, required local governments to use historical erosion data to implement an Erosion Response Plan (ERP) that reduces public expenditures due to erosion or storm damage losses. The GLO formally adopted rules for the implementation of an ERP in August 2010. The proposed rules include provisions to preserve and enhance the public's right of access and use of the public beaches. The local governments should develop a plan to evaluate the public access points and determine which ones need to be improved to protect them from erosion and storm damages. The plan must inventory the funding sources used to construct the access points and establish a procedure to deal with post storm recovery of the public access ways.

*Comprehensive access management planning (including GIS data or database)*

The Saving Our Coastal Heritage Texas Rural County Demonstration Project used GIS mapping to identify high priority areas for public access and many other identified priorities for rural Chambers County. For more information refer to management characterization in the Cumulative and Secondary Impacts Section. This is a CZM driven effort. It will result in protection of critical coastal habitats and increased public access. This project can be used as a template to expand identification of priority rural areas for a CMSP effort.

3. Indicate if your state or territory has a printed public access guide or website. How current is the publication and/or how frequently is the website updated? Please list any regional or statewide public access guides or websites.

Texas GLO produces the Texas Beach and Bay Access Guide. This book provides information on fishing, swimming, wildlife viewing, picnicking, camping, windsurfing, boat ramp, boat dock, pier, restroom, shower, electricity/lighting, fresh water, concession, entrance/parking fees, gulf access, and Bay/River/Lake Access for all public access points within the coastal counties. Two editions have been published. The GLO is currently compiling a third edition. Additionally, the Surfrider Foundation has a website (http://www.surfrider.org) that provides the public with information pertaining to public access such as ratings for beach access, water quality, beach erosion, erosion response, beach fill, shoreline structures, beach ecology, and surfing areas. The website is updated as new information is made available.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Information on non-vehicular access for private* and public access | Data | M |

| | | |
|---|---|---|
| Number of dune walkovers present | Data | M |
| Regulations on determining the loss of public access of public facilities (i.e. dikes, boat ramps, walk overs) due to natural disasters | Data | H |
| Information on the effects of sea level rise on public access | Data | H |
| Increase education, outreach and communication on information on location and status of public access sites (i.e. fishing sites, boat ramps, beach access) | Communication and Outreach | H |
| Policy analysis of potential impacts to public beach access as a result of the *Severance* decision | Policy | H |

Private access, especially boat launches but also fishing piers and beach access points are important ways that people can access both coastal waters (primarily inshore waters) and beaches. Because there is a great deal of pressure on public facilities in Texas, private access that is open to the public (usually for a fee), reduces that pressure. That means less conflict on existing facilities which reduces maintenance costs. Reduced pressure also means increased longevity of public access, especially boat ramps. Finally, the more private access sites available reduces the overall need for public access sites and allows public entities to better prioritize where to locate new access sites.

Coastal development has accelerated since the last assessment, even though the rate of acceleration has varied with economic conditions. Many private access sites, especially, boat ramps, are in prime locations for development. Private owners are making economic decisions to sell these valuable assets and access is being lost. The rate of that loss, where it is occurring and relative location to public access is important in future siting of public access.

The GLO maintains an encompassing website detailing beach access along the Texas coast, as do a number of coastal cities like Corpus Christi. An expanded effort between local communities and the GLO would greatly benefit the public. As more users gravitate to the coast, access to bays and the Laguna Madre for fishing and launching boats is growing. Additional information sources would be useful in informing the public and reducing crowding at well known and popular access sites.

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

   **High** __X_
   **Medium** _____
   **Low** _____

   Briefly explain the level of priority given for this enhancement area.

Public Access to coastal resources is an important concern for all residents of Texas. Coastal areas are experiencing high population growth impacting recreational purposes residential uses. These areas are extremely important both economically and ecologically. Thus, maintaining adequate public access is an important issue for all governmental (at the county, city, and state levels) agencies. In order to keep pace with population growth and the continually expanding coastal tourism industry, the coastal region must update and maintain shoreline access infrastructure to address the public's continuing need for additional access. Studies as early as 1999 have noted that public access is an important issue for coastal economies. This will become more evident as populations grow and tourism increases in the coastal zone. However, population growth along coastal margins continues to erode public access options. Informal discussions with directors of city tourism organizations have reinforced that concern – the need for adequate and accessible public beaches. Besides just population growth, public access is highly affected by natural disasters. The entire Gulf of Mexico area is susceptible to hurricanes and high energy storms that have substantial impacts on structures and areas of public access (i.e., closure of the Texas City Dike due to Hurricane *Ike*). The high priority ranking is due to the present and future threats to public access and its potential impact on coastal economies.

2. Will the CMP develop one or more strategies for this enhancement area?

   **Yes** __X_
   **No** _____

# *Marine Debris*

**Section 309 Enhancement Objective**

Reducing marine debris entering the Nation's coastal and ocean environment by managing uses and activities that contribute to the entry of such debris

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. In the table below, characterize the significance of marine/Great Lakes debris and its impact on the coastal zone.

The information below comes from multiple sources, but is primarily from the annual beach clean-up reports published by the Ocean Conservancy in Washington, D.C. and their recent five year (2001-2006) study entitled "National Marine Debris Monitoring Program" (NMDMP) (Sheavly 2007). Texas has a wealth of other programs involved in monitoring, clean-up, or sometimes both and they are described in other sections below.

In addition to the State information available, NOAA now operates a weekly marine debris newsletter entitled Marine Debris Weekly Report (www.marinedebris.noaa.gov).

| **Source of marine debris** | **Extent of source** (H,M,L) | **Type of impact** (aesthetic, resource damage, user conflicts, other) | **Significant changes since last assessment** (Y or N) |
|---|---|---|---|
| Land Based – Beach/Shore Litter | H | aesthetic, resource damage, tourism, economic conditions, human health | N |
| Land Based – Dumping | Refer to question 2 | - | - |
| Land Based – Storm Drains and Runoff | Refer to question 2 | - | - |
| Land Based – Fishing Related (e.g. fishing line, gear) | L | aesthetic, resource damage | N |
| Ocean Based – Fishing (Derelict Fishing Gear) (crab traps) | L(M) | aesthetic, resource damage, user conflicts | N |
| Ocean Based – Derelict Vessels | M | aesthetic, resource damage | Y |
| Ocean Based – Vessel Based (cruise ship, cargo ship, general vessel) | Refer to question 2 | - | - |
| Hurricane/Storm (upper TX coast) | H | all impacts | Y |

2. If information is not available to fill in the above table, provide a qualitative description of information requested based on the best available information.

There is no quantitative "Land Based Dumping" data or information available. Although illegal dumping of old furniture and appliances in rural areas outside of urban areas is a widely known problem, its impact on the bays is not suspected to be significant. However, placement of garbage dumps along or near river drainages in Mexico and other Latin American countries is widespread and causes considerable trash on Texas beaches when floods wash it to the sea and prevailing ocean currents carry it to Texas. Impacts are the same as "Land Based - Beach/Shore Litter" and there has been no change.

Likewise, there is no quantitative "Land Based-Storm Drain and Runoff" data and information, but it is a significant problem in coastal urban areas where large amounts of land based debris is washed into bays after significant rainfall events. Impacts are the same as above and there has been no apparent change. However, EPA has delegated permitting authority to TCEQ who issues municipalities individual permits that require cities to employ Best Management Practices, monitor runoff, and establish mitigation measures to reduce debris such as trash rakes, street sweeping, channel maintenance, inlet and lateral line cleaning, etc . Further research should be conducted to engineer more effective stormwater debris catchments.

The only quantitative data for "Land Based - Fishing Related" gear are estimates from collection stations for the monofilament recovery and recycling program. Since 2006 the program has collected an estimated 440 lbs of monofilament fishing line. Additionally, some coastal communities (e.g. Port Aransas) engage recreational volunteer divers each year to clean Gulf coast jetties, and significant amounts of fishing line and weights are recovered.

The only quantitative data available for "Ocean Based - Fishing (Derelict Fishing Gear)" is for crab traps. TPWD has administered a coast wide crab trap removal program each year since 2002. After initial large numbers of traps being removed in early years, most bays yield much smaller numbers each year now, except for Galveston Bay (446 in 2009) and San Antonio Bay (1048 in 2009). These numbers are considered low in extent, except for the two above bays which would be medium (A. Morris, personal communication, December 7, 2009).

"Ocean Based - Vessel Based" quantitative data and information is lacking as an overall category, but some information is quantitatively available for rope, which has remained constant in amount in recent years and causes aesthetic and resource damage (entanglement) impacts. In addition, the Ocean Conservancy NMDMP lists fishing line and rope as the top 2 of 14 indexed items in ocean-based sources for the northern Gulf of Mexico (Rio Grande to Florida Keys; Texas not separated out).

Lastly, there has been considerable work, clean-up, and funding for the removal of debris and derelict vessels related to Hurricanes in the reporting period. GLO, TPWD, and TxDOT all assisted in debris removal and vessel removal after Hurricanes *Rita* (2005) and *Ike* (2008) on the upper Texas coast. This included GLO removing over 28,000 cubic yards of marine debris in Galveston Bay, East Bay, West Bay, Trinity Bay and Sabine Lake as a result of Hurricane *Ike*. PINS also held a significant clean-up of *Ike* debris during this period. These hurricane debris data would be low or moderate when considered coast wide, but high if considered locally or regionally.

3. Provide a brief description of any significant changes in the above sources or emerging issues.

Regarding trends of the top ten debris items listed by the Ocean Conservancy using Texas data from 2005-2009 Adopt-A-Beach (AAB) clean-ups, four (cups/plates/utensils, glass beverage bottles, straws/stirrers, and caps/lids) have remained fairly stable, two items (food wrappers/containers and rope) are decreasing, one item (beverage cans) is increasing. Bags and plastic beverage bottles increased from 2005-2007, but decreased back to 2005 levels by 2009. Cigarettes and filters decreased sharply during 2008 and 2009, but have since increased to the highest values noted throughout the 2005-2009 period. AAB holds three annual cleanups, and special cleanups are held almost weekly at various locations along the coast. In addition, 65 groups in the Beach Guardian program have adopted more than 65 miles of coastline from Beaumont to the Rio Grande Valley.

Regarding hurricanes, enormous amounts of funding and man-hours were expended in post-hurricane cleanup. The Hurricane *Rita*, and some Hurricane *Katrina*, effort was in 2005 in the Sabine-Beaumont-Port Arthur area. During 2008 and 2009, post-Hurricane *Ike* focused in the Galveston-Bolivar Peninsula area, but it caused impacts and debris coast wide. Many state and federal agencies were included in these efforts, most focusing on their mission-oriented agency area of focus.

The Derelict Vessel and Structure Removal Program was authorized by the Texas Legislature with HB 2096 in 2005, and more recently, was enhanced by HB 3306 passed in 2009, and continues to facilitate derelict vessel and structure removal and disposal coast-wide. While a dedicated funding stream has not been identified, the program continues to build strong partnerships with coastal local governments, state and federal regulatory agencies, non-governmental organizations, and the private sector to develop creative solutions to effect removal and disposal of derelict vessels. The Program utilizes funding reimbursed from the federal government for oil spill response activities.

The Program began documentation of derelict vessels in 2004 in anticipation of drafting the enabling legislation, and currently has 600 vessels in the derelict vessel database. Since its inception in 2005, the Derelict Vessel and Structure Removal Program has removed, or caused to be removed by their owners, approximately 200 vessels from Texas coastal waters. Two significant natural disasters, Hurricane *Rita* (2005) and Hurricane *Ike* (2008) account for 143 of those vessel removals. Unlike vessels previously documented in the Derelict Vessel database, these vessels were direct casualties of the natural disaster. Because the GLO could clearly establish regulatory authority (HB 2096 and HB 3306) for vessel removal and disposal, FEMA authorized the funding necessary for removal, temporary storage, and disposal of the vessel casualties.

Lastly, two significant volunteer efforts are making a difference in two local areas of the coast: Annual Big Shell Cleanup on Padre Island and the Sunny Beaches program on Padre Island. The Big Shell Cleanup, led by Billy Sandifer, started in 1995, but in recent years has garnered more volunteers (400-500) and increased tonnage of removal (from 40-50 tons in early years to 400 in 2009). PINS facilitated the 2009 cleanup with heavy equipment and trucks.

Sunny Beaches, Inc. (sunnybeaches.org) is an award winning, dual purpose program, funded personally by James Davis of Corpus Christi. The program cleans up a segment of Padre Island three weekends per month all year long and uses the judicial system to engage mostly young offenders for beach cleanup as community service. The program and Mr. Davis have each been given the EPA Gulf of Mexico Guardian Awards in recent years for their efforts. They also were the designated volunteer for the one Texas site for NMDMP.

4. Do you use beach clean-up data? If so, how do you use the information?

Yes, GLO sponsors AAB for the State of Texas. This program originated in 1986 with the Center for Marine Conservation (now Ocean Conservancy) in Austin, Texas. Since that time, annual clean-ups have involved over 397,000 volunteers that have collected over 7700 tons of trash from Texas beaches and waterways. AAB coordinates three clean-ups per year (fall, winter, and spring). The fall clean-up is the main one for collecting data at 28 designated sites along the Texas coast, and corresponds with the Worldwide International Coastal Clean-up. The principle use of the data has been education and outreach to educate the public about the marine debris issue in hopes of raising awareness and reducing debris discharge of all kinds.

Data cards are filled out by volunteers who collect debris, and these are entered into a tabulating system through the Ocean Conservancy. The AAB program can then identify trends in types and amount of debris. Top ten debris items and trends are listed in an AAB newsletter that is distributed through email and posted on the AAB website.

The top ten debris items collected in Texas and their trends are mentioned in item 3 above. For the more geographically extensive five-year NMDMP for the entire northern Gulf of Mexico region, which includes Texas, 48.3% of the debris was land-based, 35.8% was general source, and 15.9% was ocean-based. The first and last categories did not change over the five year period (2001-2006), but the general source category increased. Metal beverage cans, balloons, and straws were the top three of nine land-based sources; plastic bags, plastic bottles (beverage), and plastic bottles (food) were the top three of eight general sources; and, fishing line and rope were the top 2 of 14 ocean based sources. Areas in which marine debris is concentrated should be identified and prioritized to better facilitate clean-up efforts.

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

A new and significantly important report on marine debris was released by the National Research Council during 2009. This new study requested by Congress highlights the growing problems of marine debris and offers new insight to management. *Tackling Marine Debris in the 21st Century* (NRC 2009) stresses that the impacts to marine organisms are well known. Ingestion of marine debris, particularly plastic, are known to impair or kill sea birds, sea turtles, marine mammals, fish and squid. Likewise, derelict fishing gear and other debris are known to entangle and injure or kill marine organisms.

A management paradigm shift promulgated by this new NRC report is a move towards "zero waste discharge" into the marine environment. In education and outreach the new mantra is reduce, reuse, and recycle.

1. For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:

| **Management categories** | **Employed by state/territory** (Y or N) | **Employed by local governments** (Y, N, Uncertain) | **Significant changes since last assessment** (Y or N) |
|---|---|---|---|
| Recycling requirements | N | N | N |
| Littering reduction programs | Y | Y | N |
| Wasteful packaging reduction programs | N | N | N |
| Fishing gear management programs | Y | Uncertain | Y |
| Marine debris concerns in harbor, port, marine, & waste management plans | Y | Y | Y |
| Post-storm related debris programs or policies | Y | Y | Y |
| Derelict vessel removal programs or policies | Y | Y | Y |
| Research and monitoring | N | N (private=Y) | N |
| Marine debris education & outreach | Y | Y | N |
| Other (please specify) | | | |

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment;
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts;
    c. Characterize the outcomes and effectiveness of the changes.

*Fishing gear management programs*

The Texas Sea Grant College Program through its Marine Extension Program operates the Texas Monofilament Recovery and Recycling Program. This voluntary program involves educating the public about the problems of monofilament fishing line with outboard motors and marine life, and it provides an expanding network of fishing line bins along the coast. The program first placed a monofilament recycling bin at the South Jetty in Port Aransas in 2004 and has spread bins coast wide since then. The Texas Monofilament Recovery and Recycling Program has been effective at collecting a potential marine debris source and increasing public awareness to the problems monofilament can create.

*Marine debris concerns in harbor, port, marine, & waste management plans*

The Texas Sea Grant Program also coordinates the Clean Texas Marina Program, which has a marine debris component. Of the 98 marinas in the CZ, 19 are certified and 12 have

pledged to work towards certification as clean marinas. This volunteer program is a coordinated effort by Texas Sea Grant, TCEQ, TPWD, and the Marine Association of Texas. The Clean Texas Marina Program has certified an increasing number of marinas as adhering to a high environmental standard. However, these programs involve slow but consistent improvements/changes because they are voluntary.

*Post-storm related debris programs or policies*

Refer to Marine Debris Item 3 above, under Resource Characterization for post-storm related debris programs during the past five years. The post-storm program received funding from many state (GLO, TCEQ, TPWD, TxDOT) and federal (EPA, FEMA, NOAA, USACE) agencies due to the magnitude of destruction and debris caused by Hurricanes *Rita* and *Ike*. The post-storm related debris programs were vital to restoring areas after the catastrophic events of *Rita* and *Ike*.

*Derelict vessel removal programs or policies*

In addition to the derelict vessel removal that took place post-Hurricane *Rita* and *Ike* (refer to Marine Debris Item 3, Resource Characterization above), the 79th Texas Legislature (2005) enhanced the GLO Oil Spill Prevention and Response Division Programs ability to deal with the growing problem of abandoned vessels along the Texas coast with HB 2096. As of December 2009, this program has been partially supported by CZM funds and overseen the removal of over 200 vessels, including 124 vessels related to Hurricane *Ike*. There are still around 400 other vessels in the GLO database that need removal.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Education and outreach to new level, including "zero discharge" and "reduce, reuse, recycle" concepts | communication, outreach | H |
| Storm-water discharge research and catchment technology | communication, capacity, outreach | M |
| Lack of source data | data | H |
| Lack of data on impacts to wildlife | data | M |

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

| | |
|---|---|
| **High** | _____ |
| **Medium** | __X_ |
| **Low** | _____ |

Briefly explain the level of priority given for this enhancement area.

Marine debris has moved from aesthetic problem or nuisance to a problem of marine life endangerment and death (from ingestion and entanglement) and to an economic liability for coastal communities (costs for clean-up and deterrent for visitors). Research of sources of marine debris and its impacts on wildlife and other resources will assist in determining priority focus areas. This will serve in effective comprehensive planning for not only marine debris management mechanisms, but many other enhancement areas that marine debris effects.

2. Will the CMP develop one or more strategies for this enhancement area?

| | |
|---|---|
| **Yes** | __X__ |
| **No** | _____ |

# *Cumulative and Secondary Impacts*

**Section 309 Enhancement Objective**

Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources.

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Identify areas in the coastal zone where rapid growth or changes in land use require improved management of cumulative and secondary impacts (CSI) since the last assessment. Provide the following information for each area:

| **Geographic Area** | **Type of growth or change in land use** | **Rate of growth or change in land use** (% change, average acres converted, H,M,L) | **Types of CSI** |
|---|---|---|---|
| Kenedy, San Patricio, Nueces, Cameron, Willacy Counties | coastal wind farms | H | avian/bat mortality; disruption of wildlife habitat; visual aesthetics; radar disruption; potential depreciation of property values |
| Brazoria, Chambers, Harris, Aransas, Nueces, San Patricio, and Cameron Counties | urban sprawl; residential and commercial development; fragmentation of farming and ranching lands | H | loss of natural wetlands and wildlife habitat; conversion of agricultural lands; nutrient enrichment; increased vulnerability to flooding and damage from severe weather events |
| Calhoun, Victoria, Refugio, Aransas, San Patricio, Nueces, and Cameron Counties | reduction of freshwater inflow | M | increased salinity; decreased sediments and nutrients; damage to fish, shellfish, wildlife habitat |
| All Texas coastal counties, but upper coast most affected | relative sea level rise | H | disruption of coastal habitat and water quality; contamination of coastal freshwater supplies with salt water; increased coastal flooding; reduce size of barrier islands; magnification of the impact of extreme weather events such as hurricanes |

Texas continues to experience rapid population growth in its coastal counties. Between 2000 and 2020, the coastal population in Texas is projected to increase from 5,211,014 to 6,832,390, a gain of nearly 25%. Some coastal counties will experience increases during this period of over 40% (TWDB 2006). These figures are comparable to those experienced during the previous assessment, but continue to pose significant management challenges in a number of areas along the Texas coast.

Coastal counties with the highest projected growth rates include, Brazoria, Chambers, Harris, Calhoun, Aransas, San Patricio, Nueces, Kleberg, and Cameron. The four counties that border the Galveston Bay system have the largest concentrations of population in coastal Texas. Currently, over 4.5 million people live in the Houston-Galveston metropolitan area, an increase of about 600,000 since 2000. The trend in population growth during the years 2010-2015 is estimated to be similar to that during the previous decade. Much of this growth will occur in the northern and western portions of Houston.

Additional high growth is expected eastward into Chambers County and southward into Galveston and Brazoria Counties. Sprawling development patterns that emphasize low-density, residential dwelling units radiating from the urban core dominate the Houston-Galveston area as well as other urban areas in Texas. Rapid population growth coupled with land use patterns that encourage the over-consumption of land originally designated for other purposes causes the conversion of agricultural lands and loss of naturally occurring wetlands. Moreover, an increase in hardened surfaces degrades the water retention features of existing hydrological systems and their drainage regimes leading to vulnerability and damage to life and property from severe weather events.

Increasing residential and commercial shoreline development can also impact navigable waterways. Shoreline modifications such as docks, piers, and marina residential development projects may impede the efficient use of important navigation channels. Some of these channels are becoming restricted and congested due to shoreline development (TxDOT 2006). Impacts on navigation need to be more effectively addressed during the coastal planning process.

Maritime trade continues to be a major activity in the coastal zone and an integral component in the state's economy. The state has 11 deep draft ports and over 270 miles of deep channels. In addition, there are over 750 miles of shallow draft channels and 9 major shallow draft ports. At present, four Texas deep-water ports rank in the top 10 of U.S water ports by shipment weight. They are Houston (#2), Beaumont (#4), Corpus Christi (#6) and Texas City (#9) (Harrison et al. 2007). Maritime transportation employs nearly 1 million residents of Texas and contributes approximately $135 billion annually in economic activity. While experiencing steady growth, it appears that marine transportation's impact on the coastal environment has not increased substantially from the previous five year period. The main effects of marine transport operations on water quality predominantly arise from dredging, waste discharge, ballast water, and oil spills. These impacts, while potentially damaging, are well understood and generally well monitored.

Fragmentation in rural areas from large farming and ranching to smaller operations is also occurring at a rapid rate in coastal counties, especially near the Houston-Galveston metropolitan area. Smaller land holdings, defined as those less than 100 acres in size, increased by 21% from 1997 - 2007. These small operations accounted for 65 % of the coast's total farming and ranching operations, while occupying only 3.6% of the land area (Texas A&M

IRNR 2009). Existing landowners have commented publicly that many who purchase these smaller properties do not practice sound land management and cause increased nutrient loading of coastal waterbodies due to problems associated with over-fertilization and runoff among other environmental problems. Local governments generally have limited financial resources, technical expertise, or legal authority to address these land use concerns in unincorporated county areas.

In addition to major land use changes resulting from so-called urban sprawl, the Houston-Galveston metropolitan area experiences significant impacts as a consequence of its heavy industrialization. Home to the nation's largest concentration of petrochemical plants, it also contains one of the top U.S. ports in value of foreign trade and total tonnage. Other major industries include food, fabricated metal products, non-electric machinery, primary metals, scientific instruments, paper and allied products, industrial supplies for the energy industry, printing and publishing.

Heavy industries in the Houston-Galveston metropolitan area have contributed to cumulative and secondary impacts on the coastal environment. Accidental discharges of toxic materials from industrial point sources into the bay system continue to occur. Large quantities of industrial pollutants find their way into waterways after being sent to publicly owned treatment plants (GBEP 2010). Most streams feeding into the Galveston Bay system receive treated domestic and industrial wastewater, as well as NPS pollution such as agricultural and residential runoff. The degradation of bay tributaries and sediments as a result of NPS pollution is seen as one of the most pressing environmental problems in the Galveston Bay watershed (GBEP 2010). Trends in contamination by metals and organic chemicals have been generally moving downward in the past 20 years with the exception of nickel and zinc in a few sites around Galveston Bay (Kimbrough et al. 2008). Additional environmental impacts occurs as a result of dredging for coastal construction and navigation maintenance projects and land subsidence caused by natural geological processes or human activities such as groundwater withdrawal and oil and gas production.

The majority of the Galveston Bay system remains closed for harvesting of oysters for direct marketing due to water quality issues. Compounding these difficulties, Hurricane *Ike* in 2008 destroyed up to 60% of the oysters in the Galveston Bay system (RAE 2009).

The second largest population center on the Texas coast is located in the Corpus Christi region. Growth rates in Nueces, San Patricio, Aransas, and Kleberg Counties are somewhat smaller than that of the Houston-Galveston area, but still robust. Between 2000 and 2020 the region's population is forecast to grow about 32% from 434,829 to 572,326. San Patricio and Aransas Counties are projected to have the most rapid population growth at 42% and 36% respectively. Much of this population increase is due to accelerating resort, tourist, and retirement developments along the barrier islands of Mustang and North Padre Islands, the coastal portion of San Patricio County, and the Live Oak Peninsula of Aransas County. Because much of this growth is occurring very close to Gulf beaches, protecting critical dune areas is of special concern.

Corpus Christi is by far the largest city in the Coastal Bend Region with a population of about 285,600. Tourism and marine-related activities are an important part of the economy, providing nearly 25% of area jobs. Agriculture (primarily sorghum and cotton) and cattle ranching continue to be important. The Corpus Christi Ship Channel's depth of 45 feet supports

the sixth largest port in terms of tonnage in the nation. More than 90% of this cargo is oil and petrochemicals. Adjacent to the Ship Channel is a large concentration of petrochemical and heavy manufacturing industries. Data over the last 20 years indicates that the concentration of metals and organic contaminants in sediments of the Ship Channel is declining with a few exceptions such as lead in the Corpus Christi Inner Harbor (Kimbrough et al. 2008). However, historic levels of several contaminants remain relatively high compared to national levels. Non-point sources of pollution including runoff from residential neighborhoods and commercial sites, agricultural fields, stormwater outfalls, and other human activities create localized problems that need additional monitoring and study. Large portions of Corpus Christi, Copano, and Redfish Bays remain off limits to oyster harvesting.

The recent construction and operation of a number of large-scale wind farms in the vicinity of Corpus Christi represents a major change in land use since the previous assessment. Currently, three wind farms with a combined energy capacity of about 663 MW (about enough electricity for 165,000 homes) are operating in Texas coastal counties. Two of these wind farms are located in Kenedy County about 60 miles south of Corpus Christi, and one is located in San Patricio County a few miles north of the city. 400 additional MW are being constructed in Kenedy and San Patricio Counties. Seven additional wind farms have been proposed and are in various stages of development in Nueces, Willacy, and Cameron Counties.

Accurately describing the likely cumulative and secondary impacts of wind farms is difficult. A commonly used estimate is that a 100 MW wind farm occupies 5,000 acres. However, this is somewhat misleading given the fact that each wind turbine structure only disturbs about 1/3 of an acre. When combining turbine pad, road, and associated buildings, it has been estimated that the surface impact is about one acre per turbine. In addition to the physical surface disruption, wind power facilities also have potential environmental impacts (birds and bat strikes, habitat degradation or loss) that have yet to be fully evaluated as well as anthropologic impacts such aesthetics and property value.

On the opposite side of the ledger, wind farms may lessen the demand for oil and gas, which present environmental challenges in coastal areas of Texas. There are over 350,000 oil and gas wells in Texas today. Most of these existing wells are located in interior portions of the state, but the tens of thousands of wells that do exist in coastal counties may cause environmental degradation through air and water contamination, disruption of wildlife habitat by roads, pipelines, or related infrastructure and other impacts.

The State of Texas has leased tracts of submerged land offshore Galveston, Jefferson, Brazoria, Calhoun, and Cameron Counties to Wind Energy Systems Technology (W.E.S.T., LLC) for the purpose of developing offshore wind farms. Additionally, Baryonyx Corporation was recently granted two wind energy leases. The company plans to develop two offshore wind farms, one off Mustang Island, and one off the Rio Grande River. While it is unclear whether construction or commercial production from any of these offshore sites will commence within the next five years, it is important for the state to better understand the environmental and socio-economic impacts of offshore wind production.

Cumulative and secondary impacts are also experienced as a consequence of reduced amounts of freshwater inflow from the Nueces River, Guadalupe, San Antonio, and other streams and rivers that flow into the bays of the Coastal Bend Region. This portion of the Texas Coast is semi-arid and prone to severe drought. Freshwater inflows to estuaries regulate salinity,

nutrients, and sediments, which in turn have a profound impact on estuarine ecosystems. Unlike the rivers north of the Coastal Bend, which have flows related to fairly consistent spring rains, thaws and late summer dry periods, the rivers in South Texas are less predictable. Withdrawals of water upstream for agricultural and municipal purposes, coupled with the construction of reservoirs has reduced average inflows and have stopped periodic floods that flushed and rejuvenated estuary ecosystems by reducing salinities and adding sediments and nutrients from the land.

The impact of reduced freshwater inflow on the habitat of endangered whooping cranes was the subject of a recently filed lawsuit by a coalition of conservation groups against the State of Texas (Price 2009). The suit claims that the state violated the Federal Endangered Species Act by granting too many water permits for withdrawals from the Guadalupe and San Antonio rivers, resulting in high salinities in marshlands and estuaries that whooping cranes depend on for their survival. According to the coalition, the primary cause of whooping crane mortality was malnutrition caused by insufficient freshwater inflows. It is too early to determine the legal merits of this lawsuit, but it clearly highlights the importance that citizens place on managing freshwater inflows in the Coastal Bend and other parts of South Texas.

Located on the southernmost portion of the Texas coast, much of South Padre Island and the lower Laguna Madre in Cameron County are highly developed and urbanized. Brownsville is the largest city with a population of about 172,000. The Port of Brownsville serves as an important point of connection for trade between the United States and Mexico. Its chief products are petroleum products, ores and minerals, steel and other metals, vegetable oils, and grains. Nearby South Padre Island is a recreational/resort area with densely spaced high-rise condominiums, hotels, single and multi-family residences, and supporting facilities such as retail establishments, restaurants, and marinas. Cameron County's population is growing faster than any other county in the state with a projected increase of 49% in the period 2000-2020. Even higher growth rates are predicted for the counties landward of the CZ boundary in the Rio Grande Valley. Cumulative and secondary impacts come primarily from the same factors as other rapidly growing urban areas along the Texas coast including NPS from untreated sewage from leaking septic systems and contaminated storm drain runoff and damage associated with dredging and shoreline construction. Elevated levels of mercury have been found in the South Bay region of the Lower Laguna Madre and the 20 year trends of nickel contamination are increasing in the Port Isabel area.

Cumulative and secondary effects of sea level rise are of growing concern in coastal Texas because of the physical and geological characteristics of the region. There is no question that relative sea level rise is occurring along the Texas coast, although most noticeably on the upper portion of the coast. Historical tide gauge measurements prove this and model projections by the Intergovernmental Panel on Climate Change predict that global sea level rise will continue at an increasing rate during the next 100 years. Even if the rate of rise does not increase, by 2100 we can expect sea level along the U.S. Gulf coast to be higher relative to the land by 1/2 to 3 feet, depending on the location. This assessment is from projecting what was actually measured by tide gauges during the last 40 to 100 years. The Texas coastal plain is relatively flat and low-lying and, in many areas, has a high rate of land subsidence, likely caused by natural geological processes or human activities such as groundwater withdrawal and oil and gas production. Consequently, the state's coastal areas are especially susceptible to even minor changes in relative sea level rise, a term that includes the effects of the water rising and the land surface subsiding. For example, research suggests that on low-lying barrier islands, a rise of just four

inches in relative sea level can cause conversion of fringing low marshes and flats to open water and seagrass beds, and dry high marshes and flats to wet low marshes and flats. Ecological shifts of this kind cause significant and unpredictable impacts on habitat and water quality that is essential for the sustainability of commercially and recreationally valuable fish, oysters and other living organisms.

Relatively small increases in sea level rise will also contaminate some coastal freshwater supplies with salt water, increase coastal flooding, shrink barrier islands and magnify the impact of extreme weather events such as hurricanes. The financial costs to mitigate and adapt to sea level rise are difficult to determine. However, recent studies of Galveston Bay showed that, given current economic conditions, just two feet of sea level rise would cause an additional property loss of $1.7 billion from a Hurricane *Ike*-type storm.

Coastal wetlands in Texas continue to be lost likely through human-induced causes such as agriculture, industrial development, oil and gas production, and most importantly urban and suburban sprawl. It has been estimated that from 1991-2003, 78% of all wetland alteration permits granted by the U.S. Army Corp of Engineers were issued outside of urban areas in a dispersed sprawl pattern. Moreover, 72% of these permits were nationwide permits, which usually involve small-scale residential development activities having minimal individual adverse impacts on the aquatic environment (Brody et al. 2008). The cumulative effect associated with thousands of small-scale disruptive activities has created significant losses of palustrine wetlands in the Houston-Galveston area and outside of other coastal population centers. In the Coastal Bend Region, palustrine marsh has decreased from 20,968 acres in the 1950s to 13,906 acres in 2004, a loss of about 147 acres a year (Tremblay et al. 2008).

Moreover, federal regulation of coastal wetlands has significantly diminished as a result of the judicial holding by the U.S. Supreme Court in *SWANCC v. United States Army Corps of Engineers*, 531 U.S. 159 (2001). Developing wetlands that are part of the "waters of the United States" have traditionally required a permit from the U.S. Army Corps of Engineers under Section 404 of the Federal Clean Water Act. The SWANCC holding eliminated federal jurisdiction to require permits for discharges into isolated wetlands that are intrastate and non-navigable. One study found, that as a result of the SWANCC decision, up to 80% of Galveston Bay watershed's freshwater wetlands were unprotected under Section 404 of the Clean Water Act (Jacob and Lopez 2005). In the subsequent decision of *Rapanos v. United States* 547 U.S. 715 (2006), the court attempted to clarify the types of isolated wetlands that may continue to fall under federal jurisdiction, but numerous questions remain as to whether certain wetlands in coastal Texas may be developed without a federal permit.

Loss of submerged aquatic vegetation continues to occur along portions of the Texas coast. The health of seagrasses depends to a large extent on local conditions. For example, in coastal areas near Corpus Christi, seagrass losses have been greatly curtailed in recent years due to proactive conservation measures such as propeller exclusion zones and salinity regime modifications and coverage has increased about 120 acres per year between the 1950s and 2004 (Tremblay 2008). In contrast, much of the lower Laguna Madre is still under threat and losing seagrasses to navigation-related dredging activities and periodic blooms of "brown tide" that shade the plants and cause stress and or death. Seagrass health can also be greatly affected by severe weather events like hurricanes.

2. Identify sensitive resources in the coastal zone (e.g., wetlands, water bodies, fish and wildlife habitats, critical habitat for threatened and endangered species) that require a greater degree of protection from the cumulative or secondary impacts of growth and development.

| **Sensitive resources** | **CSI threats description** | **Level of threat** (H,M,L) |
|---|---|---|
| Coastal wetlands and marshes | Urban sprawl, NPS pollution, dredge and fill, shoreline construction, relative sea level rise, alteration of hydrology, erosion | H |
| Submerged aquatic vegetation | Dredging; nutrient and sediment loading; brown tide; propeller scaring | M |
| Oyster reefs | Dredging, PS pollution, NPS pollution; severe weather events | H |
| Critical dune areas | Construction and fill causing physical destruction | M |
| Estuaries | Lack of freshwater inflow, NPS pollution, PS pollution, dredge and fill of wetlands and open water areas | H |
| Tidal sand and mudflats | Dredge and fill, relative sea level rise, use of off-road vehicles | M |
| Submerged lands | Dredging, dock construction | L |
| Endangered/threatened species critical habit | Construction, relative sea level rise, dredge and fill, lack of freshwater inflow | H |
| Coastal Preserves | NPS pollution, urban sprawl | M |

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

1. For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:

| **Management Categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Regulations | Y | Y |
| Policies | Y | Y |
| Guidance | Y | N |
| Management Plans | N | N |
| Research, assessment monitoring | Y | Y |
| Mapping | Y | Y |
| Education and Outreach | Y | N |

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.
    a. Characterize significant changes since the last assessment;
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
    c. Characterize the outcomes and effectiveness of the changes.

One very significant change since the last assessment was the enactment of new legislation, Senate Bill 3 in 2007 that creates a new state-wide set of policies for the protection of environmental flows within rivers, and to bays and estuaries.[1] Under this new system, local basin stakeholder teams and bay and basin expert scientific teams from all river/bay basins in the state will work together to recommend strategies and regimes for environmental flow protection within their respective bay and estuary systems. The state-wide Science Advisory Committee is a panel of experts that provides guidance to ensure consistency in technical approaches. A single state-wide Environmental Flows Advisory Group will make key appointments, keep the Texas legislature informed of committee and team activities, and issue its own recommendations to the TCEQ, which has final decision-making authority to adopt a regime for each river basin and bay system.

The impetus of the new legislation was not primarily CZM-driven, but came about in reaction to litigation brought in 2000 by a citizens group that wanted to appropriate water from the Guadalupe and San Marcos Rivers and leave it in place for environmental purposes. Under Texas water law at the time, permits could not be granted for the non-use of water for purposes of protecting environmental flows. The 2007 statute provides a regulatory method of providing for freshwater flows without granting new water rights specifically for that purpose. The two initial basin-wide teams have completed their work in 2009. Two others are just beginning their work, and the final two begin in fall 2010, so it is too early to gauge the outcomes or effectiveness of the changes. However, a key aspect of SB 3 is that adaptive management is required and the recommendations are to be updated no less than every 10 years.

Texas continues to work with NOAA and EPA on its NPS Program. Since receiving conditional approval in 2003, it has met the condition dealing with hydromodification and is working to address the four remaining areas with conditions.

[1] Texas Water Code Section 11.147 et seq.

Since the last assessment, funding from the Section 310 Coastal Nonpoint Source Pollution Control Program was provided for an educational program for agricultural producers and athletic field managers in the Arroyo Colorado Watershed. The program focused on improving skills in pesticide, nutrient, and irrigation management to reduce the potential for NPS pollution. Coastal NPS funds were also used to produce a Texas Coastal Stormwater Treatment Wetland Design Manual. This funding resulted in the publication of *Stormwater Wetlands for the Texas Gulf Coast: Ecology and Beauty for Improved Runoff Water Quality* (Jacob and Sipocz, 2009).

Coastal mapping and assessment projects have substantially increased since the previous assessment. For example, Section 309 funding is being used to determine spatial and temporal changes in wetlands and aquatic habitats in the areas of Corpus Christi-Coastal Bend, Beaumont-Port Arthur, Matagorda Bay, Freeport and San Antonio Bay, and possibly the Brownsville-Harlingen areas. The results of these studies will address the probable causes for rates and locations of change in selected areas of the Texas coast. Funding was also provided for a study to develop spatial and other data to demonstrate the effectiveness of freshwater wetlands for water quality protection and storage in the Galveston Bay Watershed. When complete, the work will help the GBEP establish priorities for wetland and habitat conservation and to work with local governments in providing guidance on best management practices for storm and water management within the watershed.

Funding is also being provided to projects that assess and map rural areas of the state's CZ that have been neglected in the past such as the Saving our Coastal Heritage–Texas Rural County Demonstration Project. The project will use GIS mapping to identify high priority areas for public access, habitat conservation and restoration, and other community identified priorities for rural Chambers County. Due to state legislation that restricts unincorporated areas of counties from engaging in zoning and many types of land planning activities, rural coastal counties typically do not have a model for community-based natural resource and public access planning. The Texas Rural County Demonstration Project will lead to multiple benefits, including: 1) protecting valuable coastal critical area habitats; 2) reducing the impacts of flooding on local communities; 3) increasing public access to the coast; 4) protecting/improving water quality from runoff; 5) increasing the potential for nature tourism as a vehicle for economic development; and 6) preserving the communities' unique local heritage. The completed plan will provide a model for work that could be accomplished in other rural coastal counties.

Increased funding from previous section 309 cycles has also been provided to create geohazards maps of North Padre, South Padre, and Mustang Islands as well as to assess the status and trends of coastal vulnerability along the Texas coast. These projects are discussed more fully in the section on Coastal Hazards.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Helping to facilitate effective community planning to reduce cumulative and secondary impacts in coastal areas and to mitigate vulnerability to sea level rise and natural hazards | Data, training, communication & outreach, and policy | H |
| Integration of scientific and policy findings from SB 3 environmental flow committees process into the CMP | Data, communication & outreach, and policy | H |
| Environmental and socio-economic data to assist in better planning for coastal and offshore wind farms and renewable energy development | Data, communication & outreach, and policy | H |
| Assisting local governments in unincorporated portions of coastal counties to improve planning and growth management | Data, training, capacity, communication & outreach, policy, and regulatory | H |

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

   **High** __X__
   **Medium** _____
   **Low** _____

   Briefly explain the level of priority given for this enhancement area.

Texas coastal areas will continue to experience high rates of population and commercial growth. Much of this growth is occurring in environmentally fragile and increasingly hazardous areas. Like many coastal states, Texas needs to better adapt to coastal change to protect the

effective functioning of valuable ecosystems and to reduce current and potential risks of damage from natural disasters. Improving comprehensive baseline data and incorporating that information into more effective planning and management mechanisms is an important way of addressing problems associated with cumulative and secondary impacts.

2. Will the CMP develop one or more strategies for this enhancement area?

**Yes** __X__
**No** _____

# *Special Area Management Planning*

**Section 309 Enhancement Objective**

Preparing and implementing special area management plans for important coastal areas

> The Coastal Zone Management Act (CZMA) defines a Special Area Management Plan (SAMP) as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone. In addition, SAMPs provide for increased specificity in protecting natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making."

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Identify geographic areas in the coastal zone subject to use conflicts that can be addressed through special area management plans (SAMP). Also include areas where SAMP have already been developed, but new issues or conflicts have developed that are not addressed through the current plan. If necessary, additional narrative can be provided below.

The Texas Legislature amended the Coastal Coordination Act in 1995 to specifically prohibit the Council from developing or approving a special area management plan, including a plan for an area designated under the national estuary program.

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

1. Identify below any special management areas in the coastal zone for which a SAMP is under development or a SAMP has been completed or revised since the last Assessment:

This section is not applicable, as development and approval of SAMPs by the Council is prohibited by the state.

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.
   a) Characterize significant changes since the last assessment (area covered, issues addressed and major partners);
   b) Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and

c) Characterize the outcomes and effectiveness of the changes.

This section is not applicable, as development and approval of SAMPs by the Council is prohibited by the state.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

The TCMP, as approved by NOAA, includes a prohibition on Council development and approval of SAMPs.

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

**High** _____
**Medium** _____
**Low** _____

Briefly explain the level of priority given for this enhancement area.

This section is not applicable, as development and approval of SAMPs by the Council is prohibited by the state.

2. Will the CMP develop one or more strategies for this enhancement area?

**Yes** _____ **No** __X__

Briefly explain why a strategy will or will not be developed for this enhancement area.

This section is not applicable, as development and approval of SAMPs by the Council is prohibited by the state.

# *Ocean/Great Lakes Resources*

**Section 309 Enhancement Objective**
Planning for the use of ocean resources

**Resource Characterization**
*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. In the table below characterize ocean and/or Great Lakes resources and uses of state concern, and specify existing and future threats or use conflicts.

| **Resource or use** | **Threat or use conflict** | **Degree of threat** (H,M,L) | **Anticipated threat or use conflict** |
|---|---|---|---|
| Fisheries | Overfishing, bycatch, HABs, hypoxia/water quality, agricultural pesticides, habitat degradation | M | Decrease in freshwater inflows, loss of nursery habitat, non-point source discharges |
| Oyster reefs | Water quality & lack of shell replenishment | M | Freshwater inflow decrease, habitat loss |
| Oil and gas | Increased intensity & frequency of storms | M | Global Climate Change, Regulatory restrictions |
| Endangered species | Habitat loss, marine debris, bycatch in commercial fisheries | H | Invasive species |
| Sand/gravel and dredge material | Burial, inaccessibility | M | Increased need for sediment for habitat restoration |
| Submerged aquatic vegetation | Boat traffic, lack of freshwater inflow, dredging | M | Boat traffic, altered hydrology, NPS pollution |
| USES | | | |
| Commercial shipping, navigation, dredging | Endangered species, essential habitat for fish and birds, dredge spoil disposal | M | Erosion |
| Commercial fishing/shrimping | Decrease in standing stocks, contamination of seafood, bycatch, essential fish habitat | M | Oil spills, fish kills from hypoxia and HABs, regulatory restrictions |
| Recreational fishing and boating | Marine debris, commercial fishing/shrimping, contamination | L | Seagrass bed destruction, limited public access |
| Shoreline use | Marine debris, sea level rise, sediment loss, erosion | M | Development, limited public access, oil spills, fish kills from HABs |
| Oil/gas production | Marine debris, spill potential | L | Rig removal could reduce fish habitat |

2. Describe any changes in the resources or relative threat to the resources since the last assessment.

The long term trends for most commercially harvested and recreational fishery species continue to decline, with few exceptions. Commercial landings for flounder, sheepshead, black drum, blue crab, and 'other finfish' have declined; only commercial snapper, eastern oyster, and shrimp are maintaining or have increased in harvests since 2006, but all lag historic high harvests (P. Hammerschmidt, personal communication, January 19, 2010). Stock abundance for most of the 15 large pelagic shark species in the Gulf of Mexico is at less than 10% of historic levels.

Loss of marine habitat that sustains critical life history periods of many estuarine-dependent species continues as a threat to maintaining viable populations of commercially important and recreational oceanic species. Habitat loss results from a multitude of interrelated causes, including decreases in river discharges, impeding or alteration of water flows through dikes, pipelines, and navigation channels, commercial and private development, and damage from recreational and commercial use. Many of the threats and their mitigation are treated in the Wetlands and Energy and Government Facility Siting sections. However, the habitat loss has far reaching but largely unquantifiable effects on populations of oceanic species. Regulation of freshwater inflows to estuarine habitats is a critical issue to all estuarine species, but also to marine species with estuarine-dependent life history stages. Texas has a process in place Senate Bill 3 (SB3) to identify environmental needs and determine allocation of water uses and flow standards. Much of the data required to establish environmental needs and conserve habitats for estuarine-dependent species is still lacking.

Oyster reefs are one of the most threatened marine habitats on earth, with an estimated 85% lost globally in recent decades (Beck et al. 2009). Freshwater inflows are important for eastern oyster (*Crassostrea virginica*) growth and survival. In particular, the combination of high salinities (>25) and temperature (>20°C) increases oyster mortality due to disease (e.g., *Perkinsus marinus*) and predation (e.g., crabs, oyster drills) (Garton & Stickle 1980, Andrews and Ray 1988, Chu et al. 1993). However, the relationship between oyster health (including growth, survival, and reproduction) and salinity is complex and depends on the timing, magnitude, and duration of freshwater inflow events (La Peyre et al. 2009, Turner 2009). Fisheries-independent data from Galveston Bay, Texas, show increased abundance of market-sized oysters one to two years after increased freshwater inflows (Buzan et al. 2009). Activities that reduce fluvial discharges, increase salinity, and increase the duration of high salinity periods have negative effects on oyster growth (Buzan et al. 2009). Oyster populations are vulnerable to climate variability because there are significant correlations between global climate signals and local salinity patterns in Texas estuaries (Tolan 2007). Precipitation patterns are linked to El Niño Southern Oscillation and the salinity structure is driven by isolated freshwater pulses (Gershunov and Barnett 1998, Tolan 2007). Historical shell dredging for industry and road construction materials has drastically altered the volume of oyster shell substrate in Texas bays. From 1955-1965, more than 100 million cubic yards of shell were removed from Texas bays, but as much as 535,000 cubic yards of shell per year were being removed as early as 1912 (Doran 1965). Oysters are also vulnerable to other stressors including increased turbidity from floods and dredging activities; oil and other chemical spills; nutrient and pesticide runoff; overharvesting; and from the lack of a program to return harvested oyster shells to estuarine areas to maintain reef structures. Despite these issues, oyster reefs in the Gulf of Mexico are likely one of the few locations on earth with the opportunity to achieve large-scale reef

conservation and sustainable fisheries, because they are the least damaged oyster reefs in the United States (Beck et al. 2009).

Bycatch from commercial trawl and other fisheries threatens early life history stages of non-target species, including endangered and threatened species such as sea turtles and marine mammals (Gilman et al. 2006, Harrington et al. 2005). Additional bycatch reduction devices (BRD) were implemented by NOAA NMFS. TPWD approved similar regulations to reduce regulatory conflict between state and federal provisions, and to allow shrimpers to operate in both state and federal waters (TPWD, TexReg 3164, July 29, 2008).

Concern about loss of habitat for oceanic species has prompted continuation of the conversion of offshore oil and gas platforms (rigs) to artificial reefs through the Rigs to Reef Program of TPWD. The Artificial Reef Act of 1989 directed TPWD to promote and enhance artificial reefs via conversion of decommissioned structures to artificial reefs; more than 100 rigs have been converted to 58 reef sites, varying in size from 40 to 160 acres. In 2009, a $1.5 million grant from the Coastal Impact Assistance Program funded creation of reefs composed of concrete and quarry blocks at three new reef sites and reimbursed the Artificial Reef Program for four previously completed reefs. The ship to reef program is a dimension of the TPWD Artificial Reef Program that began in the mid 1970's with the reefing of 12 Liberty ships at six sites along the Texas coast. In December 2007, the program funded sinking of the 473 foot Texas Clipper off South Padre Island (Bozka 2008).

Harmful algal blooms (HABs) continue to pose a threat to oceanic resources, estuaries and oyster beds along the Texas coast. Severe HABs in fall 2009 caused massive fish and shellfish kills from the central Texas coast to the Mexican border and beyond; the blooms spread into estuaries, causing additional fish kills and posed health hazards to people living or visiting the coast. Although many of the HABs are thought to result from naturally occurring conditions, some of the HABs may be invasive species.

Invasive species continue to pose threats to indigenous marine species, habitats, food webs, and fisheries. Although some invasive species may be extending their natural range as a result of global warming, most invasives probably result from the increasingly rapid transport of larvae in ballast water of commercial vessels (Carlton and Geller 1993; Ruiz et al. 1997). Adult organisms may also be transported on hulls of ships (Carlton 2003). The transit of oil and gas platforms from one oceanic basin to another is another likely source of introduction (Carlton 2003). Other invasive species may have been introduced by accidental or intentional release from marine aquaria and from accidental release from aquaculture facilities. The Indo-Pacific Red lionfish (*Pterois volitans*) has spread rapidly from a single, accidental aquarium release, throughout the Bahamas and Florida Keys, to as far north as Long Island Sound and Bermuda; the species likely will eventually spread to reefs, banks and platforms of the Texas coast. Live bait and exotic seafood can be purchased on the internet and transported quickly from almost anywhere on the earth. The tiger prawn, *Penaeus monodon*, has been found in the wild in Florida, Alabama, and Louisiana. One theory of its spread is the accidental releases by shrimp farms. No plan exists on how to control or prevent the spread of the tiger prawn if a natural population is found in Texas. The Texas Invasive Species Coordinating Committee was established in 2009 to coordinate efforts among state agencies. Currently, Texas only prohibits importation and possession of a few marine species: marine stonefish, exotic seatrout, exotic shrimp (except with permit), exotic oysters, and mitten crab.

A list of endangered species in the CZ can be obtained from the Texas Natural Diversity Database. Species include marine mammals, waterbirds, shorebirds, and coastal fishes. Several whales (black right whale, blue whale, and sperm whale) were removed from the endangered species list since 2005, but the humpback whale was added to the list. The brown pelican is pending removal from the list. As of January 30, 2006, Texas Parks and Wildlife Division has listed smalltooth sawfish as endangered under the Parks and Wildlife Code Chapter 68. Due to the extreme difficulty that lay-fishermen have in distinguishing the smalltooth sawfish from the largetooth sawfish, protection of both is believed to be the best means to protect the listed species. A proposal to protect largetooth sawfish was accepted in April 2006. All entanglement nets have been prohibited in Texas waters since September 1988 (D. Scott, personal communication, December 3, 2009).

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

1. For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:

| **Management categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Comprehensive ocean/Great Lakes management plan or system of Marine Protected Areas | N | N |
| Regional comprehensive ocean/Great Lakes management program | N | N |
| Regional sediment or dredge material management plan | N* | N |
| Intra-governmental coordination mechanisms for Ocean/Great Lakes management | N | N |
| Single-purpose statutes related to ocean/Great Lakes resources | Y | Y |
| Comprehensive ocean/Great Lakes management statute | N | N |
| Ocean/Great Lakes resource mapping or information system | Y | N |
| Ocean habitat research, assessment, or monitoring programs | Y | N |
| Public education and outreach efforts | Y | N |
| Other (please specify) | | |

* Utilized by the USACE, but not a specific state agency.

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment;

b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
c. Characterize the outcomes and effectiveness of the changes.

*Single-purpose statutes related to ocean resources*

TPWD has enacted regulations addressing harvest of most species of concern, decreasing daily and bag and possession limits, increasing size limits, requiring more efficient hooks, increasing mesh size of nets, or implementing no-catch or catch and release fisheries, for most species of concern (TPWD Coastal Fisheries Regulations, FY2006-2009). These non-CZM policy changes will allow for more effective management of Texas fisheries. However, the effectiveness to mitigate declines in population abundances of commercial and recreational fisheries will become apparent over longer time scales.

*Management Plans*

Five of the nine management categories lack comprehensive and integrated management plans or systems, and are being managed instead by individual state or federal entities. Comprehensive plans using marine spatial planning should be developed to integrate management of these categories. Marine spatial planning plans be developed or modeled from strategies being developed by the Gulf of Mexico Alliance.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Oyster shell putback – return of shells to habitat | Communication & outreach | H |
| Introduced species – introduction abatement | Communication & outreach; policy | H |
| HAB – ballast water | Communication & outreach; | M |
| Endangered species | Communication & outreach; policy | M |

Oyster reefs have declined within Texas marine waters as a result of their vulnerability to several stressors. A major stressor is the reduced flow of freshwater discharge to estuaries resulting in increased salinity, thereby favoring predators and diseases of oysters. Another, more tractable issue, is the continual decline in oyster shell, upon which oyster spat (the oyster larvae) are dependent for settlement. Oysters are harvested, marketed, or consumed, and their shell buried in landfills, instead of being returned to estuaries to promote growth of new oyster reefs. Public awareness of this problem, especially among commercial vendors and restaurants, could result in mitigation of the problem.

Introduced or invasive species are a continual threat to many of our marine resources. These invasive species include mussels crowding seawalls, intake lines and hulls; sea squirts overgrowing oyster beds; swarms of large jellyfish preventing commercial trawling; invasive corals overgrowing native corals; escaped farmed shrimp competing with native penaeid shrimps; crabs weakening levees, and harmful algal blooms. These threats are perceived as being introduced primarily via ballast water (particularly HABs) from commercial vessels or on the fouling communities on the hulls of commercial vessels. In reality, many particularly harmful species are released intentionally or unintentionally by private citizens. The red lionfish scourge that has spread to Long Island Sound, Bermuda, the Bahamas Islands, and now the Gulf of Mexico, resulted from an accidental release from private aquaria. Live fish baits and marine foods can be purchased and shipped to private citizens from almost any place on earth, without inspection or constraints. Often the packing material contains many unintended species that thrive in the absence of competitors or predators. Many private vessels are sailed or towed by trailer into Texas waters from distant ports. Deep water drilling platforms are towed into state waters and estuaries from distant sites with intact fouling communities. These threats to our marine fisheries, shellfish, and other resources could be abated with public education and more conservative policies.

Increased public awareness is needed of threats to endangered species, such as our large pelagic fishes (e.g., many large shark species). Populations of most of the large shark species in the Gulf of Mexico are at about 10% of their historic levels (Baum et al. 2003). Although much of the decline is attributed to high seas commercial fishing, the large number of recreational fishers also has substantial contributions to their mortality. Suitable fishery regulations are in place for sharks and other threatened species; additional public education would help.

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

   **High** ____
   **Medium** __X__
   **Low** _____

   Briefly explain the level of priority given for this enhancement area.

Any changes to utilization of resources, and changes to management of those resources, that have occurred since the previous Coastal Management Assessment and Strategy report were included in this revision. Recommendations for enhancement area priorities were based on several criteria, including their monetary value of the resources and the percentage of citizens using or benefitted by the resources . The ocean resources (including commercial fisheries, recreational boating and fishing, oil and gas, shipping, shoreline use, sand/gravel/dredge material, etc.) have high monetary values and an increasing percentage of citizens utilize and benefit from these resources, justifying an increase to Medium priority to this enhancement area.

2. Will the CMP develop one or more strategies for this enhancement area?

   **Yes** __X__
   **No** _____

# *Energy & Government Facility Siting*

**Section 309 Enhancement Objectives**

Adoption of procedures and enforceable policies to help facilitate the siting of energy facilities and Government facilities and energy-related activities and Government activities which may be of greater than local significance

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. **In the table below, characterize the types of energy facilities in your coastal zone (e.g., oil and gas, LNG, wind, wave, etc.). If available, identify the approximate number of facilities by type.**

| **Type of Energy Facility** | **Exists in CZ** (# or Y/N) | **Proposed in CZ** (# or Y/N) | **Interest in CZ** (# or Y/N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|---|---|
| Oil and Gas | Y (21 in CZ) | Y | Y | N |
| Coal Fired Plants | N | Y (5) | Y | Y |
| Natural Gas-fired plants | Y (≈31) | Y (5) | Y | N |
| Nuclear power plants | Y (2 reactors) | Y (4 reactors) | Y | Y |
| Pipelines | Y | Y | Y | N |
| Electric transmission cables | Y (4,300 miles) | Y | Y | N |
| LNG | Y (1) | Y (8) | Y | Y |
| Wind | Y (3) | Y (7) | Y | Y |
| Wave | N | Y (1) | Y | N |
| Tidal | N | N | N | N |
| Current | N | N | N | N |
| OTEC[2] | N | N | Y | N |
| Solar | Y (1) | Y (1) | Y | Y |
| Geothermal | N | Y (3) | Y | Y |

*Oil*

Texas leads the nation in fossil fuel reserves. Its reserves for crude oil account for almost 25% of total U.S. reserves and its natural gas reserves account for almost 30% of total U.S. natural gas reserves. Texas also leads the nation in crude-oil production, without taking into consideration federal offshore areas. The state has 27 petroleum refineries with capacity to

[2] OTEC, or Ocean thermal energy conversion, uses the difference in temperature between deep and shallow waters to produce energy. To function, an OTEC system needs the difference in ocean temperature to be at least 20ºC (36ºF) (National Renewable Energy Laboratory, n.d.)

generate nearly 4.8 million barrels of crude oil per day. That is over 25% of the country's total refining capacity. Production capacity has increased by 2.6% from 2005 to 2009. The majority of the state's refineries are situated along the Gulf Coast, in cities such as Houston, Port Arthur, and Corpus Christi. These refineries use local Texas production, overseas imports, oil produced offshore in the Gulf of Mexico, and the U.S. government's Strategic Petroleum Reserve which runs two storage facilities in Bryan Mound and Big Hill, Texas (U.S. Energy Information Administration 2009a). There is growing interest in oil and gas exploration, however, no new refineries have been built in Texas since 1976 (InTech 2007). Total active operators with oil and gas wells have been decreasing over the years, although there was a slight increase from 2004 to 2009 (RRC 2009a). The majority of oil and gas production occurs in interior portions of the state, but significant exploration and production is also occurring offshore of the CZ.

*Coal Fired Plants*

According to the NREL database (2005) of coal power plants, there are approximately 40 operating coal-fired power plants at 20 locations throughout Texas. The latest data available was from 2005. Thus, there is the need for updated information. According to the NREL database, there are no coal plants in the CZ. However, since 2005 some additional plants are in various stages of the permitting process.

*Natural Gas*

Texas leads the nation in natural gas consumption (20% of total U.S. consumption) and production, generating more than 25% of the total U.S. natural gas production. Natural gas fields are concentrated in several Texas production basins. The majority of the fields are located in the northeastern part of the State, the East Texas Basin. Texas possesses 10 natural gas market hubs and 34 active storage facilities (U.S. Energy Information Administration 2009a).

Due to its large population, hot climate, and energy-dependent economy, Texas produces and consumes more electricity than any other state (over 10% of total U.S. energy use) and per capita residential use is higher than the country's average. Some of the energy-demanding industries in Texas include aluminum, forest products, chemicals, and petroleum refining (U.S. Energy Information Administration 2009a).

As of 2009, Texas had 101,097 producing natural gas wells, a 4.8% increase from 2009 (RRC 2010a). As of February 2010, the 18 Counties in the CZ had 3,459 producing gas wells (RRC 2010b). Exploration in coastal areas decreased slightly, but has been increasing steadily in other parts of the state since 2000 (U.S. Energy Information Administration 2009b).

*Nuclear Power Plants*

The South Texas Project Plant in Matagorda County currently operates the only two reactors in the CZ. However, two other projects are currently in the permitting process. One is expansion of the South Texas project, which will create two additional reactors by 2018 and the other is the Victoria City Nuclear project, which is a proposed two-unit power plant in Victoria County expected to be in service by 2015 (National Renewable Energy Laboratory, 2010). There are three important licences that must be obtained to build and operate a nuclear power plant: Combined Construction and Operating License (COL), Early Site Permit (ESP), and a Design Certification Application for new reactors. By issuing a COL, the U.S. Nuclear Regulatory

Commision authorizes the licensee to construct and (with specified conditions) operate a nuclear power plant at a specific site, in accordance with established laws and regulations. It is valid for 40 years and it can be renewed for an additional 20 years. However, a COL alone is not enough to construct a nuclear plant, an ESP application must also be filed.When issuing an ESP, the Nuclear Regulatory Commision approves one or more sites for a nuclear power facility, independent of an application for a construction permit or combined license. An ESP is valid for 10 to 20 years from the date of issuance, and can be renewed for an additional 10 to 20 years. In reviewing an ESP application, the Nuclear Regulatory Commision staff addresses site safety issues, environmental protection issues and plans for coping with emergencies. During this process, the Nuclear Regulatory Commision notifies all stakeholders (including the public) as to how and when they may participate in the regulatory process, which may include participating in public meetings and opportunities to request a hearing on the issuance of an ESP. Both licences can occur simultaneously. By issuing a design certification, the Nuclear Regulatory Commision approves a nuclear power plant design, independent of an application to construct or operate a plant. A design certification is valid for 15 years from the date of issuance, but can be renewed for an additional 10 to 15 years.

*Pipelines*

Pipeline construction and permission for utilization has been increasing in the CZ since the last report. As of October 27, 2009 there were 29 pipeline permits to operate in the CZ. In 2008 there were 59 and in 2007 there were 46 involving the CZ (RRC 2009a; B. Waterman, personal communication, October 30, 2009). Texas Pipeline System Mileage totals 68,433 miles (natural gas, hazardous liquids, and crude oil). Several companies filed a T-4 application to ask for permission to operate. Refer to the Railroad Commission of Texas website for a complete list of permits (RRC 2009b; B. Waterman, personal communication, October 30, 2009).

In Texas, pipelines are regulated by RRC. They do not need to be permitted (given operational authority) until they are ready to actually begin flowing. Consequently, many lines can be built before RRC knows about them. The only opportunity for RRC to know about pipelines ahead of time is if they are jurisdictional to the Texans Safety Inspection Section. This applies to all new transmission lines over one mile long. The coastal counties with proposed pipelines are Chambers, Harris, and Jefferson. However, an operator is not obligated to actually build a line that he sends a report for, so being on this list does not necessarily mean there is a pipeline actually built (RRC 2009b; B. Waterman, personal communication, October 30, 2009).

*Wind*

Coastal wind, particularly that between Corpus Christi and the Mexican border, has the advantage of blowing in the afternoon, when the power is most needed. In the inland portions of Texas the wind generally blows at night. The coast also is attractive for wind farms because, unlike West Texas, there is also transmission capacity to move the power. This combination of factors has created industry interest in more coastal wind projects.

Since the last report in 2005, Texas has been increasing its wind energy generation. Wind became the leading renewable energy source in Texas (Combs 2008a). By the end of 2008, Texas had consolidated its role as the leading state in wind energy capacity with 7,118 MW, the second being Iowa with 2,791 MW (at the end of 2008). By the end of 2009, Texas added 2,292

MW of wind capacity, reaching 9,410MW of total wind power capacity (AWEA 2008, 2009a, 2009b).

*Solar*

Texas has a large potential solar energy supply due its large size and plentiful sunlight. Yet, other states lead the country in solar energy usage, generally due to state policies and incentives that support the installation of solar energy systems (Combs 2008b). Texas has 250 quads[3] of solar energy available, enough to meet the energy needs of 3 million people (SECO 2008). Despite these advantages, solar energy accounted for only 1.25% of total renewable energy consumption in Texas in 2008 (U.S. Energy Information Administration 2010).

*Geothermal*

Although little recognized by the general public, geothermal energy ("earth heat") is the third largest source of renewable energy in the United States, behind hydropower and biomass (Blodgett & Slack 2009). The rising price of electrical power and the current high price of hydrocarbons have changed the geothermal outlook in the U.S. in significant ways. Geothermal electrical power generation has traditionally been restricted to the western states where high core temperatures are closer to the surface of the Earth (SECO 2009). Yet, significant attention is being paid to geothermal energy in Texas due to emerging technologies and the state's long history with subsurface oil and gas extraction.

According to a recent report from the GLO, "New technologies, such as binary power plants, are primed to take advantage of Texas' medium-heat geothermal potential. Binary power plants take in hot water from an underground reservoir and use it to heat a secondary fluid with a lower boiling point. The resulting vapors can drive a turbine and create electricity. The electricity can then be sent to the power grid and used to power homes, businesses or industry. Much as with oil and gas leases, the GLO would make money from a royalty, or a percentage of the energy production, from any geothermal lease" (GLO 2009).

The great advantage of development of geothermal energy in Texas is the existence of large amounts of data on existing oil and gas wells (Combs 2008c). Geothermal electrical production could eventually coexist with oil and gas field wells. Geothermal electricity could also be used to power oil field equipment (SECO 2009). Commercial geothermal electrical production is under development in Texas (SECO 2009). Currently, geothermal energy is not being used to produce electricity.

2. Please describe any significant changes in the types or number of energy facilities sited, or proposed to be sited, in the coastal zone since the previous assessment.

*Coal Plants*

According the NETL's database, there are no coal plants in the CZ. However, since 2005 significant changes have occurred in the CZ. Three coal plants were permitted and are under construction and two are proposed but are still under the permitting process:

- Formosa Point Comfort Plant- located in Point Comfort, Calhoun County.

[3] 1 quad= 1015 BTU (British Thermal Unit).

- NuCoastal and Calhoun County Navigational District- Port of Port Lavaca, Point Comfort, Calhoun County. (Former Central Power Light's old natural-gas-fired E.S. Joslin power plant).
- Hunton Energy Freeport Plant (formerly Lockwood)- SNG & IGCC. This plant is located in Freeport, Brazoria County. Its air permit was issued on January 16, 2009 by TCEQ. Estimated completion date is 2012.

The two other plants in the CZ not yet approved, but under the permitting process are:

- Las Brisas Coal Plant- Las Brisas Energy Center LLC proposes to build a 1,200 MW power plant on Nueces Bay in Corpus Christi, Nueces County.
- White Stallion Coal Plant- White Stallion Energy Center, LLC is proposing a 1,200 MW pet plant in Bay City, Matagorda County.

*Nuclear Power*

The two units at the South Texas Project in Bay City remain the only existing nuclear reactors in the CZ. However, since the last report two new projects have been proposed. One of the new projects will expand the South Texas Project and create two additional reactors, units three and four, by 2018. This will increase production by 5,700 MW and make the South Texas Project the largest nuclear power plant in the country. The second proposed project is Victoria City Nuclear. A two-unit plant in Victoria County expected to be in service by 2015. That project is currently on hold.

*LNG*

In the previous report there were no LNG facilities in the CZ. However, as of December 17, 2009 several changes have occurred.

The Texas CZ has one existing LNG facility in Freeport:

- The Freeport LNG Development (Freeport LNG-GP, Inc)

There is one other facility approved by FERC and under construction:

- Sabine, TX: 2.0 Bcfd (Golden Pass - ExxonMobil).

There are also six other facilities approved by FERC, but not yet under construction:

- Corpus Christi, TX: 1.0 Bcfd (Ingleside Energy - Occidental Energy Ventures).
- Corpus Christi, TX: 2.6 Bcfd, (Cheniere LNG)
- Corpus Christi, TX : 1.1 Bcfd (Vista Del Sol - 4Gas).
- Port Arthur, TX**:** 3.0 Bcfd (Sempra)
- Freeport, TX: 2.5 Bcfd (Cheniere/Freeport LNG Dev. - Expansion).
- Port Lavaca, TX: 1.0 Bcfd (Calhoun LNG - Gulf Coast LNG Partners).

There is a proposed plan for Galveston which has not been approved to date:

- Bay Crossing (British Petroleum) Pelican Island, TX.

Lastly, there are two approved offshore facilities in the Gulf of Mexico under U.S. Coast Guard jurisdiction:

- Port Pelican: 1.6 Bcfd, (Chevron Texaco).

- Gulf of Mexico: 1.0 Bcfd (Main Pass McMoRan Exp.)

*Wind*

In the previous report, there were no wind energy farms in the CZ. However, with the advantage of coastal wind blowing in the afternoon when power is most needed, coastal zone has attracted several wind companies. Since the previous report in 2005, wind became the leading renewable energy in the state and by the end of 2008 Texas has consolidated its role as the leading state in wind energy (Combs 2008a). Currently, there are three operational wind farms and many additional wind farms proposed in coastal counties and offshore with lease agreements the GLO. For additional information on coastal wind farm development refer to question 1 in the section on Cumulative and Secondary Impacts.

*Wave Energy*

At the time of the previous report, there were no wave facilities on the Texas coast. Recently GLO has granted the first offshore lease to Texas-based Renew Blue Inc. which will use ocean water and waves to produce bottled desalinated water off the coast in Freeport, Texas. Traditionally, the desalination process requires significant amounts of electricity (around 40 to 50% of the operating costs are associated with electric use). However, the Seadog Pump technology harnesses wave-power to generate electricity, which means it operates solely on wave power to desalinate water and consequently costs are reduced significantly. The system pump uses wave motion to drive a piston which pumps water through an exhaust pipe. This water is then collected and passed through standard turbines to make electricity when needed and then returned to its source.

Renew Blue intends for the Seadog pump to be used in other applications apart from desalination. Preliminary estimates based on results from the sea trial suggest that a one square mile field of Seadog Pumps could generate anywhere from 30 MW to more than 1,500 MW of electricity on average. It is unclear when, if ever, this technology will be used in the Texas CZ.

*Solar*

At the time of the previous report, there were no solar power plants in the CZ. Since then, two projects have been proposed.

In San Benito (Cameron County) a solar array, Solar Showcase Project, was installed to provide electricity and help power the city's new water treatment plant. A grant from the EPA, in partnership with the GLO, paid for the $325,000 project. The 45 kW solar project is the largest of its kind on the Texas-Mexico border. The project will produce 75,000 kWh per year of electricity and provide about 10% of the power used to filter water at the plant.

After an agreement between the city of Houston and NRG Energy, Houston will have the largest solar power plant in the state. NRG will spend $40 million to construct a 10 MW solar plant near a local natural gas plant they own. The city of Houston will then pay NRG for the solar energy created. The solar plant is scheduled to be on line in the second quarter of 2010 and it will provide 1.5% of the city government's power needs (Souder 2009).

*Geothermal*

At the time of the last report, there were no geothermal power plants in the CZ. In April 2009, GLO awarded three geothermal energy leases off the Texas coast. Geo Texas Co., based in Eugene, Oregon, will be developing geothermal energy on 128,758 acres of state submerged land off the coasts of Galveston, Brazoria and Matagorda counties (GLO 2009).

3. Does the state have estimates of existing in-state capacity and demand for natural gas and electric generation? Does the state have projections of future capacity? Please discuss.

Yes.

*Electricity*

ERCOT states that the installed capacity in 2009 for electricity is 80,075 MW, from which 65% is provided by natural gas, 16% by coal, 10% by wind energy, 6% by nuclear power, and 3% by water/solar/biomass/and other types of renewable energy (ERCOT 2009a).

The maximum hourly demand for 2009 has been estimated to be 63,400 MW. The energy consumed in the ERCOT region in 2008 was 312,401 GW, a 1.7% increase from the previous year. The peak demand for 2008 was 62,174 MW, also an increase from 2005 showing that demand for electricity has been increasing in Texas. The reserve margin (resources available - electric load forecast) was 16.8% in 2009, versus the minimum required of 12.5%. Demand is being met by higher margins than the minimum required (ERCOT 2009a).

To meet the increasing future demand for energy, energy businesses are still developing new projects to boost the state's energy capacity. At the end of April 2009, over 9,000 MW of committed future generation (with interconnection agreements and air permits completed) and close to 97,000 MW of proposed generation was under review (ERCOT 2009a). The state also has projections of future demand and capacity.

The total summer load forecast will increase 11.6% from 62,266 MW in 2009 to 69,480 MW in 2014. During the winter, it is predicted that firm load forecast will increase 12.6% from 42,238 MW in 2009/10 to 47,557 MW in 2014/15 (ERCOT 2009b).

During the summer, total resource capacity is expected to increase 8.8% from 72,712 MW in 2009 to 79,122 MW in 2014. During the winter, resource capacity is estimated to rise 9.3% from 73,943 MW in 2009/10 to 80,813 MW in 2014/15. Consequently, the reserve margin is expected to decrease from 16.9% in 2009 to 13.9% in 2014 (closer to the minimum required of 12.5%) during the summer and from 75.1% in 2009 to 69.9% in winter 2014 (ERCOT 2009b). The demand is increasing at a faster rate than resource capacity and that means there is a need to increase energy generation.

*Natural Gas*

Natural gas capacity is expected to increase. In summer 2009 it totaled 51,299 MW and is expected to increase 5.6% to 54,184 MW by 2014. During the winter, natural gas capacity is expected to increase 5% from 53,349 MW currently to 56,021 MW by 2014 (ERCOT 2009b).

4. Does the state have any specific programs for alternative energy development? If yes, please describe including any numerical objectives for the development of alternative energy sources. Please also specify any offshore or coastal components of these programs.

Yes. Information on incentives and programs is available on the Database of State Incentives for Renewables and Efficiency (DSIRE 2009):

Table 1 below describes current incentives and programs for alternative energy development in the state of Texas. Due to the technical nature of the information provided, the material in this chart has been incorporated verbatim from the publication cited in each column.

Table 1: Programs for alternative energy development

| Program | Description | Cited From: |
|---|---|---|
| **Texas Renewable Portfolio Standard (RPS)** | This program requires 5,880 MW of energy from renewables by 2015 and 10,000 MW by 2025. Of these 5,880 MW, 500MW should come from a renewable energy other than wind energy. Wind accounts for nearly all the renewable energy in Texas.<br>Additionally, the Public Utility Commission of Texas (PUCT) established a renewable-energy credit (REC) trading program that began in July 2001 and will continue through 2019. Under PUCT rules, one REC represents one megawatt-hour (MWh) of qualified renewable energy that is produced and metered in Texas. A capacity conversion factor (CCF) is used to convert MW goals into MWh requirements for each retailer in the competitive market.<br>Committed to meeting the 500 MW non-wind goal of the RPS, the PUCT has determined a "compliance premium" for each non-wind REC generated after December 31, 2007. Compliance premiums are equivalent to an REC and can only be given to non-wind facilities that were installed and certified by the PUCT after September 1, 2005. This method doubles the fulfillment value of electricity produced by renewable resources other than wind. | (DSIRE 2009) |
| **Alternative Energy in New State Construction** | Texas requires state government departments to compare the cost of providing energy alternatives for new and reconstructed state government buildings and for certain construction or repair to energy systems and equipment. The governing body must determine the economic feasibility by comparing the estimated cost of providing energy using traditional design practices and energy systems with the estimated cost of providing energy using energy efficient architecture and design or alternative energy devices during the economic life of the building. If the use of alternative energy devices for a particular function (including space heating and cooling, water heating, electrical loads, and interior lighting) is economically feasible, then it must be included in construction plans.<br>Alternative energy is defined to include solar, biomass, wind, and geothermal energy sources. This section of Texas law (Texas Government Code § 2166.403) was originally put in place in 1995. It was amended in 2005 (S.B. 982) to add geothermal to the list of eligible resources and designate the Texas State Energy Conservation Office (SECO) as the authority for approving any methodology or electronic software used to make the required comparisons. As of April 2009, SECO accepts one software program (RETScreen) for this purpose. Further details are available on the program website (http://www.seco.cpa.state.tx.us/sa_codes.html). | (DSIRE 2009) |

| | | |
|---|---|---|
| **Solar and Wind Energy Device Franchise Tax Deduction** | Texas allows a corporation or other entity subject to the state franchise tax to deduct the cost of a solar energy device from the franchise tax. Entities are permitted to deduct 10% of the amortized cost of the system from their apportioned margin. This treatment is effective January 1, 2008 and replaces prior tax law that allowed a company to deduct (1) the total cost of the system from the company's taxable capital; or, (2) 10% of the system's cost from the company's earned surplus (i.e., income). The franchise tax is Texas's equivalent to a corporate tax. Technologies included in this deduction include Heat, Photovoltaics, and Wind. Texas also offers a franchise tax exemption for manufacturers, seller, or installers of solar energy systems which also includes wind energy as an eligible technology. | (DSIRE 2009) |
| **Solar and Wind Energy Business Franchise Tax Exemption** | Companies in Texas engaged solely in the business of manufacturing, selling, or installing solar energy devices are exempted from the franchise tax. The franchise tax is Texas's equivalent to a corporate tax; their primary elements are the same. There is no ceiling on this exemption, so it is a substantial incentive for solar manufacturers. | (DSIRE 2009) |
| **Local Option - Contractual Assessments for Energy Efficient Improvements** | Property-Assessed Clean Energy (PACE) financing effectively allows property owners to borrow money to pay for energy improvements. The amount borrowed is typically repaid via a special assessment on the property over a period of years. Texas has authorized certain local governments to establish such programs. Texas enacted legislation in May 2009 that authorizes municipalities to offer property tax financing for energy improvements. To participate, a municipality must develop a plan that includes the boundaries of the financing district, arrangements for financing the program, and the time and place for a public hearing regarding the proposed program. | (DSIRE 2009) |
| **Renewable Energy Systems Property Tax Exemption** | The Texas property tax code allows an exemption of the amount of the appraised property value that arises from the installation or construction of a solar or wind-powered energy device that is primarily for the production and distribution of thermal, mechanical, or electrical energy for on-site use, or devices used to store that energy. "Solar" is broadly defined to include a range of biomass technologies. Technologies included in this incentive are Solar Thermal Process Heat, Photovoltaics, Wind, Biomass, Storage Technologies, Solar Pool Heating, and Anaerobic Digestion. | (DSIRE 2009) |
| **Department of Rural Affairs - Renewable Energy Demonstration Pilot Program** | The Texas Department of Rural Affairs (TDRA) offers the Renewable Energy Demonstration Pilot Program (REDPP), which provides grants to local, non-entitlement local governments for the installation of renewable energy projects. In order to qualify for funding under the REDPP, activities must use "a naturally occurring, theoretically inexhaustible source of energy such as biomass, solar, wind, tidal, wave, or hydroelectric". This definition does not permit activities related to the use of fossil or nuclear fuels. | (DSIRE 2009) |

| | | |
|---|---|---|
| **LoanSTAR Revolving Loan Program** | Through the State Energy Conservation Office, the LoanSTAR Program offers low-interest loans to all public entities, including state, public school, colleges, university, and non-profit hospital facilities for Energy Cost Reduction Measures (ECRMs). Such measures include, but are not limited to: HVAC, lighting, and insulation. Funds can be used for retrofitting existing equipment or, in the case of new construction, to finance the difference between standard and high efficiency equipment. The evaluation of on-site renewable energy options (e.g., solar water heating, photovoltaic panels, small wind turbines) is encouraged in the analysis of potential projects. As of November 2007, LoanSTAR had funded a total of 191 loans totaling over $240 million dollars and resulting in approximately $212 million in energy savings. The National Association of State Energy Officials (NASEO) reports that the LoanSTAR program helped state agencies save more than $20 million in energy costs during 2008 and that the program had a waiting list of $28 million in proposed projects as of winter 2009. | (DSIRE 2009) |

All of these alternative energy incentive programs will have an impact in the CZ. At this time there is no data indicating the size or significance of this impact. Additionally, new energy legislation was passed during the Texas 81st Legislature. House Bill 469 offers tax incentives for energy-generating facilities that absorb at least 70 % of its carbon dioxide emissions, decrease sulfur and mercury emissions by 99 % and 95 % respectively and sustain a determined nitrogen oxide emission rate (Combs 2009a). House Bill 1796 will support the expansion of a depository, in state and offshore submerged land, of carbon dioxide (Combs 2009a). Senate Bill 1387 offers state-wide regulation for carbon dioxide sequestration and storage into oil and gas geologic formations (Combs 2009a).

Congress is also proposing new legislation for greenhouse gas emissions, including a federal cap and trade program. The American Clean Energy and Security Act of 2009, proposes a mandatory cap-and-trade program to control and decrease current greenhouse gases emissions to 17 % below 2005 levels and 83 % below 2005 levels by 2050 (Combs 2009a). Additional information on this Bill and other proposed legislation can be found at the Texas Comptroller of Public accounts website (Combs 2009b).

5. If there have been any significant changes in the types or number of government facilities sited in the coastal zone since the previous assessment, please describe.

There were several changes in the coastal counties due to the impact of Hurricane *Ike*. One example is a new school in Beaumont, Orange County, which was built after the hurricane hit in 2008. This school opened January, 2010. The University of Texas Medical Branch in Galveston was significantly damaged by Hurricane *Ike*. Most of the 2,300 medical students will return to work as their labs reopen. UTMB's John Sealy Hospital reopened in January, 2010 but with less than half the capacity it had before hurricane Ike (Ortolon 2009).

There are six public water supply desalination plants in the coastal zone: three in Cameron County, one in Refugio County, one in Calhoun County, and one in Aransas County. The City of Primavera desalination plant built in 2005 is the only plant built since the previous report (Texas Water Development Board, 2010a). There are also ongoing projects in the CZ to collect data and determine costs and effective methods for a full-scale plant. They include the Laguna Madre Water District desalination pilot plant and the desalination feasibility study in

Nueces County, the Brownsville Seawater desalination pilot plan in Cameron County, and the Freeport Seawater Desalination project in Brazoria County (Texas Water Development Board, 2010b). Although there is increasing interest, there were no significant changes in desalination plants since the previous assessment.

Some significant changes are occurring in the Corpus Christi Region. The first is the closure of Ingleside Naval Station in San Patricio County and second is the realignment of the Corpus Christi Naval Air Station and Army Depot in Nueces County from 2006-2011. In the BRAC 2005, the U.S DoD decided to close the Ingleside Naval Station and as a consequence relocate its ships, personnel, and equipment to Naval Station San Diego (BRAC 2010; San Antonio Business Journal 2009).

Although the closure will result in job losses, the base location has potential for redevelopment that could result in long-term economic benefits. The port of Corpus Christi and the Texas A&M University System have started a partnership to redevelop Naval Station Ingleside. The port of Corpus Christi will take control over new installations, while Texas A&M University System will manage the redevelopment of the site and turn it into a major research and training center, mostly in the area of renewable energy. This project is expected to create 2,000 to 4,000 jobs within the next six years (BRAC 2010; Castro 2009; San Antonio Business Journal 2009). According to Ruben Bonilla, the Chairman of the Port of Corpus Christi, the project can have a global impact since it involves developing infrastructure and intellectual growth for Texas, the United States, and beyond.

**Management Characterization**

*Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.*

1. Does the state have enforceable policies specifically related to energy facilities? If yes, please provide a brief summary, including a summary of any energy policies that are applicable to only a certain type of energy facility.

Yes.

*Federal Agencies*

There are six primary federal agencies involved in energy facility siting and its responsibilities: Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE), U.S. Coast Guard (USCG), Federal Energy Regulatory Commission (FERC), U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), and the National Oceanic and Atmospheric Administration (NOAA) (NOAA 2010).

The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) plans and leases land and permits offshore oil and gas production within the Outer Continental Shelf Lands Act (OCSLA). Leases located beyond 9 nautical miles offshore from Texas are administered by the BOEMRE Gulf of Mexico Region which regulates exploration, development, and production activities, including 4,000 production facilities, to ensure those activities are done safely and in an environmentally safe manner. The regulatory framework is based on several environmental laws, regulations, and executive orders. Before starting and during activities, companies have to comply with regulations concerning specific environmental

issues. Such issues include air quality, archaeology, biological and deepwater information, environmental impact analysis, military warning information, ordinance dumping, grid EA and ROV survey status report, oil spill risk, and military warning information (MMS 2010).

In regard to renewable energy facility siting, the BOEMRE established an Alternative Energy and Alternate Use program to approve and manage potential offshore renewable facilities on the OCS. The evaluation that has to be done to be able to grant leases, easements, and rights-of-way includes identifying environmental consequences and potential mitigation measures that could be appropriate for site-specific projects. The types of alternative projects analyzed are offshore wind, wave, and ocean current energy capture. However, the OCS in Texas begins at nine nautical miles offshore, and since development is expected to occur near the shore, the state of Texas has jurisdiction over the location where most projects are proposed.

*State Agencies*

In Texas, the primary energy agencies are the Public Utility Commission of Texas (PUC), Texas Commission on Environmental Quality (TCEQ), Texas Railroad Commission (RRC), and The Electric Reliability Council of Texas (ERCOT).

The PUC has no enforceable policy related to energy facilities, except for rate regulation policies, that is, the PUC has the authority to approve or deny an application for a power plant depending on need (T. Hadley, personal communication, January 12, 2010).

TCEQ oversees environmental policy issues. It grants, for example, air permits to energy facilities. Any party who plans to construct or modify a component of a project that may emit air contaminants into the air of the state of Texas must obtain a permit or qualify for a permit from TCEQ. The air permit ensures that energy facilities do not emit more polluting gases than what is allowed by safety standards. TCEQ also guarantees that facilities handling dangerous gases are not located closer than a quarter mile from any recreational area or residence (TCEQ 2006; TNRCC 2001). These permits are issued only after a series of public hearings.

RRC is the state agency that regulates the oil and gas industry, gas utilities, pipeline safety, and surface coal and uranium mining. Among many rules, the oil and gas industry must comply with the Railroad Commission's spacing rule and the protection of birds rule. A list of rules of the RRC can be viewed at: http://www.rrc.state.tx.us/rules/index.php (RRC 2010c).

Texas Coastal Management Program is a comprehensive management program for coastal land and water activities by the GLO to help manage and protect its natural resources. Policies related to land and water uses are part of this program and include: siting, construction, and maintenance of electric generating and transmission facilities; oil and gas exploration and production; siting, construction, and maintenance of residential, commercial, and industrial development on beaches, critical dune areas, shorelines, and within or adjacent to critical areas and other CNRAs (GLO 2010a).

It is responsible for (1) making the government accountable and responsive and by coordinating its actions with other agencies, (2) for promoting sustainable development on beach and dune systems and on coastal hazard areas beside Gulf shorelines, and (3) for inducing sustainable development in coastal wetlands and other marine areas (Office of Ocean and Coastal Resource Management, NOAA, & U.S. Department of Commerce 1996)

TCMP includes eight state agencies[4], 18 local governments, and the Coastal Coordination Council (CCC), which ensures that the agencies and local governments comply with the coastal policies. The implementation and enforcement of coastal policies are mainly the responsibility of those agencies and local governments through existing regulatory programs, statutes, and other authorizations.

The development of power plants and transmission lines is overseen by the Public Utility Commission (PUC). If an energy facility is located either in part or in whole within the CZ boundary, then it should state in its initial application to PUC that "this application includes facilities located within the coastal management program boundary as defined in 31 T.A.C. §503.1." Additionally, the energy company should specify if any part of the proposed facility is seaward of the Coastal Facility Designation Line and identify the type(s) of CNRA(s) that may be impacted (GLO 2010a)

PUC may then accept the application for the construction of generating or transmission facilities, but only if it determines that those facilities are consistent with the applicable goals and policies of the CMP, or that the facilities will have no significant impacts on any of the applicable CNRAs (PUC 2010).

For a project to be approved by the CCC, it must be subject to the consistency review process and must meet the goals and policies of the TCMP. The role of the CCC is to guarantee that all agencies, and in the case of energy facilities, that PUC complies with coastal policies. If necessary, the CCC can take legal action against agencies to assure compliance with TCMP policies.

Most renewable energy generation will occur offshore within Texas' territorial waters (to a distance of 9 nautical miles) and those projects must comply with the TCMP. The Texas General Land Office issues offshore leases and requires that the project be consistent with the CMP and must follow any Federal, State, and local rules, laws, ordinances or permits. Current offshore renewable energy projects have been determined to be consistent with the TCMP.

2. Please indicate if the following management categories are employed by the State or Territory and if there have been significant changes since the last assessment:

| **Management categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Statutes or regulations | Y | Y |
| Policies | Y | Y |
| Program guidance | Y | N |
| Comprehensive siting plan (including SAMPs) | N | N |
| Mapping or GIS | Y | Y |
| Research, assessment or monitoring | Y | N |
| Education and outreach | Y | N |

[4] General Land Office/School Land Board, Texas Natural Resource Conservation Commission, Railroad Commission, Texas Parks and Wildlife Department, Texas Transportation Commission, Texas Historical Commission, the Public Utility Commission, the Texas State Soil and Water Conservation Board, and the Texas Water Development Board.

3. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment;

*Statutes or regulations*

A few changes have occurred since 2005. The majority of those changes were laws enacted and amended, and financial incentives in the area of renewable energy (e.g. House Bill 469, and the solar and wind energy device franchise tax deduction). Due to the technical nature of the information provided, the material in Table 2 has been incorporated verbatim from the publication cited in each column.

Table 2: Statute and regulation changes

| Program | Description | Cited From: |
|---|---|---|
| **The Solar and Wind Energy Device Franchise Tax Deduction** | It was amended in 2008 to deduct the cost of a solar energy device from the franchise tax. | (DSIRE 2009). |
| **Local Option-Contractual Assessments for Energy Efficient Improvements** | In May, 2009, Texas passed legislation that allows municipalities to establish loans for energy efficiency and renewable energy improvements to property. This law creates the process for a municipality to be able to set the incentive program. | (DSIRE 2009). |
| **Department of Rural Affairs - Wind Energy for Desalination Program** | The Texas Department of Rural Affairs (TDRA) offers grants as high as $1.5 million to eligible local governments to use wind energy, or another renewable energy in conjunction with wind, to desalinate brackish ground water. | (DSIRE 2009). |
| **Texas Building Energy Code** | For buildings other than state-owned, energy codes must be adopted by local code jurisdictions. The goal is to demonstrate the benefits of these energy efficiency codes. The main target is state energy managers, city building officials, engineers, and architects. | (DSIRE 2009). |
| **Alternative Energy in State Construction** | Texas obliges state government departments to compare the costs of offering energy alternatives for new and reconstructed state government buildings and for specific construction or repair to energy systems and equipment. If the use of an alternative energy is economically feasible, then it should be included in the construction plans. Alternative energy here is defined as biomass, solar, wind, and geothermal energy. | (DSIRE 2009). |

| | | |
|---|---|---|
| **Mandatory Renewable Energy Educational Materials** | If a utility company must construct a line extension to a customer and the customer is in charge of paying a contribution, then the utility must provide the customer with information about on-site renewable energy alternatives. The information is determined to educate the public on available alternative options. | (DSIRE 2009). |

*Policies*

The amendment of the renewable portfolio standard in 2005 increased the renewable-energy mandate to 5,880 MW by 2015, including a target of 500 MW of renewable energy from sources other than wind, was a strong governmental action (DSIRE 2009). It probably spurred many financial incentives and regulations aimed at developing renewable energy sources.

*Mapping and GIS*

Besides historical maps, data, and research, GLO uses GIS, GPS, and CAD systems to gather, analyze, and allocate the most accurate information possible about the location of human and natural resources. GIS was first used at GLO in 1988 for legislative redistricting and surveying state lands. Since then, its use has increased significantly and its functions expanded to include supporting lease sales, oil spill response, stewardship of coastal resources, land surveying, and other business functions. The GLO offers over 100 GIS data layers to employees and the public. Some of the program areas in which GLO uses GIS include asset inspection, energy resources, oil spill response, coastal resources, and surveying (GLO 2010b).

Another important system is the Texas Natural Resources Information System (TNRIS), part of Texas Water Development Board. The mission of TNRIS is to integrate all of Texas natural resource data, socio-economic data, and the indexes related to that data to present a centralized information system (Texas Water Code 16.021). Its main task is to collect, organize, incorporate, and spread geospatial data and resources to support response, mitigation, and recuperation activities in the state and beyond its borders. Consequently, it plays an important role in the emergency management of situations such as hurricanes and other storms. In 2006, TNRIS started working on a new web-based mapping system called “Atlas”, which improves decision-making and spurs innovation. It offers easy and fast access to data and improved decision making by providing instant access to important data (TNRIS 2010).

b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and

All the significant changes occurred in the management categories were driven by non-CZM efforts. There were no projects in this category funded under the 309 program.

c. Characterize the outcomes and effectiveness of the changes.

The outcomes of the changes were an increase in renewable energy generation in the state of Texas from 2005 until 2010 and better planning with the use of GIS, such as reduced risk of oil spills, faster emergency response, and better management of Texas natural resources.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| New authority over coastal zone renewable energy facility siting | Regulatory and Policy | H |
| Implementation of new regulations and enforceable policies for renewable energy facility siting | Regulatory and Policy | H |

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

   **High** __X__
   **Medium** _____
   **Low** _____

   Briefly explain the level of priority given for this enhancement area.

The state of Texas has been a leader in energy production and consumption. Due to its large population, hot climate, and energy-dependent economy, Texas produces and consumes more electricity than any other state. However, things have been changing. The price of energy resources have been increasing, with crude oil prices reaching a peak in mid-2008. Public perception and associated concern over the contribution of fossil fuel use to climate change are shown everyday in the media and Texas has seen a steady decline in crude oil production while its demand for energy has been increasing. This gap turned the state into a net-importer of energy resources, which makes the state rely increasingly on foreign sources of energy to meet its demand for energy. As a response to the availability, cost, and impact of traditional energy resources on the environment, the state has been moving towards alternative sources of energy. In fact, with its vast natural resources, Texas has an enormous potential to become a leader in renewable energy overall, as it has with wind.

The demand for electricity in Texas has also been increasing faster than any other type of energy consumption and is expected to continue to grow. Natural gas generates around 50% of all the electricity in Texas. As seen previously, both natural gas production and demand for electricity are growing. However, the demand for electricity is increasing at a much faster rate than natural gas production. There is a clear need for Texas to develop alternative sources of energy to respond to the rising demand for electricity by its growing population.

The number of completed and proposed renewable projects has increased significantly in the CZ. Since the last report, three wind farms were built and at least seven more are being proposed onshore and offshore. There were no solar plants and subsequently there is one solar plant and one more being proposed in Houston. Three geothermal plants are planned along with eight LNG facilities. With the rapid growth of this industry in the Texas coast, it is significantly challenging to anticipate all the potential environmental impacts of the different technologies and possible locations where these renewable energy facilities might be. Texas needs to examine ways to minimize the potential impact such plants may have in the environment and this is why this enhancement area is of high priority. Clearly defined and comprehensive regulations or an equally effective mechanism and CMSP for siting of offshore energy facilities are solutions to decrease or mitigate the adverse impacts those facilities may have on the environment.

*Rules and regulations*

The BOEMRE, of the U.S. Department of the Interior (USDOI), established an Alternative Energy and Alternate Use program to approve and manage potential offshore renewable facilities on the OCS. The evaluation for granting leases, easements, and right-of-ways includes identifying environmental consequences and potential mitigation measures that could be appropriate for site-specific projects. The types of alternative projects analyzed are offshore wind, wave, and ocean current energy capture.

However, the OCS in Texas begins at nine nautical miles offshore, versus the smaller three nautical miles of most states. Since development is expected to occur close to the shore, the state of Texas has jurisdiction over the location of most proposed projects. Additionally, offshore facilities will have to include submerged transmission cables running to onshore locations and onshore locations will have to be built to support energy transmission.

Currently, there is no renewable power siting authority in Texas. Renewable power siting is unregulated by any level of government, so any review is voluntary. TPWD can be asked to review a project as if it were a project developed under NEPA. Texas Parks and Wildlife reviews projects that impact fish and wildlife resources and makes recommendations to minimize or mitigate adverse impacts (Stemler 2007).

Seeing this, there is a gap in regulation and policy over coastal zone renewable energy facility siting. Texas needs to implement regulations for proper siting of these types of energy facilities.

*Coastal and Marine Spatial Planning*

The Texas coast and adjoining waters are experiencing a growing number of important and often competing activities: recreational, cultural, energy, commercial, and conservation. These activities impact both our natural resources and our economy. At the rate humans are using the ocean and the coast, it is challenging to plan and manage those natural resources. Consequently, it is very important to develop tools that will enable us to do so.

Coastal and Marine Spatial Planning (CMSP) is a tool that utilizes stakeholder input to create a more comprehensive picture of a coastal and marine region. It recognizes areas more suitable to human uses in order to maintain ecological, economic, and cultural resources for the future. It identifies where and how a marine and coastal area is being used and what habitats and

natural resources exist. It is an instrument that has the potential to address future challenges while assuring the health and productivity of Texas natural resources (White House Council on Environmental Quality 2009).

The Texas coast is a shallow subtropical area especially vulnerable to climate change, ocean acidification, sea level rise, invasive species, etc. The Gulf of Mexico and the Texas coast are also very important to the U.S. economy. Oil and gas resources located in the Gulf are essential to the nation's economy and renewable energy sources are becoming more and more important. Population growth and coastal development offer additional stressors. CMSP can help address these challenges and identify areas more suitable for specific activities in order to reduce use conflicts, facilitate compatible uses, reduce environmental impacts, and safeguard critical ecosystem services to meet economic, security, environmental, and social objectives (McKinney 2009).

Projects related to energy and government siting have not received 309 funding in the past (T. Brooks, personal communication, January 28, 2010). The increasing interest in the Texas coast and the important and often competing uses of the marine resources show the need for action. The two regulatory gaps, coastal zone renewable energy siting authority and coastal and marine spatial planning, offer a solution to manage both human uses and the natural resources while assuring the health and productivity of the latter (White House Council on Environmental Quality 2009).

2. Will the CMP develop one or more strategies for this enhancement area?

**Yes** _X_
**No** ____

# *Aquaculture*

**Section 309 Enhancement Objective**

Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the CZ, which will enable States to formulate, administer, and implement strategic plans for marine aquaculture

**Resource Characterization**

*Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.*

1. Generally characterize the private and public aquaculture facilities currently operating in your state or territory.

According to information collected by TAA (Treece 2009), the Texas Aquaculture Industry annually produces close to 40 million pounds of aquaculture products. This has increased by 10 million pounds in recent years and in large part is due to the increase in catfish production. The industry has a net worth of approximately $57 million, which also includes the sale of water garden plants, ornamentals, filters, stocker tilapia fingerlings, and others. However, these items are not included in the annual production weight. The aquaculture industry is estimated to contribute over $171 million to the Texas economy. Similar to the previous CMP (2006-2010 309 Assessment and Strategy Report), channel catfish is the largest aquaculture crop in Texas in 2008 with an estimated production of 28 million pounds worth an estimated $22.4 million. The other major products were marine shrimp, sportfish (red drum and spotted seatrout), hybrid striped bass, tilapia, aquatic plants, ornamentals, and alligators (Table 1). Previously, the Pacific white shrimp industry was the second most valuable crop, but it peaked in 2003 and has since been declining, with only 3.73 million pounds produced in 2008. Although the Texas marine shrimp aquaculture sector has historically been one of the highest contributors of the aquaculture industry, the farm gate price has been low since 2004. The low prices have caused low profit margins for operators, which has decreased the economic interest in shrimp farming. Several shrimp farms have been converted to hybrid striped bass production or redfish production in order to diversify their products to account for low farm-gate prices (Table 1). The increase in redfish production has increased the farm gate price to $2.78/lb in 2009.

New regulations on offshore aquaculture in Texas coastal waters were adopted in 2007. Only one facility in Texas has been permitted to begin production. However, due to problems with a lease from GLO, the company dropped the project. As of early 2010, there were no offshore facilities operating in Texas. Details about each aquaculture facility and the recent trends can be found in Table 1. For more detailed information please refer to Treece (2009).

Table 1. Resource Characterization

| **Type of existing aquaculture facility** | **Describe recent trends** | **Describe associated impacts or use conflicts** |
|---|---|---|
| Catfish | Production has rapidly increased by 16.5 million pounds from 2004-2008; however, it slowed in 2009. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. User conflicts are mostly from increased U.S. imports. |
| Red drum (5 operators) | Production has increased steadily from 2004 – 2008, with approximately 4 million pounds produced in 2009. 12 million fingerlings are released annually for stock enhancement in Texas bays. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Hybrid striped bass (4 operators) | Production has increased steadily by 2 million pounds from 2004 – 2008. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Marine shrimp (7 operators) | Production has steadily decreased by 4.2 million pounds from 2004-2008. A reason for the decrease is that many farms have been converted to finfish farms. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems, invasive species (e.g. release of Pacific white shrimp to Texas waters), as well as diseases such as TSV and WSSV that may threaten native shrimp stocks.<br><br>User conflicts include an increase in import of shrimp to the U.S., dropping farm-gate prices of shrimp in Texas by $2.00/pound. |
| Water Gardens | These facilities have not changed recently and are worth approximately $7 million. | Impacts from water gardens are generally thought to be minimal; however, there is a real threat of non-native plant introductions. |
| Aquatic nursery (5 operators) | There has been no change in production levels in the last 5 years. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. There is also a threat of non-native plant introductions. |

| | | |
|---|---|---|
| Sportfish (not red drum)<br>(44 farms) | Production levels for sportfish have not changed over the past 5 years, with approximately 13 million individual fish produced each year. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Trout<br>(3 operators) | There was no production in 2004, and current production values were not reported by the 3 operators | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Crawfish<br>(20 operators) | Production levels have remained consistent with approximately 800,000 pounds produced annually. | Impacts include discharge of TSS, which can cause turbidity and sedimentation problems. Disease can also be a problem, such as WSSV. |
| Tilapia (food)<br>(3 operators) | There has been approximately 100,000 pound decrease in production from 2004 – 2008, with approximately 500,000 pounds produced in 2008 | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Tilapia (stocking)<br>(13 operators) | There has been no change in production. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems and invasive Tilapia invading native waters. |
| Ornamentals<br>(27 operators) | The value has steadily increased every year from 2004 – 2008 with the most recent value at $892,000. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems, as well as threat of ornamental species invading native waters. |
| Baitfish<br>(25 operators) | There has been no change in the annual production of 81,000 pounds from 2004 – 2008 | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Alligators<br>(12 operators) | There has been no change in the value of $100,000 from 2004 – 2008. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |
| Other food fish | Total production was estimated at 7 million pounds in 2008. | Impacts include discharge of TSS that can cause turbidity and sedimentation problems. |

**Management Characterization**

Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.

1. For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:

Generally, there were very few significant changes since the last CMP assessment. The only areas that did significantly change were with addition of new aquaculture regulations and policies for the expansion of aquaculture into Texas offshore waters. With the three main agencies (TCEQ, TPWD, and the TDA) working under a MOU, changes in regulations and policies from one agency are reflected in the others as well. Below we have described what specific regulations have been adopted and/or changed.

Table 2. Management Characterization

| **Management categories** | **Employed by state/territory** (Y or N) | **Significant changes since last assessment** (Y or N) |
|---|---|---|
| Aquaculture regulations | Y | Y |
| Aquaculture policies | Y | Y |
| Aquaculture program guidance | Y | N |
| Research, assessment, monitoring | Y | N |
| Mapping | Y | N |
| Aquaculture education & outreach | Y | N |

2. For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.

    a. Characterize significant changes since the last assessment
    b. Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and
    c. Characterize the outcomes and effectiveness of the changes.

*Aquaculture regulations and policies*

The main changes to aquaculture regulations and policies were due to implementation of new offshore aquaculture regulations adopted in 2007. There have been several amendments to the regulations since they were originally adopted. TPWD Aquaculture regulations can be found in Texas Administrative Code, Title 31, Chapter 57, Subchapter C. Although there is still no Federal permitting framework in place beyond state waters, TPWD offshore aquaculture regulations apply to facilities within the 9 mile state boundary. These changes are effective in helping to regulate offshore aquaculture facilities by providing a strict permitting framework. Currently, there are no offshore aquaculture activities due to the high cost of establishing and maintaining facilities and the risk associated with storms and other environmental issues. As previously described only one offshore project has been permitted in Texas, but there were problems with a lease from GLO and the company dropped the project (Treece 2009).

There were also aquaculture regulation/policy changes made in Texas Agriculture Code, Title 6, Subtitle A, Chapter 134. This section was amended in 2004 (134.018) and it added regulations that a license is not required for sale of certain fish, and within 30 days the buyer (who holds the aquaculture license) must submit an invoice of fish sold to TPWD. This change was driven by non-CZM efforts, and effectively allows for sale of aquaculture species to be sold that are not exotic fish, shellfish, or aquatic plants, as long as the buyer has an aquaculture license.

There were changes to aquaculture regulations on redfish and spotted seatrout in: Texas Administrative Code, Title 31, Part 2, Chapter 57, Subchapter C. This change was driven by non-CZM efforts, and these small regulatory changes were minimal. These changes were effective in regulating the marketing of cultured redfish and spotted seatrout, license application, as well as associated fees.

**Priority Needs and Information Gaps**

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy).

Table 3. Priority needs and information gaps.

| **Gap or need description** | **Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach) | **Level of priority** (H,M,L) |
|---|---|---|
| Offshore Aquaculture | Data, training, capacity, communication & outreach | L |
| Biofuels | Regulatory, policy, data, training, capacity, communication & outreach | M |

There is still a need for more information for offshore aquaculture and the types of environmental impacts that may be associated with these facilities. The Gulf of Mexico Fisheries Management Council approved an offshore aquaculture amendment in January 2009 to allow for commercial production in Federal waters. Although there is high potential for offshore production, currently production and maintenance of facilities is not cost effective. Due to these constraints in the development process, experts in the offshore arena suggest development of offshore facilities in the near future is unlikely. Therefore, the priority level for this area is determined as low (Treece 2009).

The TPWD has reported that various entities have proposed to explore algal biofuels as alternative energy sources. The proposals have included cultivation of native, non-native, and genetically-modified algal stocks in open-air ponds. There are currently no regulations or policies in place for this type of aquaculture and impacts from escape of non-native and genetically-modified algal stocks are of concern and could be a threat to native species. Thus, development of management plans for biofuel production in the aquaculture industry has been considered a medium priority.

**Enhancement Area Prioritization**

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

| | |
|---|---|
| **High** | _____ |
| **Medium** | _____ |
| **Low** | __X__ |

Briefly explain the level of priority given for this enhancement area.

The level of priority for aquaculture has varied among CMP assessments. The previous assessment moved the priority of this area from low to medium, because the state did not have a comprehensive permitting and regulation framework for offshore aquaculture. There was also little scientific data to fully understand the associated environmental impacts, as well as user impacts, from offshore facilities.

Currently, the recommendation for this enhancement priority is low because Texas has in place strong regulations for offshore aquaculture. The Gulf of Mexico Fisheries Management Council approved an offshore aquaculture amendment in January 2009 in federal waters, but the Federal government (U.S. Department of Commerce and NOAA) has not provided a management framework. The current feasibility of offshore aquaculture operations in state waters is unrealistic, and most experts agree that these operations in federal waters are too expensive and few companies will venture offshore when margins are so small and operating costs and risks of storms are high (Treece 2009). Additionally, the permitting requirements are very high, and TAA is not anticipating new operations on the Texas coast.

2. Will the CMP develop one or more strategies for this enhancement area?

| | |
|---|---|
| **Yes** | _____ |
| **No** | __X__ |

Briefly explain why a strategy will not be developed for this enhancement area.

Strategies are not developed for low priority areas.

# *Strategy - A Vision for Our Texas Coast: Framework Development for Coast-wide Planning*

**I. Issue Area(s)**

The proposed strategy or implementation activities will support the following priority (high or medium) enhancement area(s) *(check all that apply)*:

- ☐ Aquaculture
- ☑ Energy & Government Facility Siting
- ☑ Coastal Hazards
- ☑ Ocean/Great Lakes Resources
- ☐ Special Area Management Planning
- ☑ Cumulative and Secondary Impacts
- ☑ Wetlands
- ☑ Marine Debris
- ☑ Public Access

**II. Program Change Description**

**A.** The proposed strategy will result in, or implement, the following type(s) of program changes *(check all that apply):*

- ☐ A change to coastal zone boundaries;
- ☑ New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;
- ☐ New or revised local coastal programs and implementing ordinances;
- ☐ New or revised coastal land acquisition, management, and restoration programs;
- ☐ New or revised Special Area Management Plans (SAMP) or plans for Areas of Particular Concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
- ☑ New or revised guidelines, procedures and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government and other agencies that will result in meaningful improvements in coastal resource management.

**B.** *Describe the proposed program change(s) or activities to implement a previously achieved program change. If the strategy will only involve implementation activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)*

The Texas coast and adjoining waters are experiencing a growing number of important and often competing activities such as maritime transportation, oil and gas drilling, development of offshore and coastal renewable energy, and waste disposal. These conflicting uses extend into recreational and conservation activities such as kite and wind surfing, kayaking and boating, bird watching and swimming, etc. Traditionally, these activities have been managed on a sector-by-sector and case-by-case approach resulting in a variety of conflicts among users and between users and the marine environment. This situation causes decision-makers and stakeholders to merely react to events rather than having the opportunity to plan and shape actions that could lead to more cost-effective and desirable outcomes.

While general planning and mapping of coastal areas for a variety of purposes has been conducted in Texas, it has been acknowledged that a more integrated and comprehensive approach to planning, managing, and preventing conflict within the state's coastal and marine areas is needed. This approach can be achieved through the state's engagement in comprehensive coastal and marine spatial planning (CMSP). CMSP would serve as an integrated framework for coastal management that provides a guide for, but does not replace, single-sector planning.

CMSP has become a centerpiece of the President's Final Recommendations of the Interagency Ocean Policy Task Force published on July 19, 2010 (IOPTF, 2010). These recommendations propose development and implementation of CMSP that is national in scope, but based on the special needs of nine regional large marine ecosystems, including the Gulf of Mexico Region. Texas would fall within the Gulf of Mexico Region along with the states of Florida, Alabama, Mississippi, and Louisiana. As envisioned, the CMSP process will require regional planning bodies to engage in a nine step planning process that will: 1) identify regional objectives, 2) identify existing efforts in the region, 3) engage stakeholders and the public at key points in the process, 4) consult scientists and other experts, 5) analyze data, uses, services, and impacts, 6) develop and evaluate alternative future use scenarios and tradeoffs, 7) release for public comment a draft plan with supporting environmental impact analysis documentation, 8) create a final plan and submit for National Ocean Council review, and 9) implement, monitor, evaluate and modify the approved plan. (IOPTF, 2010, p. 55)

Texas would benefit from engaging in its own CMSP process as an effective means of supporting and magnifying local planning objectives and minimizing user conflicts in the state's coastal zone before engaging in the regional CMSP effort. It is anticipated that states that have initiated their own CMSP process will have those efforts incorporated into the regional planning process. The proposed regional plan will not be regulatory or supersede existing federal or state legal authority; effective implementation will depend on existing federal and state authorities and coordination mechanisms.

Clear benefits will accrue to Texas and the nation by initiating a state CMSP process using Section 309 funding rather than waiting on future federal funding for the proposed regional planning effort. By initiating a state planning process independent of the federal and regional effort, Texas will be better able to identify and tailor the planning process to meet the unique needs of its citizens prior to joining the proposed regional process. It will also allow Texas to take a leadership role in future collaborative regional meetings, as well as influence how that process unfolds.

## III. Need(s) and Gap(s) Addressed

*Identify what priority need the strategy addresses, and explain why the proposed program change or implementation activities are the most appropriate means to address the priority need. This discussion should reference the key findings of the Assessment and explain how the strategy addresses those findings.*

All high and medium priority enhancement areas will be addressed by this proposed CMSP strategy. No other strategy offers the kind of cross-cutting and integrated response to gaps and needs identified in the assessment portion of the report as CMSP. While each of the needs could be addressed by other methods, a CMSP strategy provides the most effective approach to address the largest number of high priority needs in an integrated and comprehensive manner.

Advances made in this effort will also be fully compatible with the broader regional CMSP planning process envisioned in the Interagency Ocean Policy Task Force Recommendations.

Several gaps and needs were identified that relate to the status and trends of *Wetland* habitats. The main barrier to assessment is the lack of mitigation tracking and enforcement. The need to update the wetland permit tracking program along with creating a centralized database is essential to the compilation of wetlands data for CMSP. Additionally, this strategy will identify and fill data gaps that classify indicators of biological response to fresh water inflows. This will be useful to support Senate Bill 3 efforts from the bay and basin expert science teams. The strategy's proposed Coastal Management Change Analysis will determine gaps and inconsistencies in the State's legal authority over freshwater inflows and recommend program changes to facilitate the implementation of the Senate Bill 3 process.

High priority needs in the *Public Access* enhancement area include: regulatory improvement in managing public access facilities that have been destroyed due to natural disasters; information on the effects of sea level rise on public access; understanding the practical impact on public access to beaches as a result of the *Severance* judicial decision and increases in education, outreach and communication on the location and status of public access sites. Engaging in a CMSP planning process is an important and effective means to address each of these needs. Changes to beaches, dunes and barrier islands will reshape public and private property boundaries on a vast scale and intensify existing coastal land use conflicts. CMSP will help identify where these conflicts may potentially occur and develop criteria to allow coastal stakeholders a voice in prioritizing uses. In the absence of a CMSP process, especially in light of the recent *Severance* decision, litigation will become an increasingly common method of resolving disputes and many of the gains provided by coastal management plans may be diminished. Secondary benefits of this planning process to provide public access include economic gains through tourism, habitat protection, reduction of property exposed to natural hazards exacerbated by sea level rise and erosion, and improvements in the public's understanding of coastal dynamics and the importance of public access to their quality of life. As a result of the science-based and stakeholder driven CMSP planning process, the state will be in a better position to determine the public's needs in regard to public access, to reduce user conflicts, and to evaluate the best method of regulatory reform, if necessary.

Assessment findings on *Cumulative and Secondary Impacts* point to a need for more effective planning in coastal areas to mitigate vulnerability to sea level rise and natural hazards; to assist in the planning for coastal and offshore wind farms and other renewable energy activities; and to improve planning in unincorporated portions of coastal counties. Coastal and marine spatial planning will provide a comprehensive and integrated mechanism to collect environmental, socio-economic, and policy information and to improve planning throughout the Texas coastal zone.

CMSP is specifically cited in the assessment section on *Ocean Resources* as an important tool to improve the effectiveness of managing these resources. The assessment identified that five of nine management categories lack comprehensive and integrated management plans or systems. The assessment recommends that Texas' CMSP should be developed in collaboration with similar efforts being undertaken by the Gulf of Mexico Alliance (GOMA) or other entities. GOMA is engaged in a variety of coastal planning and mapping projects that are relevant to the management of ocean resources. Texas' CMSP effort will closely partner with GOMA to identify existing planning efforts, data management products and decision tools to maximize

efficiencies and avoid duplication of effort. However, it is also important for Texas to engage in its own CMSP process. Texas' needs and objectives will be met by prioritizing state objectives, identifying existing efforts, engaging state stakeholders, and developing the data, analyses, and guidance relevant to state policy-makers. By initiating its own CMSP process, Texas will be in a strong position to have those efforts relating to managing natural resources incorporated directly into future regional planning processes.

*Marine debris* has moved from an aesthetic or nuisance problem to a marine life endangerment and death (from ingestion and entanglement) problem, and to an economic liability for coastal communities (costs for cleanup and deterrent for visitors) problem. There is a need for education and outreach to the general public. The gathering and compilation of debris source data, wildlife impact assessments, along with human use data will be vital in developing priority areas and effective management plans. A CMSP framework will provide a mechanism to better attain these policy goals. For example, by correlating spatial data and generating maps that illustrate impacts associated with marine debris, the public will be better able to visualize the problem and contribute to a more effective management plan.

Assessment of *Energy and Government Facility Siting* also explicitly recommends CMSP as a method of addressing future challenges relating to offshore renewable energy facilities while taking care not to place more stringent restrictions on such facilities than what has been traditionally observed in the oil and gas industry. Although Texas has focused on the economic benefits to the state from oil and gas development, concerns over coastal resiliency and ecological health are now being addressed as well, and with the addition of wind energy, the pressure on the resource management system to incorporate these new uses will surely increase. CMSP can help address these challenges and identify areas more suitable for specific activities in order to reduce use conflicts and to facilitate compatible uses.

The Assessment of *Coastal Hazards* emphasizes the need for geospatial data to plan for, mitigate, and recover from impacts of storms, erosion, and sea-level rise. Training for local staff in how to plan for changes in coastal environments and public outreach regarding coastal processes are also needed. Coastal marine spatial planning is a process that will involve integrating geospatial data on the built and natural environments. These data are also needed for coastal hazards analysis. Projections on how the coast will change with ongoing sea level rise, erosion, and storm impacts are also important for CMSP when considering the suitability of an area for various human uses. Furthermore, the public process of CMSP will be a vehicle for training and outreach regarding coastal hazards.

## IV. Benefit(s) to Coastal Management

*Discuss the anticipated effect of the program change or implementation activities including a clear articulation of the scope and value in improved coastal management and resource protection.*

Improved coastal management can be achieved by developing a robust CMSP process in Texas. Rather than focusing on individual coastal sectors and projects, it would be able to gather information on current and emerging human uses, environmental conditions, and stakeholder attitudes and assess tradeoffs and cumulative effects. This strategy will bring all stakeholders to the table to jointly determine the goals and objectives for the Texas coast and to provide a CMSP framework document that will be used in implementing a CMSP process to maximize use while minimizing conflicts. The framework will guide state policy-makers in developing a CMSP to

balance ecological, social, economic, and governance objectives; create greater certainty and less risk for users; and streamline permitting and regulation.

## V. Likelihood of Success

*Discuss the likelihood of attaining the proposed program change and implementation activities. The state or territory should address: 1) the nature and degree of support for pursuing the strategy and the proposed change; and, 2) the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.*

The likelihood of success in attaining program changes, at this point is somewhat difficult to gauge, but should be achievable. Unlike some other states, creating a CMSP framework in Texas will take place without the authority or guidance of a legislatively generated Oceans Act. Instead of a top down approach, support for success will need to be generated on a grass roots level. Consequently, success will depend on convincing coastal stakeholders, interested government officials, and the general public of the benefits provided by CMSP. This can be best accomplished by providing key stakeholders with a voice in determining the overall goals and priorities of the planning effort and by providing them with a mechanism to register their aspirations and concerns during the process. Public meetings and stakeholder workshops will identify important issues to address, develop criteria to prioritize uses, and devise ways to better plan for these outcomes.

Similarly, support from legislators and other government officials will be strengthened by reassuring them that the purpose of the CMSP framework is to examine methods of improving and streamlining existing legal authorities rather than adding new laws and regulations. The proposed effort to analyze laws, regulations, and programs with regard to Texas' coastal and ocean resources is intended to facilitate and simplify integrated CMSP, not add regulatory complexity. In fact, coordinating uses that include international, federal, state, and local jurisdictions will reduce the cost and improve the efficiency of implementing existing legal and regulatory requirements.

Public support will be enhanced by education and outreach efforts that explain how the CMSP framework will promote economic opportunities by fostering sustainable uses of coastal and ocean areas without significant detriment to the areas' ecology or natural beauty. The public will also gain a better understanding of how user conflicts can be reduced and unique public trust resources protected by actively incorporating existing scientific data and mapping technologies into coastal management decision-making processes.

The proposed CMSP framework strategy provides a foundation to be responsive to the needs and aspirations of affected coastal stakeholders, government officials and the general public, among others. Although unanticipated problems may emerge, there is a high probability of success in achieving the goal of creating a useful and robust CMSP framework in Texas. All parties involved in developing the strategy are eager to take positive steps to begin the process and believe that CMSP can be used as an important tool to address problems that may otherwise be overwhelming in their breadth and complexity. Dr. Larry McKinney, Director of the Harte Research Institute for Gulf of Mexico Studies and former Director of Coastal Fisheries at the Texas Department of Parks and Wildlife, summarized this prevailing view in his recent testimony on CMSP before the Interagency Ocean Policy Task Force when he said, "If a [C]MSP process can identify sensitive areas for conservation or otherwise protect critical

ecosystem services and functions, that subsequently reduce or eliminate regulatory actions, it will be a win for all, promoting and building broad stakeholder confidence and trust."

## VI. Strategy Work Plan

*Using the template below, provide a general work plan that includes the major steps necessary for achieving the program change and/or implementing a previously achieved program change. The plan should identify significant projected milestones/outcomes, a schedule for completing the strategy, and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual outcomes are a useful guide to ensure the strategy remains on track, OCRM recognizes that these benchmarks may change some over the course of the five-year strategy due to unforeseen circumstances. The same holds true for the annual budget estimates. If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. Further detailing of annual tasks, budgets, benchmarks, and work products will be determined through the annual award negotiation process.*

Total Year(s): 1-5 (FY 2011-FY 2015)

Total Budget: $2,465,600

Workplan:

**Task 1: <u>Administration</u>**

**Description of work**: A program administrator will be hired to oversee and orchestrate all tasks within the CMSP process. A Core Planning Committee will be established to guide the direction of the overall CMSP process. The Core Planning Committee will be comprised of members of the networked agencies, similar to the current 309 grant core group. The program administrator will also be responsible for organizing and supporting subcommittees under the following tasks and conducting other duties as necessary.

Year(s) 1-5

**Outcome:** Hire program administrator to oversee years 1-5. Form core planning team.

**(Total Budget Task 1: $200,000)**

**Task 2: <u>Coastal Resources Data Gathering and Assessment</u>**

**Description of work**: A comprehensive review of available data and information resources needed to implement CMSP in Texas. A Data Standards Committee composed of all state agencies involved in coastal management programs and other key partners will oversee the discovery, compilation, documentation, and evaluation of existing geospatial and related data required for CMSP. GLO will hire a sub-contractor to carry out this task. With guidance and input from the Data Standards Committee, the contractor will conduct an analysis and write a summary report on inter-agency data compatibility issues, standards/formats for data, and

existing data repositories (such as TNRIS). This report will guide workshops to identify a list of datasets, priority data needs, and establish data quality standards. A list will be compiled of applicable data sources from local, state, and federal governments, as well as universities, NGO's, and industry entities. From these sources, GOMA protocols will be used to discover, document, catalog, and compile, when necessary, geospatial data that have the potential for use in CMSP by all parties involved. Currently, GOMA is compiling geospatial "map" data related to coastal and marine habitats from the five Gulf States including Texas. The GOMA effort is focusing on natural environment and non-federal geospatial datasets in the following eight "core" data layers: seagrass, emergent vegetation, sediments, oysters, bathymetry, topography, intertidal maps, and hard bottom. This strategy will take advantage of the GOMA effort and expand data compilation to other types of geospatial data needed for CMSP.

Texas has several state agencies where geospatial data are stored that could be applied to CMSP. A few examples include shorelines and habitat maps at the Bureau of Economic Geology, coastal leases and facilities at the Texas GLO, fisheries data at TPWD, hydrologic data at the Texas Water Development Board, transportation infrastructure at the Texas Department of Transportation, and historical and recent photography at the Texas Natural Resources Inventory System. In addition to state agencies, universities undoubtedly hold collections of geospatial data valuable for CMSP, and local communities through their planning efforts may, as well. Finally, federal datasets such as census data, bathymetry and navigation, and offshore lease and infrastructure are numerous and essential to include in CMSP. Much of the geospatial data is in the form of "map" data such as land cover classifications or maps of public lands, but monitoring and sampling data, such as species counts, stream flow, and beach topographic profiles are also useful and must be incorporated into an overall dynamic geospatial view of a region.

The Data Standards Committee will report its recommendations for a CMSP data network based on the workshops and reports to the Core Planning Committee. This process will identify data gaps and needs and extra funding will be allocated to collect missing data sets identified by the Data Standards Committee as essential.

Three major sub-tasks over a period of five years will be undertaken: (1) data inventory, characterization, and compilation; (2) identify data gaps; and (3) identify data needs. These sub-tasks will be conducted in coordination with the other steps in the strategy. It is expected that as the other steps ingest data and information compiled in this step, data needs will become better known. This will guide adjustments in the types of data that are sought and how data are assessed.

Sub-task 1: *Data Inventory, Characterization, and Compilation*
Year(s) 1 – 3

1. Create Data Standards Committee.
2. Summary report to the Data Standards Committee on inter-agency data compatibility, format, location, and existing data repositories.
3. Summary reports of data standards stakeholder workshops held.
4. Follow the protocols that GOMA is using to discover, document, catalog, and compile; when necessary, geospatial data that have the potential for use in CMSP by all parties involved including, but not limited to, local, state, and federal governments, as well as universities, NGO's, and industry entities.
5. Identify data sources from local, state, and federal governments, as well as universities, NGO, and industry entities. We expect that some valuable historic data only exist in

hardcopy form. Therefore, hardcopy maps and reports will also be identified and decisions on scanning, digitizing, or simply cataloging them will be made for each case.

6. Develop a catalog of metadata

As data are discovered, their geospatial integrity will be determined and evaluated based upon Data Standards Committee findings. If a dataset is relevant to CMSP, a check of the metadata for correctness and completeness will proceed. If FGDC compliant metadata does not exist, it will be created by consulting with the generators of the data or experts on the particular data type. Metadata review will focus particularly on if there is enough information so that the data may be properly interpreted and used for resource management, scientific research, and CMSP. All metadata records will be managed online using the Metadata Enterprise Resource Management Aid (MERMAid, http://www.ncddc.noaa.gov/activities/mermaid) tool, which is supported by the NOAA National Coastal Data Development Center (NCDDC).

All metadata will be cataloged in the NCDDC EcoWatch Catalog http://ecowatch.ncddc.noaa.gov . Ecowatch is an online data discovery portal. GOMA data compilation efforts are using Ecowatch to make data discoverable to researches and the public. The NCDDC, through their support and participation in GOMA, has created a regional data discovery service for the Gulf of Mexico http://ecowatch.ncddc.noaa.gov/catalog/gom . The effort under this strategy will work with the NCDDC and GOMA to add geographic query controls for Texas and subject search controls for CMSP to the EcoWatch system.

**Outcome:** Data Standards Committee will oversee the development a catalog of data and metadata.

Sub-task 1 Budget (Years 1-3): $330,000

Sub-task 2: *Identify Data Gaps*
Year(s) 2 - 5

1. Examine the geospatial map and non-map data to determine where information gaps occur.
2. Characterize datasets by attributes such as age, spatial resolution, time resolution, and quality.
3. Datasets with approved quality based upon Data Standards Committee findings will be mapped to actual data footprints for visualization of data gaps. This analysis will help guide new data acquisition efforts.

**Outcome:** Develop a data gap analysis

Sub-task 2 Budget (Year 2-5): $182,000

Sub-task 3: *Identify Data Needs and Collect Missing Data Sets*
Year(s) 3 – 5

1. Use the data gap analysis in sub-task 2 and work with those performing the other tasks to determine the critical unmet data needs for CMSP. A new data acquisition plan will be produced in year 3 and revised in years 4 and 5, as appropriate. This plan will be

coordinated with the ongoing GOMA Gulf of Mexico Master Mapping Plan Project and the Gulf of Mexico Coastal Ocean Observing System (GCOOS).
2. Collect missing data sets deemed essential by the Data Standards Committee if funds permit.

**Outcome:** Develop a new data acquisition plan and begin collecting missing data sets.

Sub-task 3 Budget (Year 3-5): $113,800

**(Total Budget Task 2: $625,800)**

**Task 3: <u>Establish Data Serving, Visualization, and Collaboration Tools for CMSP</u>**

**Description of work:** Determine and implement a strategy for storing and serving data and information. This will involve hardware, software, and data management and access protocols and enable the development of a geodatabase and decision-making support tools for CMSP. It is critical that all coastal decision makers have access to the same datasets and tools for making decisions and managing coastal resources along the Texas coast. This step will adopt/update existing data repository resources. It will also develop an inter-agency geodatabase and spatial modeling tools to facilitate visualization and interpretation of data for coastal resource management decisions. This geodatabase will improve state information systems so as to better assess, track, and manage permitting activities and/or coastal resource use in the coastal zone to inform decision making as it pertains to coastal management.

Year 2
1. CMSP data serving

Not all datasets will need to be compiled on a new server, and it is anticipated that some types of information, such as reports or raw data, will reside in the Texas Digital Library (TDL). The TDL is a consortium of Texas universities that provides open access to scholarly assets and enables long-term preservation of digital collections. Using the TDL for appropriate data types will ensure persistent links to the information. Furthermore, if a geospatial dataset resides on a stable Open Geospatial Consortium (OCG) compliant server, it may not be necessary to copy it. It is expected, however, that for this strategy a new data repository or expansion of an existing one will be needed to house “homeless” geospatial datasets and, in some cases, to improve access to datasets for visualization and computational applications to be developed for CMSP. Access to monitoring data, such as tides and water quality, will be arranged in collaboration with The Gulf of Mexico Coastal Ocean Observing System (GCOOS) and Texas Coastal Ocean Observation Network (TCOON).

**Outcomes:** Establishment of a CMSP data server.

Year(s) 2 – 5
1. Visualization and collaboration tools for CMSP

This task will utilize data compiled and collected from task 2 to map ecologically significant areas, human use, socio-economic values, and physical/oceanographic features using

web-based and geoprocessing software. This will allow for visualizing, analyzing, and reviewing geospatial data relevant to use conflicts within the planning area. This task will create a decision support tool that enables all involved in the CMSP process access to the pertinent and various forms of information and analyses. A mapping application will provide spatial information to develop management scenarios. The mapping platform will allow users to view information in conjunction with contextual layers, such as aerial imagery, topographic maps, zoning, or other relevant datasets, and provide data symbolization choices based on attributes chosen by the user. Data investigation capabilities will include functions such as identify, query, and spatial query. It will allow users to select a zone and obtain detailed information while query gives the user the ability to generate a list of zones meeting user-defined criteria. Using spatial query, users can draw a shape on the map, and generate a list of zones which touch or fall within the shape. Spatial visualization will also provide a clear picture of location of data gaps.

**Outcome:** Develop a decision support tool which includes a GIS mapping application for data visualization and interpretation for decision making.

Year(s) 2-5 Budget: $300,000

**(Total Budget Task 3: $300,000)**

**Task 4: <u>Coastal Management Program Change Analysis</u>**

**Description of work:** A legal guidance team will be developed with representatives of other agencies involved in coastal planning to analyze existing laws, regulations, and programs with regard to Texas' coastal and ocean resources. The purpose of this analysis would be to determine the State's legal authority over coastal and ocean resources and to recommend program changes to facilitate integrated CMSP. Provide legal support for CMSP framework development and implementation.

Year(s) 1-3: Program and Regulatory Analysis

1. Organize a legal guidance team
2. Analyze existing local, state, national, and international laws, regulations, and programs with regard to Texas' coastal and ocean resources.
3. Develop a draft report summarizing regulatory analysis and recommending program and rule changes as informed by analysis findings, input during the planning process, and stakeholder outreach.

**Outcome:** Draft report on regulatory analysis of Texas' coastal resources and program/rule change recommendations

Year(s) 1-3 Budget: $225,000

Year(s) 4-5: Inform and assist the Core Planning Committee in CMSP framework policy and program change development. Identify paths for plan implementation and draft program and rule changes, as necessary.

Year 4-5 Budget: $150,000

**(Total Budget Task 4: $375,000)**

**Task 5: <u>Framework Development for Future Coastal and Marine Spatial Planning Efforts</u>**

**Description of work:** GLO will hire a contractor to assist in the planning and development of a work plan for the CMSP effort. A report of successful CMSP efforts undertaken elsewhere will be compiled and submitted to the Core Planning Committee for review with recommendations on applications for Texas. The Core Planning Committee will utilize this report along with resources and recommendations from the Data Standards Committee during meetings and workshops to create a detailed work plan (milestones, schedules, budget, etc.) for the development of a framework for CMSP efforts. They will work with the Core Planning Committee, and outside technical experts as needed, to establish a set of principles, a set of general goals, clear and measurable objectives and an assessment of the risks. Develop and put into place the framework and procedures that are an essential foundation to CMSP. This process will organize the planning team that will lead the project and determine the principles, goals, and objectives for the planning process. A draft CMSP framework document will be prepared with stakeholder group and public input.

Year(s) 1-2:

1. Survey and analyze successful coastal and marine spatial planning efforts undertaken elsewhere for guidance. Provide a report to the planning team that summarizes these findings and can be used as a basis for determining the approach taken in Texas' planning effort.
3. Create a detailed work plan including milestones, schedules and budgets.
4. Hold meetings/workshops between the planning team, outside technical experts, and selected stakeholders to develop a set of principles, goals, performance measures, and objectives for the planning process.

**Outcomes**: Implement procedures, principles, goals, performance measures, and objectives that will guide the next phase of the planning effort.

Year(s) 1-2 Budget: $135,400

Year(s) 3-4:

1. Collect and assemble the information obtained from Tasks 2-4 and draft a CMSP framework document. The drafting of this plan should be in consultation with stakeholders identified in Task 6.
2. Create a procedure to identify future information needs and establish a framework for maintaining and supplementing the planning effort in future years.

**Outcomes**: Develop a draft plan and create a procedure to identify future information needs, and establish a framework for maintaining and supplementing the planning effort in future years.

Year(s) 3-4 Budget: $157,000

Year 5:

1. Conduct stakeholder meetings on the draft CMSP framework document
2. Revise the draft CMSP framework document into a final planning document
3. Devise an implementation strategy as informed by work done under task 4

**Outcomes**: Final framework document for future CMSP efforts on the Texas coast and implementation strategy for final plan.

Year 5 Budget: $200,000

**(Total Budget Task 5: $492,400)**

**Task 6: <u>Public Input and Preparing for Implementation of Framework to Conduct CMSP</u>**

**Description of work:** Collaboration with stakeholder groups throughout the planning process will ensure coordination among groups when prioritizing and implementing projects and during the development and implementation of the platform selected to share information. An outreach plan will be developed to establish an efficient process to collect and organize the input of stakeholders and the public. Public meetings will be held to provide an opportunity for interaction between local, state, and federal agencies, as well as affected stakeholders, to share ideas and develop strategies for addressing issues affecting the coast. This initiative identifies existing issues to address; prioritizes, and devises ways to better plan for these outcomes; provides tools to local, state, and federal agencies to make informed decisions; educates the public on coastal issues; and attracts a larger percentage of federal funds to the Texas coast.

Year(s) 1-2:

1. Conduct an inventory of existing stakeholder groups to determine which groups should be utilized to obtain input from local, state, and regional experts regarding coastal issues affecting the coast.
2. Develop an outreach plan for stakeholder and public input processes for CMSP.
3. Collaborate with these stakeholder groups to review the inventory of available data and provide input on identified information needs and gaps. In addition, stakeholder groups will make recommendations on a platform for sharing information and basic metadata requirements for quality control.

**Outcomes:** Inventory of existing stakeholder groups and an outreach strategy for stakeholder and public involvement.

Year(s) 1-2 Budget: $116,000

Years(s) 3-5:

1. Obtain public input. Public input will be sought at all stages of the planning process and through various opportunities such as issuing press releases to various media outlets, posting the draft plan in the Texas Register and on the GLO website for a 30-day comment period, and hosting public meetings along the coast.
2. Public meetings will be conducted regionally to provide an avenue for the public to

share information about their local area and provide input on the goals and objectives to be established in the CMSP planning process.

**Outcomes**: Press releases advertising public meeting opportunities; public meeting agendas, meeting summaries, and number of participants (for reporting of performance measures). Funding opportunities will be identified and coordinated with stakeholder groups to leverage funding for CMSP planning efforts and avoid duplication.

Year(s) 3-5 Budget: $356,400

**(Total Budget Task 6: $472,400)**

**VII**. **Fiscal and Technical Needs**

**A. Fiscal Needs:** If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the applying agency has made, if any, to secure additional state funds from the legislature and/or other sources to support this strategy.

While it is anticipated the amount of funding made available through 309 should be sufficient to carry out the proposed strategy, the GLO is actively involved in seeking funding to supplement this effort to use in obtaining data and conducting necessary studies as identified under task 2 in the data gaps and needs analysis.

**B. Technical Needs**: If the state does not possess the technical knowledge, skills, or equipment to carry out the proposed strategy, identify these needs. Provide a brief description of what efforts the applying agency has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).

Under task 2, we would contract with a research university to carry out the meta data gathering, characterization, and assessment analysis as we don't have the in house capacity to do so. Under task 3 of our proposed strategy, we would be establishing/expanding a data depository server and developing a GIS-based platform as an inter-agency decision tool to facilitate CMSP. We currently don't have a server for this depository so we are looking to leverage funding for this under current grant funding but some additional funds may be necessary. We will also need to contract with a software developer to help build and set up these visualization tools.

**VIII. Projects of Special Merit (Optional)**: If desired, briefly indicate what PSMs the CMP may wish to pursue to augment this strategy. Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above. The information in this section will not be used to evaluate or rank PSMs and is simply meant to provide the CMPs the option to provide additional information if they choose. PSM descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not do provide detailed project descriptions that would be needed for the PSM competition.

As identified in the assessment portion of this document, Texas currently has a process to establish flow quantity standards for water rights permitting, but the program is limited by a lack of information on the relationship between inflow to bays and estuaries and the connection to bay health and living resources. Texas may wish to pursue and would benefit from a study and collection of additional information on the relationship between inflow to bays and estuaries and the connection to bay health and living resources.

# *5-Year Strategy Budget Summary by Task*

At the end of the Strategy section, please include the following budget table summarizing your anticipated Section 309 expenses by strategy for each year.

| **Strategy Task** | **Year 1 Funding** | **Year 2 Funding** | **Year 3 Funding** | **Year 4 Funding** | **Year 5 Funding** | **Total Funding** |
|---|---|---|---|---|---|---|
| Task 1: Administration | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 200,000 |
| Task 2: Coastal resources Information Gathering and Assessment Sub-task 1: Data Inventory, Characterization, and Compilation | 280,000 | 25,000 | 25,000 | 0 | 0 | 330,000 |
| Task 2: Coastal resources Information Gathering and Assessment Sub-task 2:Identify Data Gaps | 0 | 107,000 | 25,000 | 25,000 | 25,000 | 182,000 |
| Task 2: Coastal resources Information Gathering and Assessment Sub-task 3:Identify Data Needs and Collect Missing Data Sets | 0 | 0 | 50,000 | 28,400 | 35,400 | 113,800 |
| Task 3: Data Serving, Visualization, and Collaboration tools for CMSP | 0 | 75,000 | 75,000 | 75,000 | 75,000 | 300,000 |
| Task 4: Coastal Management Program Change Analysis | 100,000 | 100,000 | 25,000 | 75,000 | 75,000 | 375,000 |
| Task 5:Framework Development for Future Coastal and Marine Spatial Planning Efforts | 75,000 | 60,400 | 75,000 | 82,000 | 200,000 | 492,400 |
| Task 6: Public Input and Preparing for the Implementation of Framework to Conduct CMSP | 41,000 | 75,000 | 167,400 | 157,000 | 32,000 | 472,400 |
| **Total Funding** | 536,000 | 482,400 | 482,400 | 482,400 | 482,400 | 2,465,600 |

Andrews, J.D. and S.M. Ray. 1988. Management strategies to control the disease caused by *Perkinsus marinus*. Am Fish Soc Spec Pub 18:257-264.

AWEA. 2008. 2008: Another Record Year for Wind Energy Installations. American Wind Energy Association 1-2 pp.

AWEA. 2009a. AWEA: 2nd Quarter 2009 Market Report. American Wind Energy Association 1-16 pp.

AWEA. 2009b. AWEA: Year End 2009 Market Report. American Wind Energy Association. [Online]. Available: http://www.awea.org/publications/reports/4Q09.pdf [April 12, 2010].

Baum, J.K., R.A. Meyers, D.G. Kehler, B. Worm, S.J. Harley and P. A. Doherty. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299: 389-392.

Beck, M.B., R.D. Brumbaugh, L. Airoldi, A. Carranza, L.D. Coen, C. Crawford, O. Defeo, G.J. Edgar, B. Hancock, M. Kay, H. Lenihan, M.W. Luckenbach, C.L. Toropova and G. Zhang. 2009. Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions. The Nature Conservancy, Arlington VA. 52 pp.

Blodgett, L., and K. Slack. 2009. Geothermal 101: Basics of Geothermal Energy Production and Use. Geothermal Energy Association, 1-55 pp.

Bozka, L. 2008. Underwater Oasis. Texas Parks and Wildlife Magazine. July 2008.

BRAC. 2010. Base Realignment and Closure 2005 - U.S. Department of Defense. U.S. Department of Defense. [Online]. Available: http://www.defense.gov/brac/ [January 25, 2010].

Brody, S.D., S.E. Davis III, W.E. Highfield and S. Bernhardt. 2008. A Spatial-Temporal Analysis of Wetland Alteration in Texas and Florida: Thirteen Years of Impact along the Coast. Wetlands 28(1): 107-116.

Buzan, D., W. Lee, J. Culbertson, N. Kuhn and L. Robinson. 2009. Positive relationship between oyster abundance in Galveston Bay, Texas. Estuaries and Coasts 32: 206-212.

Carlton, J.T. 2003. Community assembly and historical biogeography in the North Atlantic Ocean: the potential role of human-mediated dispersal vectors. Hydrobiologia 503: 1-8.

Carlton, J.T. and J.B. Geller. 1993. Ecological roulette: the global transport of nonindigenous marine organisms. Science 261: 78-82.

Castro, B. 2009. Plans for Naval Station Ingleside. KRISTV. [Online]. Available: http://www.kristv.com/news/plans-for-naval-station-ingleside/ [November 10, 2009].

Chu, F.L.E., J.F. Lapeyre and C.S. Burreson. 1993. *Perkinsus marinus* infection and potential

defense-related activities in eastern oysters, *Crassostrea virginica*: salinity effects. J Invertebr Pathol 62:226-232.

Combs, S. 2008a. Energy Report - Wind Energy. Austin, Texas: Texas Comptroller of Public Accounts. [Online]. Available: http://www.window.state.tx.us/specialrpt/energy/renewable/wind.php [March 22, 2010].

Combs, S. 2008b. Energy Report - Solar Energy. Austin, Texas: Texas Comptroller of Public Accounts. [Online]. Available: http://www.window.state.tx.us/specialrpt/energy/renewable/solar.php [March 22, 2010].

Combs, S. 2008c. Energy Report - Geothermal. Austin, Texas: Texas Comptroller of Public Accounts. [Online]. Available: http://www.window.state.tx.us/specialrpt/energy/renewable/geo.php [March 22, 2010].

Combs, S. 2009a. Texas Energy Policies and Programs: Recent Texas Energy Legislation. Window on State Government. [Online]. Available: http://www.window.state.tx.us/finances/captrade/txpolicies_programs/texas_legislation.html [March 22, 2010]

Combs, S. 2009b. Finances & Economy: Proposed Legislation. Windows on State Government. [Online]. Available: http://www.window.state.tx.us/finances/captrade/captrade_legislation.html [November 30, 2009].

Cowardin, L. M., V. Carter, F. C. Golet and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

Doran Jr., E. 1965. Shell roads in Texas. Geographical review 55:223-240.

DSIRE. 2009. Texas Incentives/Policies for Renewables & Efficiency. Database of State Incentives for Renewables and Efficiency. [Online]. Available: http://www.dsireusa.org/incentives/allsummaries.cfm?State=TX&&re=1&ee=1 [March 22, 2010].

ERCOT. 2009a. ERCOT Quick facts. Taylor, Texas: Electric Reliability Council of Texas [Online]. Available: http://www.ercot.com/content/news/presentations/2009/ERCOT%20Quick%20Facts%20May%202009.pdf [February 24, 2010].

ERCOT. 2009b. Report on the capacity, demand, and reserves in the ERCOT region. (pp. 1-92). Taylor, Texas: Electric Reliability Council of Texas. [Online]. Available: http://www.ercot.com/content/news/presentations/2009/2009%20ERCOT%20Capacity,%20Demand%20and%20Reserves%20Report.pdf [February 24, 2010].

FEMA. 2001. Understanding Your Risks: Identifying Hazards and Estimating Losses. Federal Emergency Management Agency. [Online]. Available: http://www.fema.gov/library/viewRecord.do?id=1880 [March 7, 2009].

Garton, D. and W.B. Stickle. 1980. Effects of salinity and temperature on the predation rate of Thais haemastoma on Crassostrea virginica spat. Biological Bulletin 158:49-57.

GBEP. 2010. Seventeen Priority Problems. Galveston Bay and Estuary Program. [Online]. Available: http://www.gbep.state.tx.us/priority-problems/seventeen-priority-problems.asp [July 6, 2010].

Gershunov, A. and T.P. Barnett. 1998. ENSO influences on intraseasonal extreme rainfall and temperature frequencies in the contiguous United States: observations and model results. J Climate, 11: 1575-1586.

Gilman, E., E. Zollett, S. Beverly, H. Nakano, K. Davis, D. Shiode, P. Dalzell and I. Kinan. 2006. Reducing sea turtle by-catch in pelagic longline fisheries. Fish and Fisheries 7: 2-23.

GLO. 2009. Geothermal Energy. Texas General Land Office. [Online]. Available: http://www.glo.state.tx.us/energy/sustain/geothermal.html [October 30, 2009].

GLO. 2010a. Texas Coastal Management Program. Texas General Land office. [Online]. Available: http://www.glo.state.tx.us/coastal/cmp.html [February 10, 2010].

GLO. 2010b. About Geographic Information Systems at Texas General Land Office. Texas General Land Office. [Online]. Available: http://www.glo.state.tx.us/gisdata/about.html [February 26, 2010].

Harrington, J. M., R. A. Myers, and A. A. Rosenberg. 2005. Wasted fishery resources: discarded by-catch in the USA. Fish and Fisheries 6(4): 350-361.

Harrison, R., N. Hutson, and V. Prasad. 2007. Containerization and Related Trends at Texas Deep Water Ports. Center for Transportational Research. [Online]. Available: http://www.utexas.edu/research/ctr/pdf_reports/0_5538_P2.pdf [June 8, 2010].

InTech. 2007. ISA 30 years and still no new refineries. InTech. [Online]. Available: http://www.isa.org/Content/ContentGroups/News/20071/June38/30_years_and_still_no_new_refineries.htm [November 16, 2009].

IPCC. 2007. Climate Change 2007: Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK/New York: Intergovernmental Panel on Climate Change.

Jacob, J.S. and M. Sipocz. 2009. Stormwater wetlands for the Texas Gulf Coast: Ecology and beauty for improved runoff water quality. A Report of the Coastal Coordination Council pursuant to NOAA Award No. NA06NOS4190219. TAMU-SG-09-701.

Jacob, J.S. and R. Lopez. 2005. Freshwater, non-tidal wetland loss, lower Galveston Bay watershed 1992-2002: A rapid assessment method using GIS and aerial photography. Texas Coastal Watershed Program. GBEP 582-3-53336.

Kimbrough, K. L., W.E. Johnson, G.G. Lauenstein, J.D. Christensen and D.A. Apeti. 2008. An Assessment of Two Decades of Contaminant Monitoring in the Nation's Coastal Zone. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 74, 105 pp.

La Peyre, M.K., B. Gossman and J.F. La Peyre. 2009. Defining optimal freshwater flow for oyster production: effects of freshet rate and magnitude of change and duration on eastern oysters and *Perkinsus marinus* infection. Estuaries and Coasts 32:522-534.

Luttes v. State, 324 S.W.2d 167 (1958).

McKinney, L. 2009. Marine Spatial Planning – A Gulf of Mexico Perspective. Oral Presentation presented at the Interagency Ocean Policy Taskforce about marine spatial planning (MSP), Washington, D.C., USA. [Online]. Available: http://02a8a22.netsolhost.com/docs/2009_mckinney_testimony_on_ocean_policy.pdf [March 26, 2010].

MMS. 2010. Fast Facts. Mineral Management Service- Gulf of Mexico Region. [Online]. Available: http://www.gomr.mms.gov/homepg/whoismms/aboutmms.html [February 1, 2010].

NREL. (2010). Combined License Applications for New Reactors. National Renewable Energy Laboratory. [Online]. Available: http://www.nrc.gov/reactors/new-reactors/col.html [April 12, 2010]

NREL. (n.d.). Ocean Thermal Energy Conversion - What is Ocean Thermal Energy Conversion? National Renewable Energy Laboratory. [Online]. Available: http://www.nrel.gov/otec/what.html [April 12, 2010]

NOAA. 2010. NOAA Office of Ocean and Coastal Resource Management: Energy and Government Facility Siting: Federal Gov. Agencies. Ocean & Coastal Resource Management. [Online]. Available: http://coastalmanagement.noaa.gov/issues/energy_federal.html [January 5, 2010].

NRC. 2009. Tackling marine debris in the 21st century. National Research Council. The National Academies Press. Washington, D.C.

Office of Ocean and Coastal Resource Management, NOAA, & U.S. Department of Commerce. 1996. Texas Coastal Management Program- Final Environmental Impact Statement. Texas General Land Office. [Online]. Available: http://www.masgc.org/gmrp/plans/TXCCC.pdf [January 5, 2010].

Open Beaches Act, 56th Leg., 2d C.S., ch. 19, 1959 Tex. Gen. Laws 108

Ortolon, K. 2009. Rising from the storm. University of Texas Medical Branch in Galveston. [Online]. Available: http://www.utmb.edu/PDFs/utmb.rising09.pdf [March 26, 2010].

Price, A. 2009. State environmental agency to face whooping crane lawsuit. *Austin American-Statesman*. [Online]. Available: http://www.statesman.com/news/content/news/stories/local/2009/12/09/1209crane.html

[January 25, 2011].

Public Management, Inc. 2006. Chambers County Comprehensive Recreation, Conservation and Economic Development Master Plan.

PUC. 2010. Substantive rules applicable to electric service providers. Public Utility Commission of Texas. [Online]. Available: http://www.puc.state.tx.us/rules/rulemake/34737/34737straw.pdf [November 16, 2009].

RAE. 2009. Galveston Bay Recovering, Rebuilding Six Months After Hurricane Ike. Restore America's Estuaries Newsletter. [Online]. Available: https://www.estuaries.org/galveston-bay-recovering-rebuilding.html [June 30, 2010]

Rice, H. 2010. State Calls Off Big Galveston Beach Project: Recent Texas high Court Ruling on Open Beaches Act Gets Blame. *Houston chronicle*. [Online]. Available: http://www.chron.com/disp/story.mpl/metropolitan/7295713.html [November 16, 2010].

RRC. 2009a. Oil & Gas Permits. Railroad Commission of Texas. [Online]. Available: http://www.rrc.state.tx.us/licenses/og/index.php [January 5, 2010].

RRC. 2009b. Pipeline Permitting & Mapping Home Page. Railroad Commission of Texas. [Online]. Available: http://www.rrc.state.tx.us/licenses/piplinepermitting/ [October 30, 2009].

RRC. 2010a. Natural Gas Production and Well Counts (1935 - 2009). Railroad Commission of Texas. [Online]. Available: http://www.rrc.state.tx.us/data/production/gaswellcounts.php [March 25, 2010].

RRC. 2010b. Gas Well Counts by County, as of February 2010. Railroad Commission of Texas. [Online]. Available: http://www.rrc.state.tx.us/data/wells/wellcount/gaswellct_0210.pdf [March 25, 2010].

RRC. 2010c. Railroad Commission of Texas Rules. Railroad Commission of Texas. [Online]. Available: http://www.rrc.state.tx.us/rules/index.php [February 8, 2010].

Ruiz, G.M., J.T. Carlton, E.D. Grosholz and A.H. Hines. 1997. Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent, and consequences. American Zoologist 37: 621-632.

San Antonio Business Journal. 2009. Texas A&M System will redevelop Naval Station Ingleside. San Antonio Business Journal. [Online]. Available: http://sanantonio.bizjournals.com/sanantonio/stories/2009/04/27/daily19.html [December 1, 2009].

SECO. 2008. Solar Energy. State Energy Conservation Office. 1-4pp.

SECO. 2009. Texas Geothermal Energy. State Energy Conservation Office. [Online]. Available: http://www.seco.cpa.state.tx.us/re_geothermal.htm [November 16, 2009].

Severance v. Patterson, No. 09-0387 (Sup. Ct. Tex.) Nov. 5, 2010

Sheavly, S.B. 2007. National marine debris monitoring program: Final program report, data analysis and summary. Prepared for U.S. Environmental Protection Agency by Ocean Conservancy. Grant number X83053401-02.

Souder, E. 2009. Houston to get state's largest solar plant. *Dallas News*. [Online]. Available: http://www.dallasnews.com/sharedcontent/dws/bus/stories/DN-solar_25bus.ART0.State.Edition1.3d00795.html [November 13, 2009].

Stemler, J. 2007. Wind power siting regulations and wildlife guidelines in the United States (p. 52). Denver, Colorado: Jodi Stemler Consulting. [Online]. Available: http://www.batsandwind.org/pdf/afwastsitsum.pdf [March 26, 2010].

Supreme Court of Texas. 2011. Case Search Results on Case #09-0387. [Online]. Available: http://www.supreme.courts.state.tx.us/opinions/case.asp?FilingID=30434 [January 25, 2011]

TCEQ. 2006. Chapter116 - Control of Air Pollution by Permits for New Construction or Modification. Texas Commission on Environmental Quality. [Online]. Available: http://www.tceq.state.tx.us/assets/public/legal/rules/rules/pdflib/116l.pdf [March 26, 2010].

Texas A&M IRNR. 2009. Texas Land Trends. Texas A&M Institute of Renewable Natural Resources. [Online]. Available: http://www.texaslandtrends.org/Briefings/CoastalLandUse.aspx [May 17, 2010].

TNRCC. 2001. Chapter 106- Exemptions from Permitting. Texas Natural Resource Conservation Commission. [Online]. Available: http://www.tceq.state.tx.us/assets/public/legal/rules/rules/pdflib/106o.pdf [March 26, 2010].

TNRIS. 2010. TNRIS Geospatial tool is featured in Microsoft case study. Texas Natural Resources Information System. [Online]. Available: http://www.tnris.state.tx.us/news.aspx?id=1184 [February 19, 2010].

Tolan, J.M. 2007. El Nino-Southern Oscillation impacts translated to the watershed scale: Estuarine salinity patterns along the Texas Gulf Coast, 1982 to 2004. Estuar Coast Shelf S 72:247-260.

Treece, G.D. 2009. The Texas Aquaculture Industry-2009. [Online]. Available: www.texasaquaculture.org/Texas%20Aqua-2009.pdf [November 30, 2009].

Tremblay, T.A., J.S. Vincent and T.R. Calnan. 2008. Status and Trends of Inland Wetland and Aquatic Habitat in the Corpus Christi Area. Coastal Bend Bays and Estuaries Program, Publication Number 55, Corpus Christi, 89 pp.

Tremblay, T.A. and T.R. Calnan, 2009. Status and Trends of Inland Wetland and Aquatic Habitats, Beaumont-Port Arthur Area. Final Report to the Texas General Land Office and

NOAA, Texas Bureau of Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/beaumont-portarthur/index.html [November 30, 2009].

Turner, R. E. 2009. Comments on Buzan et al. “Positive relationships between freshwater inflow and oyster abundance in Galveston Bay, Texas”. Estuaries and Coasts 32: 213-217.

TWDB. 2010. Desalination Database. Texas Water Development Board. [Online]. Available: http://www.twdb.state.tx.us/iwtdesaldb/dbStart.aspx [May 14, 2010].

TWDB. 2010. Desalination projects. Innovative Water Technologies. Texas Water Development Board. [Online]. Available: http://www.twdb.state.tx.us/iwt/desal/projects.asp#completed-projects [May 14, 2010].

TWDB. 2006. Populations projection data. Texas Water Development Board. [Online]. Available: www.twdb.state.tx.us/data/popwaterdemand/2003Projections/PopulationProjections.asp [January 5, 2010].

TxDOT. 2006. 2005-2006 GIWW Legislative Report. Texas Department of Transportation. [Online]. Available: ftp://ftp.dot.state.tx.us/pub/txdot-info/library/reports/gov/tpp/giww05.pdf [May 18, 2010].

U.S. Department of the Interior. 2003. Interim guidelines to avoid and minimize wildlife impacts from wind turbines. United States Department of the Interior. [Online]. Available: http://www.fws.gov/habitatconservation/wind.pdf [March 26, 2010].

U.S. Energy Information Administration. 2009a. State and Historical Energy Information and Statistics. United States Energy Information Administration. [Online]. Available: http://www.eia.doe.gov/overview_hd.html [March 11, 2010].

U.S. Energy Information Administration. 2009b. Texas Natural Gas Reserves Summary as of Dec. 31. United States Energy Information Administration. [Online]. Available: http://tonto.eia.doe.gov/dnav/ng/ng_enr_sum_dcu_STX_a.htm [March 25, 2010].

U.S. Energy Information Administration. 2010. Annual Energy Review- Renewable Energy. United States Energy Information Administration. [Online]. Available: http://www.eia.doe.gov/emeu/aer/renew.html [March 11, 2010].

White House Council on Environmental Quality. 2009. Interim framework for effective coastal and marine spatial planning (p. 35). Washington, D.C., USA: The White House Council on Environmental Quality. [Online]. Available: http://www.whitehouse.gov/sites/default/files/microsites/091209-Interim-CMSP-Framework-Task-Force.pdf [March 26, 2010].

White, W A., Tremblay, T.A., Waldinger, R.L. and T.R. Calnan., 2002. Status and Trends of Wetlands and Aquatic Habitats on Texas Barrier Islands, Matagorda Bay to San Antonio Bay. Final Report to the Texas General Land Office and NOAA, Texas Bureau of

Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/matagorda-sanantonio/index.html [November 30, 2009].

White, W.A., Tremblay, T.A., Waldinger, R.L. and T.R. Calnan, 2004. Status and Trends of Wetlands and Aquatic Habitats on Barrier Islands, Upper Texas Coast, Galveston and Christmas Bays. Final Report to the Texas General Land Office and NOAA, Texas Bureau of Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/galveston-christmas/index.html {November 30, 2009].

White, W.A., Tremblay, T.A., Waldinger, R.L., Hepner, T. L. and T.R. Calnan, 2005. Status and Trends of Wetlands and Aquatic Habitats on Barrier Islands, Freeport to East Matagorda Bay, and South Padre Island. Final Report to the Texas General Land Office and NOAA, Texas Bureau of Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/freeport-spi/index.html [November 30, 2009].

White, W.A., Tremblay, T.A., Waldinger, R.L. and T.R. Calnan, 2006. Status and Trends of Wetlands and Aquatic Habitats on Texas Barrier Islands Coastal Bend. Final Report to the Texas General Land Office and NOAA, Texas Bureau of Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/coastalbend/index.html [November 30, 2009].

White, W.A., Tremblay, T.A., Waldinger, R.L. and T.R. Calnan, 2007. Status and Trends of Wetlands and Aquatic Habitats on Texas Barriers: Upper Coast Strandplain-Chenier System and Southern Coast Padre Island National Seashore. Final Report to the Texas General Land Office and NOAA, Texas Bureau of Economic Geology, Austin, TX. [Online]. Available: www.glo.state.tx.us/coastal/statustrends/chenier-pins/index.htm [November 30, 2009].

White, W. A., Tremblay, T.A., Wermund, E.G., Jr., and L.R. Handley. 1993. Trends and status of wetland and aquatic habitats in the Galveston Bay system, Texas: Galveston Bay National Estuary Program, Publication GBNEP-31, 225 pp.

## *Federal Data Sources*

American Society of Civil Engineers (ASCE), *"Facts About Windstorms"*
Web site: http://www.asce.org/

Bureau of Reclamation, U.S. Department of the Interior
Web site: http://www.usbr.gov/

Federal Emergency Management Agency (FEMA)
Web site: http://www.fema.gov/

National Climatic Data Center (NCDC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: http://lwf.ncdc.noaa.gov/oa/ncdc.html

National Geophysical Data Center, *"Tsunamis and Tsunami-Like Waves of the Eastern United States"*
Web site: http://www.ngdc.noaa.gov/hazard/tsu.shtml

National Inventory of Dams, U.S. Department of the Interior
Website: https://rsgis.crrel.usace.army.mil/apex/f?p=397:12:425770484350151

National Hurricane Center, NOAA
Web site: http://www.nhc.noaa.gov/

National Severe Storms Laboratory (NSSL), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: http://www.nssl.noaa.gov/

National Weather Service (NWS), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: http://www.nws.noaa.gov/

Storm Prediction Center (SPC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service
Web site: http://www.spc.noaa.gov/

The Tornado Project, St. Johnsbury, Vermont
Web site: http://www.tornadoproject.com/

United States Geological Survey (USGS), U.S. Department of the Interior
Web site: http://www.usgs.gov/

In order to provide the public an opportunity for input on the future needs of the TCMP, a notice of public comment/review was distributed along with a copy of the Assessment draft through multiple organizations, websites, and listserves including: HRI, TGLO, CBBEP, GBEP, MANERR, and Texas Sea Grant. Public comment hearings were held in Corpus Christi, Texas on April 29, 2010 and in Galveston, Texas on May 5, 2010. Additionally, a link to an online survey was available for those unable to submit comments at the public hearings. All comments were reviewed, addressed, and incorporated into the assessment document, where necessary.

## General Comments

1. Table of contents should be added to the document.

2. Definition of "coastal communities" should be uniform throughout the document.

3. An executive summary would be helpful in seeing that small scale suggestions included in the document are not overlooked. Some solutions could be easily implemented by state agencies but might not warrant extensive strategy development.

4. What criteria are there for rating categories as L, M, or H?

## Wetlands

1. Development/Fill (type of threat) should be rated as high severity of impact instead of medium severity; see table on page 19.

2. Hydrological connections of state waters and Palustrine wetlands
    - Question stemmed from the isolated determination as per the Corp.
    - Need for Hydrodynamic models
    - Need for DEMs as a result of LIDAR; TNRIS has most counties covered, but with "bad" lidar data; the resolution is at 1 meter point spacing, but the control (ground truthing) is not good; this work is done by private contractors and more control on methods are currently needed/being implemented.
    - Question was raised about accuracy of the National Wetland Inventory data.
    - Issues: Biologically important areas and Flood mitigation

3. Concerns were expressed about the Management Characterization table on page 21.
    - Q: Why have no significant changes occurred since the last assessment?
    - A: no state agency interaction
    - A: TPWD is creating a database for resource characterization

4. Inconsistency related to the Main Threats to Wetlands
    - In the table on page 19, Sea level rise should be listed as High Severity in the table, as it is described in the main body of the text.

5. Freshwater Inflow and indicators as they relate to biological productivity

6. Food Web Dynamics
    - Q: Is quantifiable information available?
    - A: Can't sample the whole area in an adequate time frame, so need for focus on integrators within the system.

7. Instream Connections to Downstream Aspects/Conditions

8. Seagrass Management Plan has been revised within the past year

9. No Net Loss of Wetlands Program needs to be evaluated

10. Need for the Corp to monitor permits;
    - Q: Is data transferred to their database?
    - Q: Is there follow-up after permit is issued? – They are in the process of hiring someone to address this issue.

11. Use of dredge material mentioned to another group, but might be/is relevant to Wetlands Group

## Coastal Hazards

1. You will continue to be disappointed, but not surprised by the lack of planning and implementation as well as the lack of strategies to reduce the economic impact of communities by thing like sea level rise. This is in part due to the fact that there is no centralized state entity with authority. This in itself is troubling.

2. Tools have to be developed, not just this but these tools need to be used by the community and the community in many cases needs to be taught how to use them.

3. There is a lack of authority that the county has. When this occurs, citizens become disinterested in ordinances primarily because they are unclear about their responsibility, and the lack of coordination. This prompted several individuals to suggest that we raise the level of 'Rural and urban counties have no ordinance powers' in the Priority Needs and Information Gaps Section from a level of priority of medium to high.

4. Is the term 'coastal resiliency' in this section of the document? If not where could it be included if at all?

5. Which category does the Ike Dike fit into under the Management Characterization section? It was suggested that an 'other' category be established to accommodate these types of projects.

6. When asked to define sea level rise mapped inventories for communities, it was suggested that the numbers don't provide an effective picture. Meaning the presence or use of data in a community does not imply that the community has an integrated management approach for coastal hazards. Stress that very few in Texas are pulling this

data together for planning purposes. With this in mind, it was decided that we would better convey this potential disconnect below the mapped inventory section.

7. Several individuals commented on the NOAA framework including awkwardness the tables. We stressed that this framework was provided to us by NOAA and that tables were mandatory.

## Public Access

1. Request made for funds to be allocated for more kayak trails.

2. Interest in private and public partnership(Such as improving public access at the Corpus Christi Marina).

3. Should consider opening up private boat ramps to public boat ramps. You could provide an incentive such as a tax break to encourage it.

4. Track trends of loss of private ramps available as well as public ramps.

5. Consider using the Broady Atlas to acquire data on dune walkovers.

6. Suggested Sea Level rise should be ranked as high and not medium.

7. Figure 1 not clear or able to stand alone.

8. Table of Contents needs to be added.

9. The whole document needs an executive summary.

10. Agreed public access is a high priority.

## Marine Debris

1. LCRA Project Study identified many dump sites along the Colorado River through a flyover. Though anecdotal, this points out a potential issue. Report states “No data available to determine significance of Land Based Dumping”

2. Jim Needham conducted a pilot study to look at storm drain debris

3. John O’Conner is the Sea Grant Program Coordinator for Monofilament Recovery & Recycling program (MRRP) and data is available online at www.mrrp.tamu.edu.

4. Derelict shrimp boats w/ fuel, asbestos, etc need to be removed (approx. 190 boats in the Port Isabel and Brownsville area).

5. R. Vega serves on Marina Board with City of Corpus Christi. There is an issue with debris in runoff in the marina. We need to research/engineer stormwater runoff structures to capture debris. He also added how organizations, such as CCA, could help with education and outreach regarding marine debris.

## Cumulative and Secondary Impacts

1. Are wind farms creating national security or safety issues with the Naval Air Station Corpus Christi?

2. Freshwater inflow should be added to Endangered/threatened species category in the resource characterization table.

3. Rural land use change should be addressed in the text. Land fragmentation is occurring as large ranches are being subdivided into smaller plots. Most that purchase these smaller plots do not have experience in proper land management. This can create issues with increased nutrient loading due to over-fertilization and runoff. Local governments should be assisted primarily to deal with the unincorporated county areas. Management characterization table #2 should include the development of an education and outreach component to assist with this.

4. Sea level rise rate of change should be moved to high (H) rating in resource characterization table #1

5. Support was given for the discussion of SB3 environmental flow. Science and management decision should be integrated in to the CMP.

6. Management characterization table #2 category #4 “Assisting local governments” should be moved to high (H) priority. Regarding urban sprawl the county has a lack of authority, coordination, and organization.

7. “Oyster reefs” should be moved to high (H) level of threat in resource characterization table #2 due to ~60% loss in Galveston Bay after Hurricane *Ike*. Additionally, CSI threats for this category should include severe storm events.

8. “Submerged aquatic vegetation” category in resource characterization should say nutrient and sediment loading in the CSI threats description column.

9. Management characterization table #2 gap #3 should replace “coastal wind farm development” with “renewable energy development.”

## Ocean Resources

1. The placement of dredge material needs to be considered as it smothers habitat and affects hydrologic flows.

2. What criteria or metric is used to establish the classifications of L, M or H? Is this standardized between states, or between sections within a state?

3. 60% of the oysters in Galveston Bay were lost as a result of Hurricane Ike. Increased sedimentation covered the settling substrate for spat.

4. A new, multi-agency invasive species coordinating committee, Texas Invasive Species Coordinating Committee, was established in fall, 2009.

5. Should there be a mention about oyster water TMDL for bacteria? It is more of a health issue than an ecosystem or resource issue. The oysters have no problems, only the consumers (people) have the problem with the decline in water quality.

## Energy and Government Facility Siting

1. Look at desalination plants. Potentially look at the ones the city owns and incorporate that in the Government facility siting section.

2. On the gap or need description, instead of "offshore renewable energy siting authority", take out the offshore and name it "Coastal Zone renewable energy siting authority". By doing this we will be looking at a broader siting authority which includes not only offshore facilities, but coastal (land) renewable energy facilities as well.

## Aquaculture

1. There is a need for the permitting process to be streamlined for aquaculture, as a "one-stop-shop" for all the permits. This would help to promote/develop the industry.

2. On the Resource Characterization table, add a note if the operators are for commercial or stocking purposes.

3. In the Priority needs and information gaps table, include "regulatory" gap under the type of gap or need for Offshore Aquaculture.

4. Reconsider having Biofuels listed in Table 3 as a priority need or gap as there are currently no biofuel farms in Texas nor any regulation on it, so it may not need be listed. Most of the biofuel farms are currently in West Texas.

# *Appendix B – Mapped Inventory Contacts*

*Community Data Sources:*

| Community | Contact(s) | Flooding | Storm Surge | SLR | Erosion | Hurricanes | Geohazards | Subsidence |
|---|---|---|---|---|---|---|---|---|
| Aransas County | Rick McLester, Jade Smith, David Vyoral | Y (2006) | Y (2006) | N | Y (1982) | Y (2006) | Y (2006) | Y (2006) |
| Town of Fulton | Cindy LaPoint | N | N | N | N | N | N | N |
| Aransas Pass | Frank Trueit | Y (2001) | N | N | N | N | N | N |
| Rockport | Brian Jacobs, David Vyoral, Rick McLester | N | N | N | N | N | N | N |
| Brazoria County | Eric Dyress, Stephanie Bradford, Bill Bass | Y (2005) | Y (2008) | N | Y (2000) | Y | Y (2005) | N |
| Freeport | Delia Munoz | N | N | N | N | N | N | N |
| Richwood | Karen Theis | Y (1999) | N | N | N | N | N | N |
| Calhoun County | Laurel Lacy, Melvin Strong, Mike Pfeiifer | Y (2005) | Y (2005) | Y (2003) | Y (2003) | Y (2003) | Y (2005) | Y (2003) |
| Point Comfort | City Secretary | N | N | N | N | N | N | N |
| Port Lavaca | Marcela, Planning Department | N | N | N | N | N | N | N |
| Cameron County | Alfonso Garrido, Scott Fry, Burney Basket | Y (2010) | N | N | N | N | N | N |
| Port Isabel | Mapping Department | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Rio Hondo | Mr. Hung | Y (1981) | N | N | N | N | N | N |
| South Padre Island | Reuben Trevino, Burney Basket | N | N | N | N | N | N | N |
| Brownsville | Ann Whitco-Benevides | Y (2007) | Y (2010P) | N | N | N | N | N |
| Chambers County | Bill Bass | Y (2005) | Y (2005) | N | Y (2000) | Y (2008) | Y (2005) | N |
| Galveston County | Bill Bass | Y (2009) | N | Y (2008) | Y (2000) | Y (2008) | Y (2005) | Y (1995) |
| Bayou Vista | Norm Desmo | Y (2002) | N | N | N | N | N | N |
| Clear Lake Shores | Jonathan Athers | Y (1983) | N | N | N | N | N | N |
| Galveston City | Jim Gibeaut; Charlie Kelly | Y (2002) | N | N | Y (2003) | N | Y (2007) | N |
| Jamaica Beach | Janna Shoals | Y (2002) | N | N | N | N | N | N |
| Kemah | Bill Kerber | Y (1983) | Y (2009) | N | N | Y | N | N |
| Texas City | Bruce Clawson | Y (2005) | Y (2005) | N | N | N | N | Y (2005) |
| Port Bolivar | Careen Plumer, Sid Bouse, Jerry Parker | Y (2009P) | Y (2009) | Y (2009) | Y (2008) | Y (2009) | Y (2010P) | Y (2009) |
| Hardin County | Theresa Wigley | Y (2005) | Y (2005) | N | N | Y (2005) | Y 2005) | N |
| Harris County | Bill Bass, Michael Waters, Jim White | Y (2005) | Y (2005) | Y (2008) | Y (2000) | Y (2008) | Y (2004) | Y (1995) |
| Baytown | Matt Bailey | N | N | N | N | N | N | N |
| Deer Park | Stuart Jones | Y (2007) | Y (2010P) | N | N | Y | N | N |
| El Lago | Tom Merchant | Y (2007) | N | N | N | N | N | N |
| Galena Park | Chief Lon Squyres | Y (2007) | N | N | N | N | N | N |
| Houston | City of Houston Local Hazard Mitigation | Y (2006) | Y (2004) | N | N | Y (2008) | Y (2004) | N |
| Jacinto City | Chief Lon Squyres | Y (2007) | N | N | N | N | N | N |
| La Porte | Tim Tietjens; Jim White | Y (2007) | Y (2010P) | N | Y (2000) | N | N | N |
| Seabrook | Jeff Galyean | Y (2007) | N | N | N | N | N | N |
| Shoreacres | Dave Roads | Y (2007) | Y (2009) | N | Y (2004) | N | N | N |
| Taylor Lake Village | City Secretary | N | N | N | N | N | N | N |

| Community | Contact(s) | Flooding | Storm Surge | SLR | Erosion | Hurricanes | Geohazards | Subsidence |
|---|---|---|---|---|---|---|---|---|
| Jackson County | Damon Moore | Y (2005) | Y (2005) | N | N | Y (2004) | N | N |
| Jefferson County | Jose Pastrana, Greg Fountain | Y (2009) | Y (2009) | N | Y (2005) | Y (2009) | Y (2005) | N |
| Beaumont | Tim Ocnaschek | Y(2002) | Y(2007) | N | N | N | N | N |
| Groves | Darin Brown | Y (1983) | N | N | N | N | N | N |
| Port Arthur | John Russell; Ronda Bell | Y (1992) | Y (1980) | N | N | N | N | N |
| Kenedy County | Eleuteria S Gonzales; Veronica Vela | Y (1992) | N | N | Y (2000) | N | N | N |
| Kleberg County | Melissa De La Garza, Noel Pena | Y (2006) | Y (2006) | N | Y (2005) | Y (2006) | Y (2006) | Y (2006) |
| Kingsville | Andy Vigstol | Y (1981) | N | N | N | N | N | N |
| Matagorda County | Bill Bassm Cristyn Hallmark | Y (2004) | Y (2004) | N | N | Y (2004) | N | N |
| Palacios | Miles Davis | N | N | N | N | N | N | N |
| Nueces County | Mike Beavers, Bill Roberts | Y (2010) | Y (2006) | N | Y (2000) | Y (2006) | Y (2006) | Y (2006) |
| Port Aransas | David Parsons, Joe Lamb, Pam Hatzenbuehler | Y (1992) | Y (1992) | N | Y (2009) | N | Y | N |
| Corpus Christi | Mike Beavers, Larry Messer | Y (1998) | Y (2008) | Y (2010P) | Y (2010P) | Y (2008) | Y (2005) | N |
| Orange County | Jeff Kelley, Linda Kam, Kelly Bates | Y (2005) | Y (2005) | N | N | Y (2005) | Y (2005) | N |
| Bridge City | Jerry Jones | Y (1982) | N | N | N | N | N | N |
| Orange | Jerald Ziller | Y (2008) | Y (2008) | N | N | N | N | N |
| Vidor | Ricky Jorgensen | N | N | N | N | N | N | N |
| West Orange | Theresa Van Meter | N | N | N | N | N | N | N |
| Refugio County | Connie Konce, Laurel Lacy | Y (2005) | Y (2005) | N | N | Y (2006) | Y (2007) | Y (2006) |
| San Patricio County | JR Galvan, William Zagorski, King and Petrus | Y (2004) | Y (2006) | N | Y (2000) | Y (2006) | Y (2007) | Y (2006) |
| Aransas Pass | William Zagorski | Y (1992) | Y (2008) | N | N | N | N | N |
| Gregory | William Zagorski | Y (1981) | Y (2008) | N | N | N | N | N |
| Ingleside | JR Galvan, Shanna Herzer | Y (2004) | N | N | N | N | N | N |
| Portland | JR Galvan, Jim Nelson | Y (2004) | N | N | N | N | N | N |
| Sinton | William Zagorski | Y (1981) | Y (2008) | N | N | N | N | N |
| Victoria County | Laurel Lacy | Y (2005) | Y (2005) | N | N | Y (2003) | Y (2002) | N |
| Willacy County | James Jackson | Y (1998) | N | N | N | Y (2009) | Y (2004) | N |

# *Appendix C – Setbacks for Coastal Hazard Development*

| Community | State Mandated Setbacks | More Stringent than State |
|---|---|---|
| Aransas County | N/A | N/A |
| Town of Fulton | N/A | N/A |
| Aransas Pass | N/A | N/A |
| Rockport | N/A | N/A |
| Brazoria County | Y | N/A |
| Freeport | N/A | N/A |
| Quintana | Y | N/A |
| Calhoun County | Y | N/A |
| Point Comfort | N/A | N/A |
| Port Lavaca | N/A | N/A |
| Cameron County | Y | N/A |
| Port Isabel | N/A | N/A |
| Rio Hondo | N/A | N/A |
| South Padre Island | Y | N/A |
| Brownsville | N/A | N/A |
| Chambers County | Y | N/A |
| Galveston County | Y | N/A |
| Bayou Vista | N/A | N/A |
| Clear Lake Shores | N/A | N/A |
| Galveston City | Y | N/A |
| Jamaica Beach | Y | N/A |
| Kemah | N/A | N/A |
| Texas City | N/A | N/A |
| Port Bolivar | N/A | N/A |
| Hardin County | Y | N/A |
| Harris County | Y | N/A |
| Baytown | N/A | N/A |
| Deer Park | N/A | N/A |
| El Lago | N/A | N/A |
| Galena Park | N/A | N/A |
| Houston | N/A | N/A |
| Jacinto City | N/A | N/A |
| La Porte | N/A | N/A |
| Seabrook | N/A | N/A |
| Shoreacres | N/A | N/A |
| Taylor Lake Village | N/A | N/A |
| Jackson County | Y | N/A |
| Jefferson County | Y | N/A |
| Beaumont | N/A | N/A |
| Groves | N/A | N/A |
| Port Arthur | Y | N/A |
| Kenedy County | Y | N/A |
| Kleberg County | Y | N/A |
| Kingsville | N/A | N/A |
| Matagorda County | Y | N/A |
| Palacios | N/A | N/A |
| Nueces County | Y | Y |
| Port Aransas | Y | N/A |
| Corpus Christi | Y | N/A |
| Orange County | Y | N/A |

| Community | State Mandated Setbacks | More Stringent than State |
|---|---|---|
| Bridge City | N/A | N/A |
| Orange | N/A | N/A |
| Vidor | N/A | N/A |
| West Orange | N/A | N/A |
| Refugio County | Y | N/A |
| San Patricio County | Y | N/A |
| Aransas Pass | N/A | N/A |
| Gregory | N/A | N/A |
| Ingleside | N/A | N/A |
| Portland | N/A | N/A |
| Sinton | N/A | N/A |
| Victoria County | Y | N/A |
| Willacy County | Y | N/A |

## *Appendix D- Summary of the Results Obtained from the Public Access Survey*

A coast wide online survey was conducted for all coastal counties. The survey was separated into the Upper (Sabine Lake to Matagorda Bay), Middle (San Antonio Bay to Corpus Christi and Padre National Seashore), and Lower (Lower Laguna Madre South of Port Mansfield to Port Isabelle) coast, and requested participants to rank the accessibility of beach access, boat ramps, trailer parking at public boat ramps, marinas, and park access on a scale of 0 -5, where 0=don't know, 1=poor , 2=below average, 3=adequate 4=good, and 5=excellent. There were a total of 141 responses for the Upper Coast, 156 responses for the Middle coast, and 97 responses for the lower coast.

All three surveys indicated the same pattern with beach access (Upper Coast = 3.38, Middle Coast = 4.28, and Lower Coast = 3.86) and park access (Upper Coast = 3.13, Middle Coast = 3.72, and Lower Coast = 3.40) having a mean ranking above average. Mean values for responses were calculated by surveymonkey.com. The mean ranking calculated included the "don't know" responses (values of 0).X

Adequacy of boat ramps was rated slightly lower than beach access (Upper Coast = 2.74, Middle Coast = 2.84, and Lower Coast = 2.69). Trailer parking at boat ramps has often been cited as an issue and was ranked similar to boat ramp numbers (Upper Coast = 2.64, Middle Coast = 2.5, Lower Coast = 2.57), and marinas (Upper Coast = 2.85, Middle Coast = 2.92, and Lower Coast = 2.77) having a mean ranking below average (Figure 1).

Overall, the lowest mean ranking was for parking trailers at boat ramps and the highest mean ranking was for beach access for the Middle Coast (Figure 1). The survey indicates a need to improve public access for all areas but most specifically for boat ramps, trailer parking at boat ramps, and marinas (Figure 2).

The ability to provide specific comments was also encouraged as part of the survey. There were a total of 52 comments for the Upper Coast, 34 comments for the Middle Coast, and 23 comments for the Lower Coast provided. The comments were insightful, informative and mostly consisted of people stating the need for more public access. Those comments are briefly summarized in the following section. Additionally, selected comments were tabularized to allow reviewers a sense of just how significant an issue public access is to the Texas public.

Comments from the Upper Coast survey mostly referred to the lack of public access locations in Galveston (Table 1). A comment stated that the lack of access in Galveston makes it not feasible to go the beach with a family member anymore. Moreover, it was stated that public areas (San Luis Pass) have been closed due to private development (i.e. condos) and that millions of dollars should not be spent on replacing sand on private beaches. Comments for the Upper Coast also referred to a lack of parking at boat ramps and the beach, and a lack of fishing piers and boat ramps in the Galveston area.

Table 1: Subsample of comments provided by the Upper Coast Survey

| | |
|---|---|
| Very limited public access to beaches and trailer parking, few marinas and almost no public fishing piers remain after Hurricane *Ike*. | Galveston only has 2-3 boat ramps working since Hurricane *Ike* left. There used to be about 10. |
| Galveston has limited beach access sooooo much that it is not feasible to go to the beach with a family any longer.....they have to change that. | Beach access in Galveston is below "Poor" on the West End. Miles of beach are unused by the public because of poor access. We need more access by autos and golf carts, but the arrogant beach front property owners do not want this and have lobbied in Austin against it. It is time for a change! |
| Beach Access: It must be excellent based on our experience. Private property owners adjacent to our beaches are expected to shoulder the burden of trash that comes with public beach access points. We pony up money when funding is needed. We spend our resources and time to cleanup, re-nourish beaches and dunes only to watch bubba Texas run his pickups and four wheelers over this delicate landscape. If Texans want continued public access to the beach they need to fund it properly, care for it and take the cars off the beach. There are now 24.8 million of us. If we all brought a car and parked them as tight as we could, we would pack all of our 624 miles of our shoreline with a stack 45 cars deep. We cannot continue on this path. The state needs to purchase land where people go to the beach and provide off beach parking. The natural environment cannot handle the load. It shouldn't be a burden the turtles or adjacent neighbor landowners should shoulder. Ask yourselves if you would like to watch the states drunken guests day after day trash your neighborhoods and destroy the landscape, then claim it's their constitutional right. It's time to reconsider everything Beach/Coast in Texas. | In general, the public is not aware of their beach access rights in Texas. They may have heard of the Open Beaches Act but they do not understand it enough to realize that many coastal communities collude with developers to restrict public access. This is done surreptitiously so it often is not noticed. "Public parking" signs tend to funnel visitors to areas away from condos, hotels, and expensive neighborhoods. Even worse, the spirit and often the letter of the OBA is violated by restricting or eliminating public parking in subdivisions. Most subdivisions, condos, and hotels, ask the city to reduce nearby parking to only the MINIMUM required by the OBA. One must remember that those requirements were written 20 years ago, when there were fewer people who live in or visit the coast. The increase in population and demand will lead to fewer opportunities to satisfy the needs of the public. Although we do have many miles of coastal parks, the vast majority require a four-wheel drive vehicle to use. More parks, closer to the population areas are needed. |
| TEXAS Beaches are to BE Kept OPEN, BY Law!!!! Galveston TX, the City of Is Restricting Public assess On the WEST End of the Island, UN Lawfully!!!<br>The 6$$$ Million Dollars worth of Sand, Should NOT go On Beaches That the Public Cannot DRIVE their Car ON! | I'm from the Houston area and it is a real pain to find a good place to take the family fishing or to the beach. More piers, parking at fishing sites, better markings on public areas that can be accessed without worrying about if it is private or public. |

Comments from the Middle Coast survey stated the need for more parking, boat ramps, and a marina in Port O Conner (Table 2). Another comment indicated that by purchasing a beach parking pass in Nueces County causes public beach access to be too expensive for some people. Comments from the Lower Coast Survey stated that the beaches have too much trash, and that there is little to no parks on the beaches or bays (Table 3). Parking also was commented as a problem. One comment did state that public access was good overall but that the area needed more bait shops.

Overall, the majority of the comments for all three surveys stated that parking, maintenance and presence of structures are issues for public access.

Table 2: Subsample of comments from the Middle Coast Survey

| | |
|---|---|
| Port O Connor needs a Public Marina and Large parking area | Beach access is presently good but regularly threatened for areas near the city of Corpus Christi usually related to a real estate project. |
| The ramp east of SH 361 in Packery Channel has the best parking, but is too steep for long trailers, silts up swiftly, and is too close to the blind spot/bottleneck created by the adjacent bridge. Consider abandoning it and spending the money instead on the other 2 public ramps/parking areas along Packery Channel under the east end of the JFK Causeway Bridge. | The population of the area continues to increase, while at the same time public access to the beaches and bays are being reduced. Several primitive spots on private land, where kayakers could launch into Redfish bay, Copano Bay, etc. have been purchased and converted to gated residential communities. |
| With all the money made through fishing it would seem like a priority for Nueces County to provide better Public Boat Launch sites available. The ones that we have are in poor condition with little parking. Aransas County has done a wonderful job with their new Boat Ramps and Bathroom facilities. The National Seashore has a fair boat ramp but very little parking. | In Corpus Christi they force you to purchase a sticker for beach access. This is NOT FREE PUBLIC BEACH ACCESS and denies some access to outr PUBLIC beaches. |

Table 3: Subsample of comments from the Lower Coast Survey

| | |
|---|---|
| The Town of South Padre Island has no beach or bay parks. The ones run by Cameron County are unfit, filthy and littered with trash. | The implosion of the SPI Tower and the use of the concrete to provide the Beach access at the north end of the Island for county access will tell another story once high tide hits these accesses and enables entry to our Beautiful Beaches. Thank You for OUR FUTURE..... |
| The beaches have too much TRASH. Our suggestion is to implement a fee - $6 or so for entry into the parks, with a large trash bag provided. If the visitor brings the trash back full, then they will be refunded a % of the fee. Right now, the County does nothing, and provides a small small generic trash bag that would not even hold a 6 pack of cokes! Give visitors a LARGE bag, and encourage them to pick up their trash as well as others. Beach goers are afraid to pick up beer cans of others. Encourage them to pick up all trash, regardless. Reward them with a refund on their entry fees. Sincerely. | South Padre Island has little access unless you are staying in a hotel or condo. The county parks are ok, but holidays and weekends, they are very overcrowded with people parking in the dunes and sidewalks, etc. Also, the north beach with vehicle access is very crowded and can be hard to access depending on tides. Another issue is a large concrete wall on the beach and the La Quinta, both of which can be impassable at high tide. |

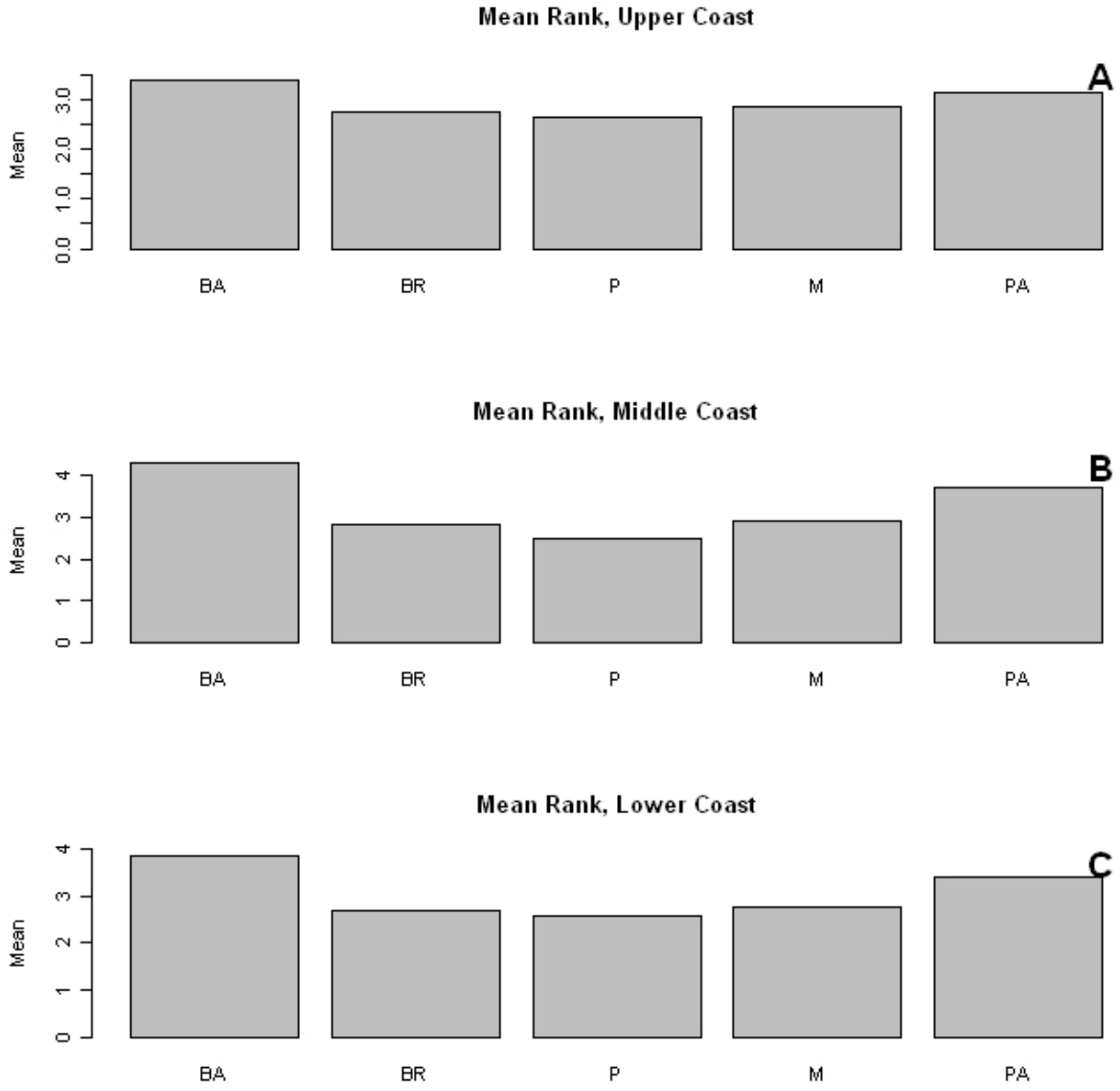


Figure 1: Mean rank levels for beach access (BA), boat ramps (BR), trailer parking at public boat ramps (P), marinas (M), and public access (PA) for A)upper coast, B) middle coast, and C) lower coast.

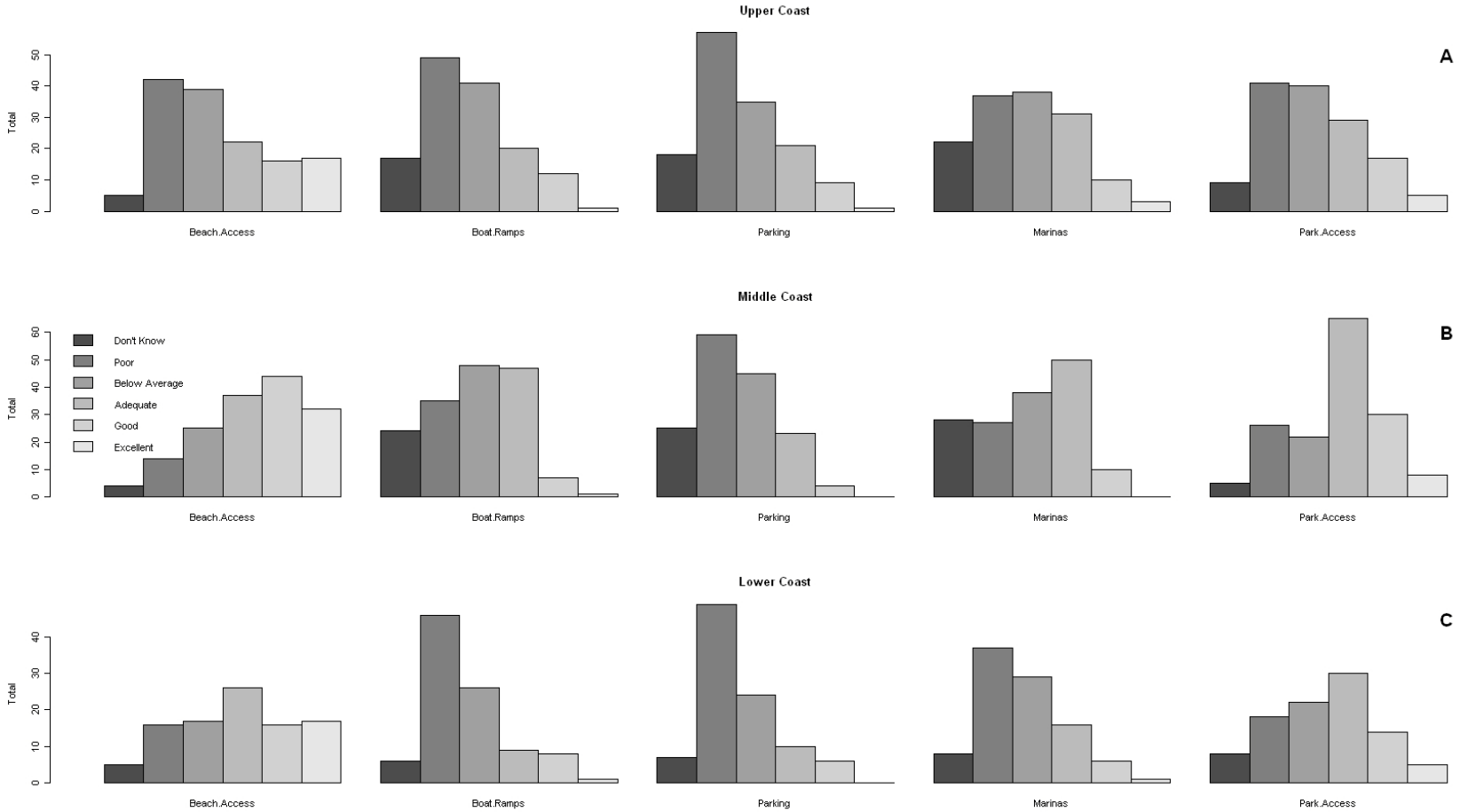


Figure 2: Total number of don't know, poor, below average, adequate, good and excellent responses with regards to beach access, boat ramps, trailer parking at public boat ramps (parking, marinas, and park access for A) upper coast, B) middle coast, and C) lower coast.

## *Appendix E- Summary of the Results Obtained from the Boat Ramp Survey*

With all bays combined the majority of the ramps were ranked as requiring no expansion (60%, n=146), followed by 14% (n=35) ranked as needing some expansion, 6% (n=15) needing moderate expansion, 1% (n=3) needing extensive expansion, and 2% (n=4) requiring extensive expansion for capacity (Figure 4). Data were not available to determine if expansion was needed for capacity for 17% (n=42) of the ramps (Figure 4).

The majority of the ramps with regards to parking availability were ranked as not needing expansion (67%, n=164), 13% (n=31) were ranked as requiring some expansion, 10% (n=25) were ranked as needing moderate expansion, 6% (n=14) were ranked as needing considerable expansion, and 4% (n=11) were ranked as requiring extensive expansion (Figure 4).

Condition of the structures at the ramps overall were ranked as 48% (n=117) needing no repair, 27% (n=67) needing some repair, 12% (n=29) needing moderate repair, 5% (n=13) needing considerable repair, and 8% (n=19) ranked as needing extensive repair (Figure 4).

Safety of the ramps were ranked as 37% (n=91) requiring no repair, 25% (n=62) requiring some repair, 10% (n=24) requiring moderate repair, 6% (n=15) requiring considerable repair, and 4% (n=11) requiring extensive repair (Figure 4).

Overall, the majority of the boat ramps were ranked as needing no expansion for capacity and parking, and needing no repair with regards to structures at the ramps and safety of the ramps. The survey can be very useful in prioritizing where improvements are most sorely needed and would be of the greatest benefit for improving public access.

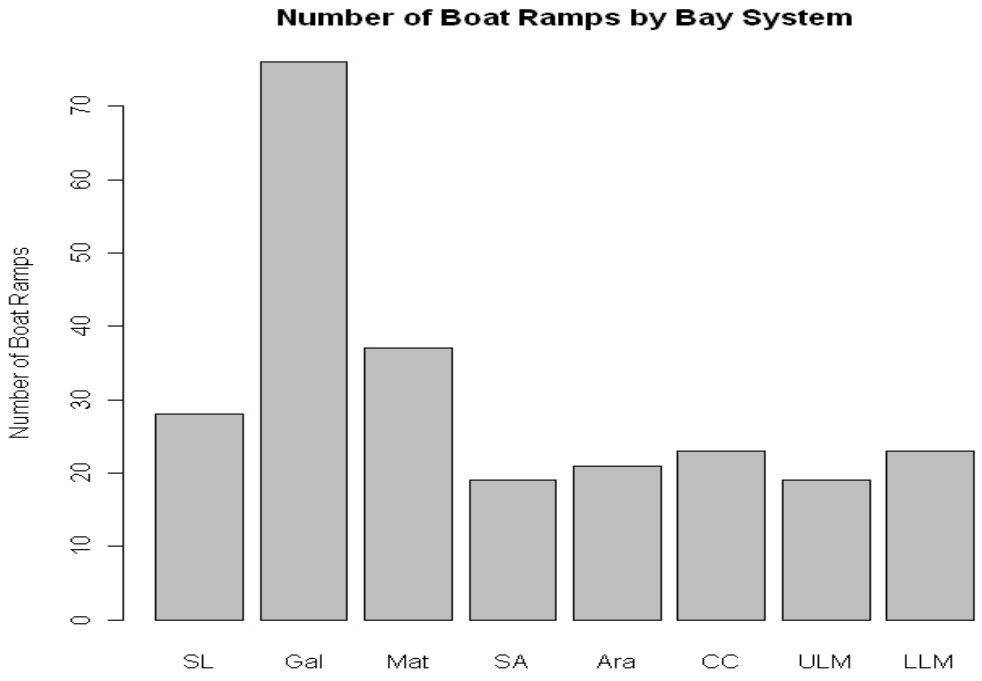


Figure 3: Number of boat ramps by bay system surveyed by TPWD in 2009-2010 low-use creel survey season. SL = Sabine Lake, Gal = Galveston, Mat = Matagorda, SA = San Antonio, Ara = Aransas, CC = Corpus Christi, ULM = Upper Laguna Madre, LLM = Lower Laguna Madre.

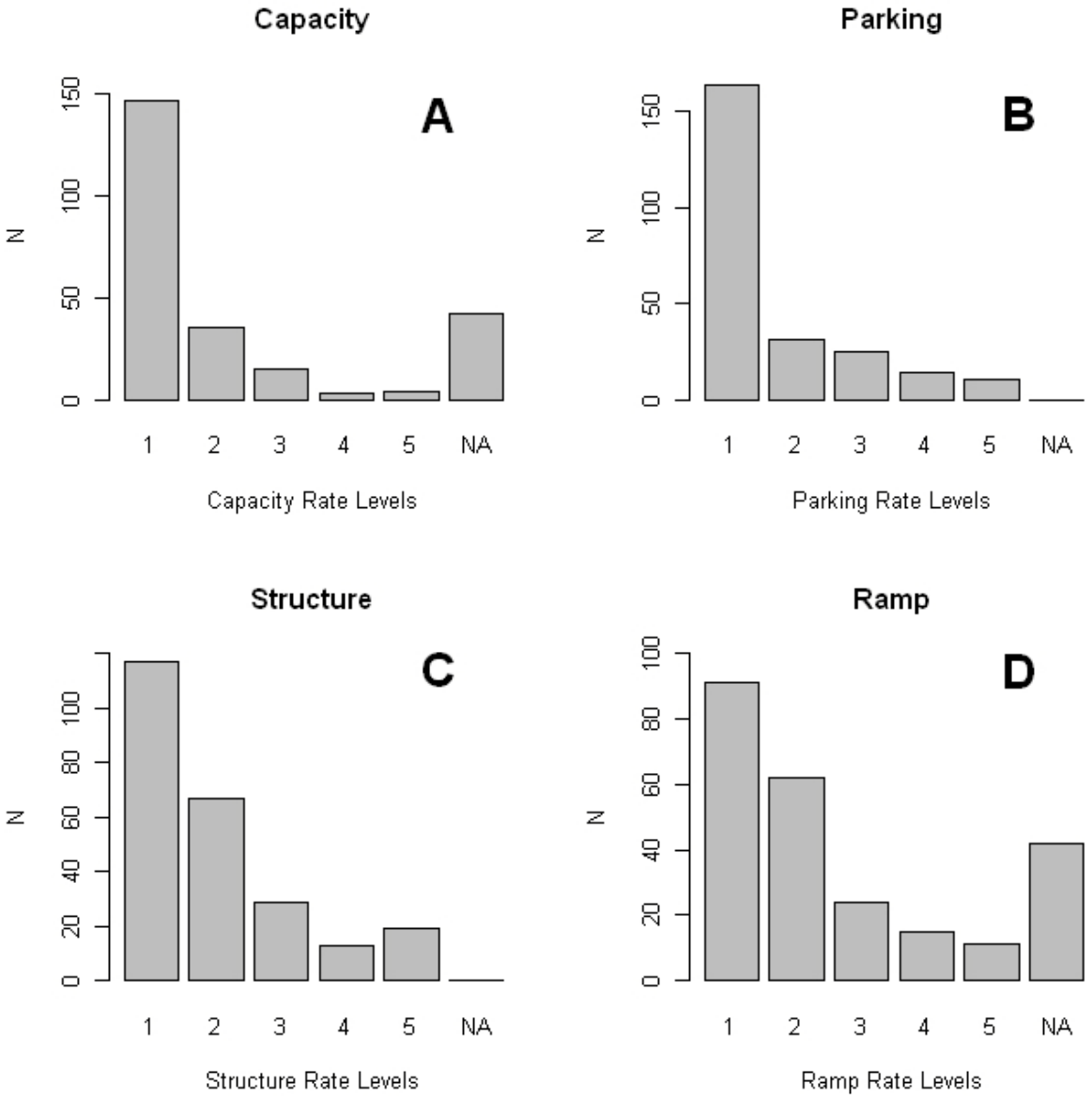


Figure 4: A) Number of capacity rate levels for all boat ramps combined. Rate 1= no expansion, 2 = some expansion needed, 3 = moderate expansion needed, 4= considerable expansion needed, 5 = extensive expansion needed, and NA = data not available. B) Number of parking rate levels for all boat ramps combined. Rate 1= no expansion, 2 = some expansion needed, 3 = moderate expansion needed, 4= considerable expansion needed, 5 = extensive expansion needed, and NA = data not available. C) Number of structure rate levels for all boat ramps combined. Rate 1 = no repair needed, 2 = some repair needed, 3 = moderate repair needed, 4 = considerable repair needed, 5 = extensive repair needed, and NA = no data available. D) Number of ramp rate levels for all boat ramps combined. Rate 1 = no repair needed, 2 = some repair needed, 3 = moderate repair needed, 4 = considerable repair needed, 5 = extensive repair needed, and NA = no data available.