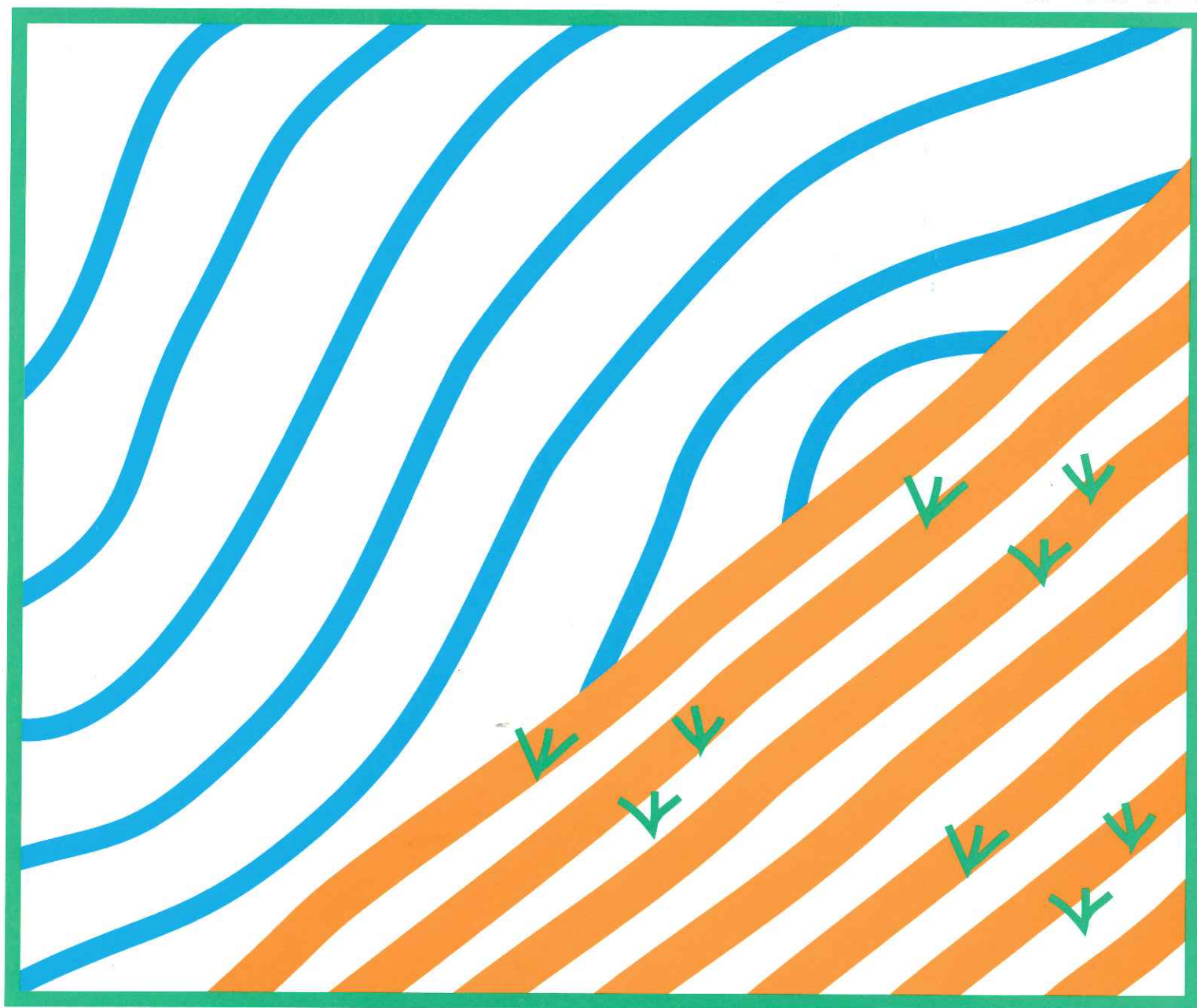


FEB 26 1991

# TEXAS COASTAL MANAGEMENT PLAN



## 1990-1991

TEXAS GENERAL LAND OFFICE  
GARRY MAURO, COMMISSIONER



January 1991

Governor Richards, Members of the Legislature,  
and the Citizens of the State of Texas:

In 1989, at the request of the 71st Texas Legislature, the General Land Office began coordinating the development of a comprehensive coastal management plan for the state's coastal public lands. This report presents recommendations on three issues of immediate concern to everyone with an interest in the future of the Texas Gulf Coast: coastal erosion, beach access, and wetland loss.

To ensure that our recommendations would reflect the viewpoints and needs of all Texans, I appointed an 84-member advisory committee whose membership represents a broad range of coastal interests. We also worked closely with state and federal task forces representing nearly two dozen agencies with coastal responsibilities.

The advisory committee, the task force members and coastal citizens have given generously of their time, expertise, and energy to help us formulate these first elements of a plan for improved coastal management in Texas. Many of them participated in a series of "consensus-building" workshops held during the summer of 1990. The purpose of the workshops was to illuminate as many points of view on coastal erosion, beach access, and wetland loss as possible—from scientific opinion to emotional reaction—in the hope of finding common ground.

The result was surprising. Representatives of interests as diverse as the oil and gas industry, real estate development, commercial and recreational fishing, conservation, and all levels of government reached agreement on the policy recommendations presented here. Public meetings were held along the coast to give coastal residents the opportunity to comment on the draft of this report. Their opinions are reflected in the final recommendations as well.

All Texans will benefit from better management of their coastal public lands—from a healthy environment, high-quality recreational opportunities, and the continued economic productivity of the coastal area. We believe these recommendations are an important first step, and we look forward to the exploration of new policies for other coastal management issues.

Sincerely,

  
Garry Mauro  
Texas Land Commissioner





## Table of Contents

<b>ACKNOWLEDGEMENTS.....</b>	<b>1</b>
Advisory Committee.....	2
State Agency Task Force.....	3
Federal Agency Task Force.....	3
 <b>EXECUTIVE SUMMARY.....</b>	 <b>4</b>
Importance of the Texas Coast.....	4
Texas Coastal Management Plan.....	5
Coastal Erosion and Dune Protection.....	5
State-Owned Wetlands.....	6
Beach Access.....	7
 <b>PRIMARY ISSUES OF CONCERN.....</b>	 <b>9</b>
<b>Coastal Erosion and Dune Protection.....</b>	<b>9</b>
Sand Budget.....	10
Bayshore Erosion.....	11
Dune Protection.....	12
Use of Dredged Material.....	13
Interagency Coordination and Planning.....	14
Public Education.....	15
Appropriations.....	16
<b>State-Owned Wetlands.....</b>	<b>16</b>
Wetland Loss.....	17
Wetland Degradation.....	18
Interagency Coordination.....	19
Public Education.....	19
Wetland Enhancement and Restoration.....	20
Appropriations.....	20
<b>Beach Access.....</b>	<b>22</b>
Beach Access Points.....	22
Beach Access Planning.....	23
Interagency Coordination.....	23
Public Education.....	24
 <b>OTHER ISSUES OF CONCERN.....</b>	 <b>26</b>
Oil Spills.....	26
Marine Debris.....	27
Freshwater Inflow.....	29
Nonpoint-Source Pollution.....	30
Hazardous Waste Generation and Disposal.....	31
 <b>APPENDIX I</b>	
The Consensus-Building Process.....	34
 <b>APPENDIX II</b>	
Coastal Management Plan Workshop Participants.....	36
 <b>APPENDIX III</b>	
Coastal Responsibilities of Texas State Agencies.....	39



## ACKNOWLEDGEMENTS



he Coastal Management Advisory Committee appointed by Land Commissioner Garry Mauro is composed of knowledgeable individuals representing diverse interests on the Texas coast. This committee has provided invaluable service to the General Land Office throughout the planning process. In addition, many agencies and private citizens have been of great assistance to the General Land Office in beginning the plan development.

The Texas Water Development Board provided a grant to the land office to conduct consensus-building workshops on the primary coastal issues. Dr. Thomas Bonnicksen of Texas A&M University's Office for Strategic Studies in Resource Policy coordinated these workshops. Private citizens, representatives of business and industry, and local, state and federal government officials participated in the workshops.

Members of the State Agency Task Force and Federal Agency Task Force provided time and assistance in the public meetings, workshops, and in drafting the management plan.

General Land Office staff who assisted in the effort were:

**Andrew Mangan, Deputy Commissioner for Resource Management**

**Sally Davenport, Director, Coastal Division**

**Don Cook, Director, Special Programs**

**Jeff Frank, Director, Research**

**Tom Nuckols, Director, Land Resources, Legal Services Program**

**Catherine Weiss, Director, Graphics**

*Diana Aguilar, Tom Calnan, Susan Cox, Jan Justice, Quentin Keith, Jeff Long, Kimberly McKenna, June O'Quinn, Greg Pollock, Bruce Smith, Peggy Spies, Gavin Villareal, Jana Waller, and Muriel Wright.*





Advisory Committee

**Garry Mauro**, Chairman  
**Alan Allen**, Executive Director, Sportsmen Conservationists of Texas  
**John Armstrong**, Rancher, Kingsville  
**Neal Armstrong**, The University of Texas at Austin  
**John Arrington**, Beachfront Property Owner  
**James Barr, Sr.**, Mayor, City of Port Aransas  
**Eddie Barr**, Galveston County Commissioner  
**Lola Bonner**, Attorney, Rockport  
**Peter Bowman**, University of Houston-Clear Lake  
**David Braun**, Executive Director, Texas Nature Conservancy  
**Le Roy Bruner**, Pres., AFL-CIO, International Longshoremen's Assoc.  
**Calvin Byrd**, Mayor, City of Port Isabel  
**Mary Lou Campbell**, Sierra Club  
**Frank Carmona**, County Commissioner, Galveston County  
**Malcom Clark**, Former Mayor, City of Port Arthur  
**Ken Conway**, Parks Director, South Padre Island  
**Barbara Crews**, Mayor, City of Galveston  
**Dan Currens**, Amoco Production  
**George Deshotels**, County Commissioner, Matagorda County  
**Joe Dial**, Citizen's Advisory Committee, EPA-Gulf of Mexico Program  
**Phillip Douglas**, Phillip J. Douglas, Inc.  
**Carl Duncan**, Commissioner, San Patricio County  
**Russell Eitel**, Chairman, Galveston Beach Environment Committee  
**Allen Faulk**, Mayor, City of Freeport  
**Merriwood Ferguson**, Conservation Co-chair, Frontera Audubon Society  
**A. Frank Frankovich**, Dannenbaum Engineering  
**J. A. Garcia, Jr.**, Judge, Kenedy County  
**Antonio Garza, Jr.**, Judge, Cameron County  
**Lucy Gibbs**, Executive Director, Texas Shrimp Association  
**Mike Gray**, Plant Manager, Monsanto Corporation  
**John Hall**, Lower Colorado River Authority  
**Pat Hallisey**, Director, Galveston County Parks Board  
**Don Hansen**, Executive Vice President, Texas Hotel/Motel Association  
**Alex Hernandez**, Judge, Calhoun County  
**Jake Hershey**, Retired Businessman, Houston  
**Mike Hightower**, Deputy Director, Sea Grant College Program  
**William Holmes, Jr.**, Director, Boating Trades Association  
**William Jasper**, Director, Environmental Svcs., Central Power & Light  
**Robert Jones**, Director, Univ. of Texas, Marine Science Institute  
**Thomas Lambright**, Commercial Fisherman, Port O'Connor  
**Berdon Lawrence**, President, Hollywood Marine, Inc.  
**Kenneth Lester**, Former Mayor, Port Lavaca  
**Eddie Long**, Secretary-Treasurer, Texas Pipe Trades Association  
**J. P. Luby**, County Commissioner, Nueces County  
**Joseph Malina**, Department of Civil Engineering, Univ. of Texas  
**Linda Maraniss**, Regional Director, Center for Marine Conservation  
**Sharon Mattox**, Attorney, Vinson & Elkins  
**David McKee**, Asst. Professor of Biology, Corpus Christi State Univ.  
**James McNicholas**, Commissioner, Drainage District No. 6  
**Maurice Meyers**, Former Mayor, Beaumont  
**Becky Moeller**, President, Coastal Bend Labor Council-CWA  
**Joe Moseley**, Shiner, Moseley & Associates, Inc.  
**Ron Neighbors**, Director, Houston-Galveston Subsidence District  
**Robert Parker**, Vice President, Parker Brothers & Co., Inc.  
**Robert Pinkerton, Jr.**, Mayor, City of South Padre Island  
**Bill Rapp**, Judge, Willacy County

**Mike Reuwsaat**, Parks Director, Kleberg County  
**George Fred Rhodes**, Attorney, Port Lavaca  
**C. F. (Dick) Schendel**, Soil & Water Conservation Board  
**A. R. (Babe) Schwartz**, Attorney, Galveston  
**Roy Sedwick**, Texas Floodplain Management Association  
**Linda Shead**, Executive Director, Galveston Bay Foundation  
**Gwen Smith**, Natural Resources Comm., Tx. League of Women Voters  
**Mike Speed**, Conrad Blucher Institute, Corpus Christi State Univ.  
**Bob Stallman**, Texas Farm Bureau  
**C. L. Standley**, Commercial Fisherman, Dickinson  
**Meta Stearns**, Clean Campos for the Coastal Bend  
**N. E. (Nick) Stepchinski**, Crescent Electric, Inc.  
**Sharron Stewart**, Texas Environmental Coalition, Freeport  
**James Stringer**, Judge, Orange County  
**Robert Stroder**, Engineer, Jefferson County  
**Mary Ellen Summerlin**, Mayor, City of Port Arthur  
**Adolph Thoma**, Commissioner, Cameron County  
**Betty Turner**, Mayor, City of Corpus Christi  
**Janet Wagner**, 3-D Environmental  
**Bart Wales**, Mayor, City of Refugio  
**Robert B. Wallace, Jr.**, Attorney, Corpus Christi  
**John Watson**, Mitchell Energy & Development  
**Ro Wauer**, National Audubon Society, Corpus Christi  
**William Younger**, County Extension Marine Agent, Matagorda County

**Dan Beckett**, Texas Water Commission  
**Ken Cross**, Texas Attorney General's Office  
**Walt Lillie**, Texas Railroad Commission  
**William Longley**, Texas Water Development Board  
**Alvin Luedecke**, Texas Dept. of Highways & Public Transportation  
**Andrew T. Mangan**, Deputy Commissioner, Texas General Land Office  
**Larry McKinney**, Texas Parks & Wildlife Department  
**Robert Morton**, Bureau of Economic Geology, University of Texas  
**Bruce Moulton**, Texas Water Commission  
**Leland Roberts**, Texas Parks & Wildlife Department  
**Lori Wrotenberry**, Texas Railroad Commission

**C. R. Burchett**, Texas District Chief, U.S. Geological Survey  
**Tom Grahl**, U.S. Fish and Wildlife Service  
**David Hankla**, Field Supervisor, U.S. Fish and Wildlife Service  
**Brad Harris**, Regional Director, Federal Emergency Management Agency  
**B. D. King**, U.S. Fish and Wildlife Service  
**Robert Layton, Jr.**, Regional Admin., Env. Protection Agency  
**Jim LeGrotte**, Federal Emergency Management Agency  
**Brink Miller**, Colonel, U.S. Army Corps of Engineers  
**Donald Moore**, Area Supervisor, National Marine Fisheries Service  
**Harry (Wess) Oneth**, Soil Conservation Service  
**Rusty Swafford**, National Marine Fisheries Service  
**Gary Westmoreland**, Asst. Conservationist, Soil Conservation Service

State Agency Task Force

Federal Agency Task Force





# EXECUTIVE SUMMARY



he Texas Legislature recognized the many problems threatening the Texas Gulf Coast by passing Senate Bill 1571 in 1989. This legislation designated the General Land Office the lead agency in developing a comprehensive, long-term plan for state-owned coastal public lands. This is the first substantial legislation addressing coastal needs in Texas since 1973.

Texas is one of two coastal states (excepting the Great Lakes states) that do not have federally approved and financed Coastal Zone Management Plans. Texas attempted to join the federal program during the 1970's, but incentives were not sufficient at that time to overcome opposition. Recent years have brought a change in attitude among coastal citizens and businesses. These interests now agree that enhancement and preservation of coastal natural resources makes good sense for business as well as environmental reasons.

This document presents the initial recommendations for the Texas Coastal Management Plan being developed under S.B. 1571.

Over a third of the state's population and economic activity is concentrated in a tenth of its land area within 100 miles of the coast. It is projected that by the year 2000, more than 5.3 million persons will live in the first tier of counties bordering the Texas coast. The population living directly on the state's shoreline will have more than doubled between 1960 and 2010, according to projections by the U.S. Department of Commerce.

Oil, gas, and petrochemical production have been the leading industries on the Texas coast, which houses almost 65 percent of the nation's petrochemical capacity and 25 percent of its refining capacity. Texas has supplied about one-third of all the oil and gas produced in the U.S. The Gulf Coast region produced 11 percent of the oil and 22 percent of the gas produced in Texas in 1987.

Since the decline in the oil and gas industry during the late 1980's, tourism and various forms of recreation have become more important to the Texas economy. Tourism is now the state's number two industry, and three of the ten Texas counties that lead in tourism expenditures are located on the coast.

The Texas marine commerce and navigation industry is another principal economic contributor. Texas ports handled over 291 million tons of cargo in 1987, and cargo transported via the Gulf Intracoastal Waterway in 1989 had a total value of \$23.6 billion.

Commercial fishing and agriculture are also important segments of the Texas coastal economy. The ex-vessel value of the commercial fishery in 1986 was over \$246 million. In 1982, there were approximately 5.5 million acres of farm-

land in Texas coastal counties, with cattle, cotton, grain, fruits and vegetables leading the product list.

Soon after the passage of S.B. 1571, in the spring of 1989, Texas Land Commissioner Garry Mauro appointed a Coastal Management Advisory Committee and a State Agency Task Force to aid the Texas General Land Office in putting together a long-range management plan. In addition, a Federal Agency Task Force was organized to help coordinate overlapping federal and state interests.

In February, March, and April of 1990, the General Land Office held five public meetings along the coast to determine which issues coastal citizens felt were most critical and should be addressed first by the plan. Three issues emerged from the public meetings as being of primary importance to the coastal public: coastal erosion/dune protection, wetland loss, and beach access.

These issues were discussed in depth at a series of consensus-building workshops held in the summer of 1990 with representatives of business, environmental interests, and government. This document summarizes the management recommendations developed and approved for each of these issues by the citizens who participated in the workshops and by the Coastal Management Advisory Committee.

Five other issues were identified as important concerns of the Texas coastal community: marine debris, oil spills, hazardous wastes, freshwater inflow into bays and estuaries, and nonpoint-source pollution. The experience of two major oil spills in and around Galveston Bay during the summer of 1990 made clear the need for improvement in Texas spill response plans. Recommendations concerning oil spill response and ongoing state efforts to address the other four issues are summarized here as well.

Of the 367 miles of Texas Gulf shoreline, approximately 60 percent is eroding at rates of between one and 50 feet per year. About 33 percent is stable, and seven percent is accreting. Erosion is not confined to the Texas Gulf beaches; it also affects the bay systems, where it causes the loss of agricultural, industrial, and residential lands and threatens the productive wetlands that serve as nursery grounds for sport and commercial fisheries. In total, about two-thirds of Texas bay shores are eroding.

- Develop coastal erosion demonstration projects to show the feasibility of different methods of slowing coastal erosion or alleviating the current deficiency in the sand budget.
- Manage placement of dredged material to replenish eroded areas as appropriate, establishing guidelines for stockpiling beach-quality dredged material that incorporate grain size and toxicity level standards.
- Increase planting of vegetation as a low-cost means of inhibiting bayshore erosion.
- Design a state program which can be certified under the 1988 Upton-Jones Amendment to the National Flood Insurance Act. Establish develop-

# Texas Coastal Management Plan

## Coastal Erosion and Dune Protection

### Recommendations

## Importance of the Texas Coast



ment guidelines and setbacks in coastal areas based on historical rates of shoreline erosion.

- Support research and nursery projects to develop and cultivate disease-resistant vegetation adapted to local conditions. Seek government and private help in this effort.
- Require new dams, groins, and other structures which impede sand movement to be constructed with sediment bypassing systems, and, where feasible, retrofit existing structures to allow bypassing.
- Amend the Dune Protection Act to apply to all Texas coastal counties.
- Give coastal counties regulatory authority to manage beaches in unincorporated areas.
- Increase efforts to educate the public about the causes of erosion and the importance of barrier islands, dunes, and bays as a natural defense against storms and hurricanes.
- Evaluate the feasibility of bypassing sediment at dams to allow it to reach the coast.
- Appoint the General Land Office as the lead state agency for coordinating erosion response planning among appropriate local, state, and federal agencies.

State-Owned Wetlands

Coastal wetlands are among the world's most important and threatened ecosystems. Wetlands act as flood storage and flood conveyance systems, cleanse polluted waters, support fish and wildlife, protect shorelines, recharge aquifers, and provide settings for outdoor recreation and educational opportunities. Texas lost an estimated 35 percent of its coastal marshes between the mid-1950's and 1979 according to U.S. Fish and Wildlife studies. More than 10,000 acres have been lost in the Neches River valley alone. The loss has been due to increased coastal development, pollution, and subsidence. Mitigation efforts (attempts to replant or replace damaged wetlands) do not always work.

State-owned wetlands include vegetated bay, lagoonal, or river bottoms and intertidal flats to mean high tide.

Recommendations

- Develop and adopt a State Wetland Conservation Plan for state-owned coastal lands, to be drafted by the Texas Parks and Wildlife Department in coordination with the Texas Water Commission, the General Land Office and other appropriate local, state, and federal agencies.
- Adopt a goal of no overall net loss of wetlands on coastal public lands and establish a policy framework for achieving that goal, with the Texas Parks and Wildlife Department responsible for monitoring and enforcement.
- Use a "networking" strategy to improve coordination among existing state and federal agencies with wetland permitting and protection responsibilities,

perhaps employing memoranda of agreement (MOAs) and permit processing coordination.

- Reduce nonpoint-source pollution of Texas bays and estuaries, adopting standards developed by both state (Texas Water Commission and Department of Agriculture) and federal (Environmental Protection Agency) agencies.
- Provide for adequate seasonal freshwater inflows to Texas bays and estuaries to help decrease contaminant concentrations and maintain overall estuarine productivity. Request the Texas Water Commission, the Texas Parks and Wildlife Department, and the Texas Water Development Board, in coordination with other agencies, to consider protection of wetlands as they determine the inflow requirements of each estuary.
- Examine the effects of boat traffic in sensitive wetlands. The Texas Parks and Wildlife Department should coordinate a public education effort to inform boaters of the sensitive nature of wetlands and proper boating procedures. The Texas Parks and Wildlife Department should conduct scientific studies to determine the effects of boat traffic in wetlands.
- Prepare long-range navigational dredging and disposal plans. As recommended in the 1990 Texas Outdoor Recreation Plan, encourage the Texas Legislature to require all local sponsors of navigation projects to prepare long-range dredging and disposal plans in coordination with the Corps of Engineers insuring adequate wetland protection.
- Distribute public education materials, to be produced by the Texas General Land Office and the Texas Parks and Wildlife Department, explaining the importance of coastal wetlands.

The Texas Open Beaches Act guarantees the public the right to use the state-owned beaches bordering on the seaward shore of the Gulf of Mexico. The state owns the *wet beach* up to the line of mean high tide. The act also confirms the public's right of access and use of a public easement above the high tide line, across the *dry beach* to the vegetation line.

Conflicts have arisen between the state Attorney General's Office, which is responsible for enforcing the act, and private beachfront property owners, since state courts have ruled that the public's easement to the beach is a rolling easement that varies as the vegetation line is moved by storms or erosion. Another concern is that Texas law does not clearly provide for adequate accessways perpendicular to the shoreline, and that shoreline development has diminished public access to the beach in some areas.

- Approve the proposed Texas Heritage Trust Fund for acquisition of parkland and environmentally sensitive areas, with a portion of the fund earmarked for quality beach access points.
- Mandate comprehensive beach access planning at the local level with state coordination. Give coastal counties the authority to design and imple-

Beach Access

Recommendations



ment comprehensive beach management plans. Require the General Land Office to act as the lead oversight agency for beach access planning.

- Require the General Land Office and the Attorney General's Office to develop guidelines and rules, as appropriate, to address administrative questions arising from the Open Beaches Act, with the Texas Attorney General's Office maintaining enforcement responsibilities under the act.
- Promote erosion-conscious development to minimize real property loss resulting from enforcement of the Open Beaches Act.
- Develop appropriate guidelines so that the state of Texas can be certified to help local or private landowners secure aid under the Upton-Jones Amendment to the Federal Flood Insurance Act.
- Disseminate educational materials concerning the Texas Open Beaches Act and the importance of preserving Texas natural beach areas and dune systems, with the Attorney General's Office, the General Land Office, the Texas A&M Sea Grant Program, and the Texas Education Agency working together to develop and distribute the materials.
- Provide a uniform bilingual beach access sign, designed and produced by the State Department of Highways and Public Transportation and the General Land Office, to local governments on the coast.



## PRIMARY ISSUES OF CONCERN

### Coastal Erosion and Dune Protection



The Texas coast is a fragile, dynamic environment which is constantly changing in reaction to natural and human influences. Shoreline erosion — the continual stripping away of sandy beaches and grassy bay shorelines as the shore migrates landward — is a serious problem on the Texas coast, and one that citizens and government alike must address to maintain the economic and ecological integrity of the coastal area. Of the 367 miles of Texas gulf shoreline, approximately 60 percent (220 miles) is eroding at rates of between one and 50 feet per year; approximately 33 percent is stable, and seven percent is accreting. Shoreline erosion can limit beach access, harm the environment, and damage the state's economy.

Erosion is not confined to the Texas gulf beaches; it also affects the bay systems, where it causes the loss of agricultural, industrial, and residential lands and threatens the productive wetlands that serve as nursery grounds for sport and commercial fisheries. Shoreline erosion rates have been measured for about half of the bay shores, including Galveston, Matagorda, San Antonio, Copano, and Corpus Christi bays. In total, about two-thirds of Texas bay shores are eroding. From the mid-1800's to 1974, the gulf shore land loss averaged 225 acres per year.

The Texas barrier island coastline is a natural buffer against storms and hurricanes. Erosion of barrier islands is becoming critical in some parts of the Texas coast. In 1983, for instance, beach erosion caused by Hurricane Alicia's storm surge and winds compelled the Texas Attorney General to enforce provisions in the Open Beaches Act and claim as state land parts of the coast that had been in private ownership, including several private residences.

An example of severe coastal erosion is found at Sargent Beach, where the gulf shoreline is disappearing at a rate of at least 33 feet per year. What makes the situation especially critical — besides the loss of homes and beachfront property — is the fact that only 600 feet now separates the Gulf Intracoastal Waterway from the open Gulf of Mexico. A breach in this strip of land would expose the channel to the open gulf, disrupting ship and barge traffic which annually carries an average of 17 to 19 million tons of goods worth \$20 billion.

In addition to threatening Texas coastal shipping, shoreline erosion — particularly beach erosion — is extremely detrimental to the growing tourist industry. Coastwide, tourism produces over \$6 billion per year in state revenue. This tourism depends not only on the quality of Texas beaches and shores, but also on a reliable coastal road system. Shoreline erosion that has forced the closing of State Highway No. 87 along the Jefferson County coast has reduced visita-



tion to Sea Rim State Park by 50 percent. Local businesses in Sabine Pass, predominantly seafood businesses and restaurants, are struggling because of the decline in tourism.

Galveston County alone records between five and six million visitors spending nearly \$300 million annually. If unchecked, erosion in Galveston at West Beach may undermine the west end of the seawall within the next ten years.

Corpus Christi, the nation's sixth largest port, attracts 2.8 million visitors annually. In 1989, tourism generated \$350 million in local spending. Continued erosion of unstable bay shores poses a threat to the owners of private, agricultural, and ranch lands, and to coastal cities through loss of taxable property. In addition, the commercial and tourism-related industries are adversely affected by shoreline loss. South Padre Island is a year-round beach resort that attracts more than two million visitors a year. Motel and hotel receipts totalled \$27.8 million in 1989. But dunes on the island have been leveled for construction of high-rise hotels. Dune losses and erosion rates of five to ten feet per year suggest an unstable coastal environment and the need for more erosion-conscious development practices.

Sand Budget

The "sand budget" is a quantitative statement of all sources, sinks, and transport of sediment within a defined area. From the sand or sediment budget, it is possible to determine whether the gains and losses are in balance. That balance is critical to the stability of the shoreline. Many factors affect the sediment budget both negatively and positively. Some can be managed, some cannot. Fundamental natural causes of erosion are decreases in sediment supply, storms, and subsidence. Man has exacerbated gulf shoreline erosion by compartmentalizing the coast, reducing river sediment, accelerating subsidence, possibly increasing the rate of sea-level rise, and allowing poor beach and dune management practices.

One of the most significant human-induced changes is the interruption of sediment transported alongshore. Structures such as jetties and groins trap sediments eroded from adjacent beaches, depriving downdrift shores of sand and inducing localized erosion.

Dams reduce the amount of sediment supplied to the littoral zone by rivers in two ways. One is the physical trapping of sediments within reservoirs created by the dams. The other is the reduction of the flood peaks through temporary storage of runoff within the reservoirs, which reduces downstream velocities and therefore the sediment carrying capacity. Only in recent years have freshwater inflows to bays and estuaries and provisions for sediment bypassing to supply material to beaches been considered in the planning of freshwater impoundments.

The Brazos River and the Rio Grande, which have dams, discharge directly into the Gulf of Mexico. The Colorado River has discharged into the Gulf since the early 1930's but will be diverted back into Matagorda Bay within the next few years. The San Bernard River has no major water development projects, and little is known about its sediment discharge into the Gulf of Mexico. Forty dams for reservoirs with capacities exceeding 5,000 acre-feet have been constructed in the Brazos River basin alone. These dams trap the primary source of terrigenous sediments needed to stabilize the shoreline at Surfside, Freeport, and

Sargent Beach. A 1976 study of the Brazos River basin estimated that the reservoirs capture 148,600,000 cubic feet of sediment annually. The accumulation of sediment in inland reservoirs decreases both flood storage capacity and reservoir yields.

The rivers entering the Gulf of Mexico have not been the only source of sediment for the beaches in the past few thousand years; they are merely the source over which there is some human control and which can be reduced by human activities.

- Develop demonstration projects with the Corps of Engineers and local governments to show the feasibility of sand bypassing at inlets and dams and the use of offshore sources of beach-quality sand for beach nourishment.
- Distribute the costs of the demonstration projects among federal, state, and local governments and the private sector.
- Evaluate the feasibility of retrofitting existing jetties, groins, and other coastal structures to allow bypassing of sediments. (Successful working prototypes are located in Florida, Delaware, and at the mouth of the Colorado River in Texas.)
- Where practicable, require new water impoundment structures downstream of the seawardmost reservoir in rivers that flow directly into the Gulf of Mexico to be constructed with sediment bypassing systems. This would affect six of the 14 new water supply reservoirs proposed by the Texas Water Development Board (TWDB) in the 1990 Texas Water Plan.
- Require studies to estimate the quantity and quality of sediment trapped by reservoirs and to identify the sources of that sediment.
- Create a plan for sediment bypassing in each basin that maximizes the amount of sediment passed and minimizes the cost of building and operating the bypass systems.
- Decrease and eventually eliminate human-induced subsidence by limiting the amount of groundwater withdrawals and maintaining adequate pressure in hydrocarbon reservoirs consistent with proper petroleum reservoir engineering principles.

The twelve major bay systems on the Texas coast are Sabine Lake, Galveston Bay, Matagorda Bay, San Antonio Bay, Aransas Bay, Corpus Christi Bay, Baffin Bay, Trinity Bay, Lavaca Bay, Copano Bay, Nueces Bay, and Laguna Madre. The total length of Texas bay shoreline is estimated at 1100 miles.

Erosion of bay shores can be caused by a variety of circumstances including interruption of sediment transport by upstream structures, shoreline structures and fills, subsidence, ship and boat wakes, high wave energy during storms, and the loss of vegetation due to both natural forces and human activities.

The dredging of inlets, harbors, and channels for navigation and commerce alters the tidal prism and affects the natural movement of sand and sediment

Recommendations

Bayshore Erosion



within the coastal depositional system. The dredging of deep-draft channels alters the salinity regime and biological distribution within bays and estuaries. In addition, dredging and disposal activities modify circulation and impact the natural habitats, breeding grounds, and nurseries for species which are critical to the upper reaches of the food chain. Historical practices of open bay disposal of dredged material have ignored the immediate and long-term impacts on the flora and fauna. Today, government and industry are working together to investigate the beneficial uses of dredged material.

Another factor which indirectly contributes to the rate of erosion is subsidence—the sinking of land relative to sea level. Subsidence allows the shores to be exposed to greater wave activity and elevated salt water levels on the coastal banks. There are two causes of land subsidence: (1) the natural compaction of deltaic sediments by the overlying weight of newly deposited layers of sediments; (2) man's removal of groundwater and minerals. Human-induced subsidence has resulted in tremendous land surface changes in the Galveston Bay area, particularly in Baytown, where the land has sunk more than nine feet since the early 1900's because of resource extraction. Subsidence can damage structures and impede access to the bayshores by making roads more vulnerable to flooding.

Bay shorelines are eroding at rates of up to five feet per year. Rates of one to two feet per year are commonly reported. In Chambers County, an estimated 46 acres disappear into East Galveston and Trinity bays every year.

Recommendations

- Increase bay and gulf shore vegetation. Plant selected bayshore areas with marsh grasses to inhibit erosion. (Successful stabilization projects have been conducted along Galveston and San Jacinto bays by the Texas A&M Marine Advisory Service, the U.S. Soil Conservation Service, the Galveston Bay Foundation and the University of Texas. The ports of Houston and Corpus Christi and other private industries have actively contributed toward bayshore erosion research.)
- Work with nursery projects to develop and cultivate disease-resistant vegetation adapted to local conditions. Explore possible public/private partnerships to establish a coastal vegetation nursery and laboratory.
- Explore the use of dredged materials to build berms as buffers to wave energy on bay shores.

Dune Protection

Sand dunes in coastal areas are important natural protective formations. They prevent storm waters from flooding the low interior areas; they store sand that replenishes eroded beaches after storms; and they act as a buffer against wind-blown sand and salt spray. Well-established dunes provide more effective protection at a lower cost than hard structures such as seawalls. In addition, dunes offer an essential and diverse wildlife habitat. Texas dunes are home to lizards, kangaroo rats, ghost crabs, raccoons, opossums, various snakes, and coyotes.

Coastal dunes are built by sand that blows into a vegetated area on the beach. The vegetation acts as a sand-trapping device by reducing wind velocities so that sand drops out of the wind stream and accumulates on the vegetation

barrier. Although tolerant of temperature extremes and changes in salinity, dune vegetation is unable to withstand excessive trampling. Recreational vehicles and uncontrolled pedestrian traffic can cause irreversible damage to dune vegetation and thus make dunes more susceptible to erosion by wind and wave action. In addition, indiscriminate development practices on Galveston and South Padre islands have damaged and destabilized dunes.

The Texas Dune Protection Act, passed by the Texas Legislature in 1973, allows the commissioners' court of any county bordering on the Gulf of Mexico and north of the Mansfield Ship Channel that has a barrier island or peninsula within its boundaries to establish a dune protection line on the Gulf beach. This line may lie up to 1,000 feet landward of the mean high tide line. When such a line has been established, anyone proposing an activity seaward of the line must obtain a permit from the county commissioners' court. Permit applications are circulated to the General Land Office for comment before they are acted upon; a county dune protection committee composed of local citizens also reviews the applications. At present, only Nueces and Brazoria counties have established dune protection lines and are participating in the Dune Protection Program. However, Galveston and several other cities have instituted dune protection ordinances, and several other counties are considering the establishment of dune protection lines.

In Brazoria and Galveston counties, local municipalities have promoted the use of recycled Christmas trees as effective sand traps for establishing or restoring dunes.

Recommendations

- Amend the Dune Protection Act to apply to all Texas coastal counties.
- Grant coastal counties regulatory authority to manage beaches in unincorporated areas. Coastal counties currently have no authority to create a meaningful policy for the beach.
- Minimize vehicle and pedestrian impact on dunes by creating traffic lanes, off-beach parking, and dune walkovers.
- Plan for the expected population and tourism increase along the Gulf Coast in order to minimize the effects of beach traffic on beaches and dunes.
- Promote dune revegetation and restoration to protect both the dunes and upland property.

For decades, material dredged from channels has been disposed of offshore or in disposal mounds along the Gulf Intracoastal Waterway and ship channels. Recently, the Corps of Engineers (COE) has investigated the use of dredged material for coastline rehabilitation. Section 933 of the Water Resources Development Act authorizes the federal government to share 50 percent of additional costs required to place dredged material on adjacent shorefronts if it is economically feasible for storm damage prevention. Beach-quality material dredged from the Mansfield and Brownsville ship channels has been used by the COE for beach restoration on South Padre Island.

Use of Dredged Material



Beach nourishment has become the most acceptable method of shoreline stabilization, because it is more compatible with the natural systems. Although expensive, nourishment can be economically justified in areas of high recreational use with a nearby source of beach-quality sand. Beach nourishment is not a one-time solution to an eroding shore but involves a commitment of the community to replenish or renourish the beach over time. This solution can be very costly. In Florida, where beach nourishment is the major erosion control technique, costs for adding beach-quality sand to the shore average \$2.6 million per mile. One of the largest beach nourishment projects occurred at Miami Beach, where thorough design and limited storm activity have contributed to the project's success.

Recommendations

- Use dredged material to replenish eroded areas as appropriate.
- Establish beach nourishment projects.
- Establish guidelines for stockpiling beach-quality dredged material, incorporating grain size, toxicity levels, and suitability of the material to a specific site.
- Implement demonstration projects with the Corps of Engineers and local governments to illustrate the feasibility of using beach-quality dredged material for beach nourishment.
- Encourage the Corps of Engineers and local sponsors of navigational projects and private channels to prepare long-range navigational dredging and disposal plans in consultation with the appropriate federal and state agencies and affected local jurisdictions to identify cost-effective beneficial uses of dredged material.
- Collaborate with the Corps of Engineers to develop programs to alleviate or mitigate shore damage attributed to federal navigation works.

Interagency Coordination

Texas state agencies with coastal responsibilities include:  
**Bureau of Economic Geology at The University of Texas**  
**Texas Agricultural Extension Service/Marine Advisory Service.**  
**Texas Attorney General's Office**  
**Texas General Land Office**  
**Texas Parks and Wildlife Department**  
**Texas Railroad Commission**  
**Texas Soil & Water Conservation Board & Districts**  
**Texas State Department of Highways and Public Transportation**  
**Texas Water Commission**  
**Texas Water Development Board**

Federal agencies include:  
**Federal Emergency Management Agency**  
**U.S. Army Corps of Engineers**  
**U.S.D.A. Soil Conservation Service.**  
**U.S. Environmental Protection Agency**  
**U.S. Fish and Wildlife Service**  
**U.S. Geological Survey**  
**U.S. NOAA/National Marine Fisheries Service**

Local agencies include the county commissioners' courts and local planning boards, river authorities, water districts, ports and navigation districts.

Local governments should be aware of available funding opportunities and guidelines established by the federal government. At present, the Texas Water Commission is the coordinating state agency for floodplain management. No statewide flood insurance program has been established for the state of Texas.

Recommendations

- Appoint the General Land Office as the lead state agency in networking with appropriate agencies to coordinate local/state/federal erosion response planning.
- Identify coastal erosion areas of statewide significance and develop restoration or protection plans for each.
- Establish step-by-step procedures for erosion planning, plan review, agency coordination, and plan implementation.
- Identify and establish three planning districts (regions with similar geologic and erosional characteristics) to identify critical areas of erosion and set planning goals. The state would be responsible for coordinating with the proper agencies to implement the locally devised plans.
- Design a state program which can be certified under the 1988 Upton-Jones Amendment to the National Flood Insurance Act. (The Upton-Jones Amendment provides flood insurance payments for structures that are in imminent danger of collapse due to shoreline erosion. Homeowners can receive from the federal government up to 40 percent of the value of a house to relocate it further inland in an erosion-setback zone and up to 110 percent to demolish the house.)

Public education programs are essential to comprehensive coastal management. An informed public is more apt to respond appropriately to the hazards of living in erosion-prone coastal areas. To date, no ongoing public information effort concerning coastal erosion has been established.

Public Education

Recommendations

- Increase public awareness by stressing the importance of barrier islands, dunes, and bays as protective natural systems against storms and hurricanes.
- Educate the public about the causes of erosion, long- and short-term consequences of erosion, and erosion control techniques.
- Encourage agencies to collaborate on educational projects, thus minimizing duplication.
- Establish a Texas Environmental Education Fund to be administered by the Texas Education Agency as a mechanism to encourage donations from private industry and private foundations.



## Appropriations

Erosion control projects are complex, expensive, and time-consuming to plan and prepare. At present, there is no dedicated, permanent funding source for applied research on coastal erosion or for implementation of beach and dune restoration programs in Texas.

## Recommendations

- Seek general state, federal, and local appropriations for demonstration projects which show promise for alleviating coastal erosion.
- Collaborate with the Corps of Engineers to develop programs to mitigate shore damage attributed to federal navigation works (as amended Pub. L. 99-662, Title IX, 915(f), 940, Nov. 171, 1986, 100 Stat. 4191, 4199.) Sec. 111 of the River and Harbor Act of 1968.

## State-Owned Wetlands

Coastal wetlands are among the world's most important ecosystems. They have been described as "the kidneys of the landscape," because they are downstream receivers of wastes from natural and human sources, and they perform functions in hydrologic and chemical cycles. Wetlands have been found to store as well as convey floodwaters, cleanse polluted waters, support fish and wildlife, protect shorelines, recharge aquifers, provide settings for outdoor recreation and educational opportunities, and help preserve the natural beauty of an area. Once thought of as disease-ridden wastelands of little value, wetlands were drained and filled. With further study, however, wetlands began to be recognized as productive areas worth preserving.

The importance of wetlands in flood storage can be grasped when it is realized that a one-acre wetland will hold 330,000 gallons of water if flooded to a depth of one foot. Wetlands are most effective during floods of high intensity and short duration. Studies have shown that the presence of wetlands in a floodplain can reduce flood peaks by 80 percent. By controlling floodwater, wetlands can minimize the costs of disaster relief and property repair.

Wetlands improve water quality by removing suspended and dissolved materials and chemicals from the water that passes through them. They filter out sediment carried by runoff or streams. Water flows more slowly as it passes through a wetland, causing suspended sediments to fall to the bottom. Other sediments may be blocked by wetland plants. The water-cleansing function is especially important in agricultural and urban areas where runoff carries a heavy sediment load. By removing chemicals from runoff, wetlands serve the critical function of preventing bays and estuaries from becoming more polluted. Marshes can remove nitrates and phosphates from rivers or creeks which receive treated sewage from upstream sources; however, studies have shown that although wetlands can serve as sinks of nutrients for several years, their assimilation capacity is limited. Acceptable pollutant and hydrologic loadings must be determined for the use of wetlands in wastewater treatment.

Wetlands are probably most important as areas of great natural diversity and productivity. It is estimated that over 95 percent of the Gulf of Mexico's recreational and commercial fish species are estuarine-dependent, spending at least part of their life cycle in estuaries or bays. Three-fourths of North America's bird species depend upon wetlands for resting, feeding, or nesting. In addition, well over one-third of the 564 plant and animal species listed as threatened or endangered in the U.S. utilize wetland habitats during some portion of their life

cycle, although wetlands constitute only 5 percent of the land surface in the lower 48 states.

A number of attempts have been made to place a dollar value on an acre of marsh. It is difficult to reach a consensus value because of the variability of wetlands and the need to assess both market and nonmarket values. Better techniques for determining the value of wetlands must be developed. One method used to assess the value of wetlands is the amount of energy used to produce the goods and services provided by wetlands. Using this method, the combined market and nonmarket values range from \$10,000 to \$30,000 per acre annually. In addition, the value of wetlands as permanent open space may be reflected in higher real estate values of surrounding properties.

Although the importance and value of wetlands are now being recognized and translated into protective laws and regulations, coastal wetlands in Texas are still being lost at an alarming rate. Texas needs to learn to manage this valuable resource wisely. For the purposes of the following discussion, wetlands are restricted to state-owned wetlands including vegetated bay or river bottoms and intertidal flats to mean high tide.

The U.S. Fish and Wildlife Service (USFWS) estimates that Texas lost approximately 8,400,000 acres (52%) of wetlands (inland and coastal) between colonial times (1780's) and the 1980's, the second highest total of any state.

The USFWS also estimates that approximately 35 percent of the coastal marshes in Texas were lost between the mid-1950's and 1979.

Wetlands are being replaced by water and barren flats in most river deltas along the Texas coast, with the greatest losses occurring along the San Jacinto, Neches, and Trinity river deltas. More than 10,000 acres have been lost in the Neches River valley alone.

Submerged vascular vegetation (mostly seagrass) in the Galveston Bay system has declined by approximately 90 percent since 1956.

- Adopt a goal of no overall net loss of wetlands, based on acreage and function, that will be consistent with the federal definition and establish a policy framework for achieving that goal. The Texas Parks and Wildlife Department (TPWD) should monitor and enforce the policy.
- Maintain a balance between unavoidable losses and wetland enhancement/restoration and other compensatory mitigation projects. Apply known technology and promote the development of new technology that will help create wetlands. Use as many regulatory and nonregulatory tools as needed to ensure no overall net loss.
- Monitor the success of enhancement and mitigation plans.

Inventory wetlands regularly to determine gains and losses in areal extent, gains and losses in wetland types, gains and losses of function, and the causes of alterations. Inventories should follow standardized methods and be conducted by the TPWD, the Bureau of Economic Geology at The University of Texas, or the USFWS.

## Wetland Loss

## Recommendations



Other inventories should include sites for compensatory mitigation and other restoration or enhancement projects, and sites for acquisition priorities.

- Adopt a State Wetland Conservation Plan for coastal public lands.

This will set forth the state's goals and objectives for protecting coastal public wetlands. The plan will embrace the goal of no overall net loss, establish a policy framework for achieving that goal, and provide for monitoring the achievement of the goal. TPWD, in coordination with the Texas Water Commission (TWC) and the General Land Office (GLO), should be responsible for drafting the plan.

- Examine the effects of boat traffic in sensitive wetlands. TPWD should coordinate a public education effort to inform boaters with private boating interests about the sensitive nature of wetlands and about proper boating procedures. TPWD should examine the effects of boat traffic in bays or lagoons where seagrasses are abundant.

- Prepare long-range navigational dredging and disposal plans.

As recommended in the TPWD 1990 Texas Outdoor Recreation Plan, the legislature should require all local sponsors of navigational projects, in conjunction with the Corps of Engineers, to prepare long-range navigational dredging and disposal plans which assure adequate wetland protection by encouraging beneficial uses of dredged material, and to submit plans to appropriate state agencies for approval.

- Require that new dams constructed downstream of the last existing reservoir before the coast in rivers that flow directly into the bays and estuaries be constructed with sediment bypassing systems.

- Require studies to be done to estimate the quality, quantity, and sources of sediments trapped by existing reservoirs in rivers flowing directly into bays and estuaries and to identify and evaluate methods for capturing and bypassing the trapped sediment.

- Create a plan for sediment bypassing in each basin that maximizes the amount of sediment bypassed and minimizes the cost of building and operating the bypass systems.

Wetland Degradation

Nonpoint-source pollutants significantly reduce water quality and degrade wetlands. Many coastal wetlands are adjacent to or downstream from cultivated fields that receive pesticides and herbicides. Concern has been expressed about the effects of these chemicals on the flora and fauna in these marshes. Another concern is that accelerated sea level rise will increase saltwater intrusion, erosion, and wetland inundation.

Recommendations

- Reduce nonpoint-source pollution.

Standards should be developed at the state (TWC and Texas Department of Agriculture) and federal (Environmental Protection Agency) levels and

responsibilities delegated to enforce the standards. Cities should encourage recycling programs, and farming practices should include the reduction of chemical pesticides and fertilizers. Construction practices should include vegetated buffer zones and the replanting of disturbed areas.

- Incorporate sea level rise considerations into all coastal management programs.

Many agencies and programs currently in place at the state and federal levels affect wetlands either directly or indirectly. These programs and agencies, however, often overlap, work at cross purposes, or are fragmented.

- Use a "networking" strategy to improve coordination among existing state and federal agencies and programs.

The unique physical parameters of wetlands demand special management techniques. Because wetlands are the interface between land and water, they fall under the jurisdiction of both water and land-use agencies. Wetland protection must be included in the management activities of a broad range of agencies that presently manage water and land resources, such as the TWC, TPWD, GLO, U.S. Army Corps of Engineers and the Environmental Protection Agency. Networking will involve the use of existing programs and agencies and help overcome a number of problems, such as the lack of an overall goal in wetland protection, inadequate maps or other data, and inadequate tracking of permits and mitigation efforts. Memoranda of agreement (MOAs) can be the instruments used to implement a networking system. TPWD should be the lead agency in this system. TPWD recognized the need for improved interagency coordination in its Texas Wetlands Plan, an addendum to the 1985 Texas Outdoor Recreation Plan.

- Assess current processes used by state agencies in reviewing or issuing wetland permits or commenting on Corps of Engineers permits. The GLO should coordinate this effort.

- Work with the TWC to align water quality standards for wetland protection with physical and biological standards required by TPWD and GLO in their permitting/reviewing process.

- Examine the possibility of creating a formal coordinating mechanism among state agencies.

Failure to understand the importance of wetlands, as well as the magnitude of wetland decline in Texas, underlies the many wetland issues coastal managers must address. If the public can be made to understand how interconnected the coastal environment is, then they will support strong legislation to protect wetlands.

- Develop educational materials illustrating the importance of coastal wetlands. The Texas General Land Office and the Texas Parks and Wildlife Department should collaborate on this project.

Interagency Coordination

Recommendations

Public Education

Recommendations



- Promote the establishment of a National Wetlands Information Center.

The federal government should establish a National Wetlands Information Center to coordinate all phases of its public education program. The center would accumulate, synthesize, and disseminate objective information on wetlands between the various federal, state, and local agencies and serve as a liaison with the private sector. Because of their historic involvement in wetland resource issues, the USFWS along with the Corps of Engineers and the Environmental Protection Agency should administer the center.

Wetland Enhancement and Restoration

Mitigation efforts are often fragmented and unsuccessful. The networking of all agencies involved in overseeing mitigation efforts would bring continuity and expertise to the efforts and might turn the failures around. Evaluating the success or failure of mitigation efforts will require functional assessment of the wetland prior to alteration, approval of the mitigation plan before the project begins, and careful monitoring of the compensation activity.

There is no effort by any state, federal, or educational entity to identify areas that are suitable for enhancement/restoration.

Recommendations

- Clarify and unify all mitigation policies and direct TPWD, the GLO, and the TWC to develop guidelines and regulations for mitigation banking at a local or regional level. All mitigation efforts should work toward the goal of no overall net loss of wetlands.

Attempts to avoid altering the natural terrain must be emphasized in any mitigation policy, as the functions and values of many wetlands cannot be replaced. In some cases, however, avoidance may not be essential or possible, and another form of mitigation may be the only alternative. When there are unavoidable impacts, wetland restoration rather than wetland creation should be the preferred policy option. On-site mitigation is preferable to off-site, and in-kind is preferable to out-of-kind mitigation. Mitigation of wetland damage is not to be viewed as undesirable or as a means to deny permits, but it is also not meant to be the "easy way out."

- Establish interagency MOAs to help implement mitigation policies.
- Monitor the success of enhancement/restoration projects and identify areas suitable for enhancement.

Appropriations

There are no state funds or incentives available for wetland enhancement/restoration, acquisition, or protection.

Few funds are available for inventorying current wetlands or those sites available for mitigation projects.

Recommendations

- Seek funds for state programs which protect wetlands, such as the Texas Coastal Preserve Program.
- Encourage land acquisition programs, such as the Heritage Trust Fund and Land and Water Conservation Funds. Land acquisition programs should also include the purchase of "buffer zones" for additional protection. Wetland

purchase programs should involve careful preliminary inventories to maximize the benefits available from state funds and to ensure that particularly sensitive or threatened wetlands are acquired and protected by public agencies. Annual land acquisition goals should be set.

The Texas Heritage Trust is a proposal to establish a minimum of \$100 million in general obligation bonds issued by Texas for the acquisition and development of public lands to provide increased green spaces, hunting and fishing opportunities, and natural resource preservation. This purchase would be part of a comprehensive program to manage and preserve the state's natural resources while providing a variety of recreational opportunities.

- Establish a state fund which can accept donations and grants to encourage marsh enhancement or restoration projects on state lands. This fund could be subdivided to serve various regions of the coast. Projects jointly supported by state and federal agencies should be pursued. The state should work with the Gulf of Mexico Task Force of the Congressional Sunbelt Caucus in sponsoring legislation that includes funds for wetland protection in Texas.

- Encourage land donations for wetland protection. Landowners donating land may be eligible for tax deductions. When land is donated, the donor may include a reverter clause that provides that if the land is not managed according to the agreement, the property must be returned to the original owner or to a third party, such as a nonprofit land trust or government body. In addition, encourage local taxing authorities to tax wetland property at a low rate in order to promote wetland retention.

- Promote the use of conservation easements to transfer certain rights and privileges concerning the use of land or a body of water to a nonprofit organization, governmental body, or other legal entity without transferring title to the land.

An easement gives its owner a less than "fee simple" interest in a property — that is, some, but not all, of the property rights. By acquiring a conservation easement, a government body can gain control of only those property rights that are necessary to preserve an area's natural values. Easements often contain provisions granting the easement owner access to the property to ensure that its terms are being met.

Easements can also include management plans for wetland areas. The sale or donation of a conservation easement may be tax-deductible.



Beach Access

The state of Texas has been a leader among coastal states in guaranteeing the public's right to use the beaches. From the time stagecoaches and horseback riders first used the beaches as roads, Texans have had free and unrestricted access to the gulf shoreline. The Texas Open Beaches Act, passed in 1959, affirmed the existing state policy and provided a mechanism for protecting public access rights.

The Open Beaches Act guarantees the public the right to use the "state-owned beaches bordering on the seaward shore of the Gulf of Mexico." The state owns the *wet beach* up to the line of mean high tide. Above the high tide line, across the *dry beach* to the vegetation line (or a line 200 feet inland from the line of mean low tide), the public enjoys an access right or public easement because of long-standing public use of nearly all parts of the Texas Gulf Coast. Of the 367 miles of Texas Gulf beaches, 293 miles are open for public use. Only those beaches which are not accessible by public road or ferry are exempted from the Open Beaches Act.

In enforcing the Open Beaches Act, the courts have ruled that the public's easement to the beach is a rolling easement which moves with the vegetation line as it is changed by storms or continual coastal erosion. This ruling has caused conflicts between the state Attorney General's Office, which is responsible for enforcing the act, and private beachfront property owners.

Texas law does not clearly provide for adequate accessways perpendicular to the shoreline, and as shoreline development has increased, direct access to the beach has diminished. Developers have not been required to provide pathways or roadways to the beach. Some local communities have addressed this problem by acquiring rights-of-way from developers and posting beach access signs clearly visible to the public. Others have allowed perpendicular access to decrease through the years.

Beach Access Points

For many years, beaches provided the only roadway between shoreline destinations. Thus, allowing unrestricted vehicle use of the beach was an accepted practice in Texas. However, with today's increased beachfront development and population growth, conflicts have arisen between bathers and drivers, and there have been traffic accidents fatal to pedestrians on the beach. Some local governments have barred vehicles from portions of the beach, having beach visitors instead park in designated lots near beach access pathways. If the local communities do not compensate for the loss of access by providing convenient off-beach access points and parking facilities, the effect can be to convert public beaches into private ones.

In some heavily used beach areas, public restrooms and other facilities are inadequate to meet the needs of peak-season crowds. These conditions have resulted in the violation of private property rights. Beach users often trespass on private property or use restrooms in hotels or condominiums.

Recommendation

- Approve the proposed Texas Heritage Trust Fund to be administered by the GLO and the Texas Parks and Wildlife Department. This legislation would allow the voters in the state to consider a constitutional amendment authorizing the state to issue bonds to fund acquisition of parkland and environmentally sensitive areas to increase green spaces and hunting, fishing, and public recreation opportunities. The acquisition of beach access points should be an allowable use of the funds.

Beach Access Planning

The Open Beaches Act is enforced by the Texas Attorney General, who may bring civil action to prevent and remove encroachments or physical obstructions from the public beach. The act has been a strong tool for protecting the public's right to use the beaches. The drawback to the act is that it requires litigation for enforcement, so that every new violation means another court case for the attorney general and many public dollars spent in court.

Local planning for beach access has been haphazard or piecemeal. Local governments have often responded to ad hoc development proposals, having no systematic access plan in place which considers future public needs. On the county level, government often does not have adequate authority to make beach management decisions. In some cases, the Attorney General's Office has been asked to step in to ensure compatibility of individual developments with the Open Beaches Act. This places the Attorney General, the legal counsel for the state, in the inappropriate role of land use planner for local communities.

Frequent storms and occasional hurricanes on the Texas coast contribute to beach erosion. Often the vegetation line is moved inland, placing all or part of many structures seaward of the vegetation line in the public beach easement area. Court cases have upheld the right of the state to have these structures removed. Individual homeowners are often confused about whether their homes are in violation of the Open Beaches Act, and whether they can rebuild dunes destroyed by the storm.

- Mandate comprehensive beach access planning at the local level with state oversight. These plans should include a mechanism for assuring public input.
- Require the General Land Office to act as the lead oversight agency for beach access planning. The GLO should develop guidelines and rules, as appropriate, to address administrative questions arising from the Open Beaches Act. The Attorney General's Office should maintain enforcement responsibilities under the Open Beaches Act.
- Give coastal counties the authority to design and implement comprehensive beach management plans in conjunction with state-level efforts. This action would greatly expedite the decision-making process for developers and providers of public recreation facilities. It would allow these counties to plan for access points with off-beach parking, adequate public facilities and dune walkovers. In addition, local governments should consider erosion rate zones in their beach management plans.
- Promote erosion-conscious development in order to minimize real property loss due to enforcement of the Open Beaches Act. (See report section on Coastal Erosion and Dune Protection.)

The subject of beach access is of concern to all levels of government, and many agencies deal directly or indirectly with the issue. On the state level, the Attorney General, the Texas State Department of Highways and Public Transportation, the Texas Parks and Wildlife Department, and the General Land Office all have some responsibility in this area. On the federal level, the Federal Emergency Management Agency, the National Park Service, and the U.S. Fish

Recommendations

Interagency Coordination



and Wildlife Service deal with various aspects of beach access. Both cities and counties provide beach access on the local level. Currently, there is little coordination or information exchange among all these entities concerning the beach access issue.

Recommendations

- Designate the General Land Office as the state agency to coordinate and communicate state standards and rules for beach access among the different levels of government. Planning for beach access should remain at the local level (possibly through local action committees) since access needs and types of development pressures vary along the coast.
- Develop appropriate guidelines so that the state of Texas can be certified to assist local or private landowners in qualifying for aid under the Upton-Jones Amendment to the Federal Flood Insurance Act.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program at the federal level. The Upton-Jones Amendment, enacted by Congress in 1988, provides for flood insurance loss payments on structures that are in "imminent danger of collapse" due to erosion. An owner of a house endangered by coastal erosion may receive federal payments in an amount of up to 40 percent of the house's value to relocate it farther inland. Alternatively, the owner may receive a payment of up to 110 percent of the house's value to demolish it. Upton-Jones prohibits rebuilding on the land after demolition or removal of the house, but would allow the land to be dedicated for beach access. "Imminent danger of collapse" can be determined by a house's proximity to a physical shoreline feature, such as the vegetation line. This provision offers a unique opportunity for Texas in that it can be used to compensate owners of houses subject to removal because they have come into violation of the Open Beaches Act. It also offers the opportunity to acquire additional public beach access points.

The state of Texas should gain approval from FEMA to administer this program on a coastwide basis. This would require that erosion setback lines be established for each participating community.

Public Education

The public's lack of understanding of the Texas Open Beaches Act has cost many public and private dollars in lawsuits. In addition, much of the beach-going public and some developers do not realize the importance of preserving the dunes and other natural beach systems as they gain access to the beach. In some places on the coast, the public has difficulty locating beach access points other than through the public parks.

Recommendations

- Develop and distribute public information about the Texas Open Beaches Act. The General Land Office and the Attorney General's Office should cooperate in this effort.
- Develop public school materials for natural science classes which explain the importance of natural beach systems and the necessity of preserving them. The Texas A&M Sea Grant Program should work with the Texas Education Agency to develop these materials.

- Develop public service announcements emphasizing the importance of preserving Texas natural beach areas and dune systems. The General Land Office should assume this task.
- Design a uniform beach access sign for pedestrians and vehicles and provide it to local governments. The State Department of Highways and Public Transportation should work with the General Land Office to provide the signs.





## OTHER ISSUES OF CONCERN



he production, refining, and transportation of petroleum and petroleum products has long been considered the lifeblood of the Texas economy. Because of the tremendous concentration of oil-related activity on the Texas Gulf Coast, the threat of a devastating oil spill is an ever-present concern.

### Oil Spills

The Texas Hazardous Substances Spill Prevention and Control Act is the primary state legislation addressing Texas oil spill response. Under this act, the Texas Water Commission is to coordinate matters relating to oil spills. The U.S. Coast Guard is the lead federal agency for oil spill response coordination on the coast.

Recent events along the Texas Gulf Coast have clearly pointed to the inadequacy of the state's ability to respond to large oil spills. The offshore Mega Borg spill and the Apex barge spill in Galveston Bay resulted in the discharge of over 4.7 million gallons of petroleum and revealed serious problems with the current response capability. Confusion and unacceptable delays were characteristic of the response effort for both spills and highlight the need for an overhaul of the state's current spill response apparatus. As this nation's leading importer of crude petroleum and petroleum products, Texas is faced with a serious challenge that demands our immediate attention. State, federal and private interests must work together to develop a first-rate response capability, or accept the inevitable consequences.

The General Land Office has taken an active role in developing an improved state response capability. The following discussion could provide a framework for improving Texas' oil spill preparedness.

**Prevention** should be the major component of any oil spill plan. Funding for the U.S. Coast Guard (USCG) should be increased to permit strict enforcement of new and existing tanker safety regulations. The USCG should also promulgate new offshore lightering regulations that require contingency plans, set equipment standards, and designate special areas for lightering.

**The Texas Oil Spill Response Program** would act as a safety net to existing contingency plans maintained by the private sector. The Texas plan would involve dividing the coast into five regional response districts, each equipped with state-owned oil spill response equipment and a full-time staff. The plan would also create a comprehensive pollution training program for oil spill response employees, state agency employees, local officials and volunteer groups. Under the Texas Plan, the Oil Spill Response Fund cap (established by the current spill response act) would be increased from \$5 million to an amount sufficient to cover the realistic cleanup cost of a major oil spill.

**Written contingency plans** should be required for all tankers, barges, lightering operations, oil and chemical terminal facilities, and production facilities in Texas. Contingency plans would be regularly audited to check for adequacy and capability for immediate implementation.

Regular **spill drills** and **training sessions** would be required of all entities filing contingency plans. The readiness response drills would involve both announced and unannounced drills and would involve the full deployment of equipment and personnel at all levels.

In addition to booms, skimmers, and dispersants, newer **innovations in cleanup technologies** need to be incorporated into contingency planning. For example, bioremediation has shown great promise as an effective cleanup technology for oil spills, and further study should be undertaken. Federal and state regulatory impediments to the use of new technologies and equipment should be removed. New funding initiatives should be encouraged that would pump money back into federal agencies, state agencies, and academic institutions for work on innovative cleanup technology.

**Oil spill models** are an invaluable tool for predicting and assessing the impact of oil spills. Models predict the movement of oil with a high degree of accuracy and are capable of incorporating the effects of channels, currents, tidal flows, salinity, and winds on oil movement. Current Texas oil spill models assume spills in the 200,000 to 300,000 gallon range. New models need to be developed for spills in the 30 to 40 million gallon range.

Spills, discharges, and escapes of pollutants resulting from the transfer, storage, and transportation of such products pose threats to the environment of the state, to owners and users of property on the coast, and to public and private recreation. All citizen, government and industry officials must work together to protect these resources.

Marine debris is a persistent problem on the Texas Gulf Coast, largely due to prevailing currents that retain floating trash in the Gulf of Mexico until it is carried ashore by wind, waves, tides, and longshore drift. It has been estimated that 70 to 90 percent of the trash that accumulates on Texas beaches comes from offshore.

Along some portions of the Texas shoreline, the density of beach trash averages more than a ton a mile according to records from Adopt-A-Beach cleanups since 1986. In the September 1990 coastwide beach cleanup sponsored by the Texas Adopt-A-Beach Program, 15,822 volunteers collected 233.27 tons of trash from 185.5 miles of beach. The heaviest concentration of trash was on five miles of Matagorda Peninsula shoreline, where it averaged 5.25 tons per mile.

Marine debris imposes both environmental and economic costs. It is estimated that as many as 100,000 marine mammals and two million seabirds die in this country each year from entanglement in marine debris or ingestion of it, and many thousands more are injured. Floating trash is both a nuisance and a safety hazard to boaters and fishermen. It can jam propellers, clog water intakes, and foul fishing nets.

Cities and counties along the Texas coast spend millions of dollars on beach cleaning each year. But the cost of marine debris and beach litter should be assessed not only in terms of money spent, but of money lost. Trash floating in nearshore waters and polluting the beaches is a certain detriment to the tourist industry. It threatens the health and safety of beach users, and it is an aesthetic affront. Lost economic potential has been documented in complaints from beach visitors.

### Marine Debris



The most damaging type of marine debris is plastic. Plastic debris is lightweight, easily carried by wind and water; it is often mistaken for food by marine animals; it is durable, projected to last 400 years before disintegrating; and it is abundant, composing as much as 60 percent of the trash found on Texas beaches. Common plastic items such as six-pack rings and fishing line are responsible for numerous reported cases of animal entanglement.

The Texas General Land Office has taken a leadership role in addressing the problem of marine debris along the Gulf Coast. It has adopted rules prohibiting the dumping of solid waste from platforms and vessels operating in state waters under state permits and requiring marinas on state-owned land to provide garbage reception facilities. The agency's Adopt-A-Beach Program ensures that 172 miles of Texas beach are cleaned regularly three times a year, twice during coastwide cleanups sponsored by the program, and once during independent cleanups by adopting groups. The two annual coastwide cleanups sponsored by the program bring thousands of volunteers into the effort, raising awareness of the problem of beach debris, educating the public about its sources, and alleviating the cleanup burden of coastal communities.

A General Land Office representative serves as co-chair of the Marine Debris Subcommittee of the EPA's Gulf of Mexico Program. The Gulf of Mexico Program is a coordinating group composed of federal, state, and local government representatives and coastal citizens working toward common solutions to environmental problems of the Gulf.

Data collected by Texas beach cleanup volunteers was instrumental in securing the ratification of MARPOL Annex V and the passage of national enforcement legislation. The Adopt-A-Beach Program has worked to persuade the International Maritime Organization to designate the Gulf of Mexico a *special area*, where virtually all garbage dumping will be prohibited.

A new program, *Operation Clean Sweep*, is encouraging ports to provide dock-side facilities for the disposal of debris collected by commercial fishermen. This pilot project, involving three Texas ports, is proving successful and is expected to be copied by other ports, both in Texas and in other Gulf Coast states.

The General Land Office proposed new state legislation, adopted in 1989, to help promote recycling of plastic in the state. The law requires Texas manufacturers to imprint codes indicating resin content on rigid plastic containers to facilitate their sorting for recycling. As part of its public education campaign, the Adopt-A-Beach Program is encouraging recycling as a means of keeping solid waste out of the coastal environment.

Reduction of marine debris should be a goal of the state's coastal management plan. The environmental and economic benefits of a cleaner coastal environment are obvious. Any progress Texas makes in this regard will surely have positive effects throughout the Gulf of Mexico. Several Gulf states have organized Adopt-A-Beach programs based on the Texas model. Participation by Texas in the EPA's Gulf of Mexico Program offers opportunities for increased gulfwide cooperation in combating marine debris as well as other coastal problems.

## Freshwater Inflow

Freshwater inflow is the lifeblood of estuarine systems along the 367 linear miles of Texas coastline. Along this land-sea boundary are twelve estuarine systems with an estimated 1.5 million acres of open-water bays and 1.1 million acres of adjacent wetland marshes. The twelve major bay systems are Sabine Lake, Galveston Bay, Matagorda Bay, San Antonio Bay, Aransas Bay, Corpus Christi Bay, Baffin Bay, Trinity Bay, Lavaca Bay, Copano Bay, Nueces Bay, and Laguna Madre. The intricate biological processes which contribute to the use of these systems as nursery areas by fish and shellfish are dependent upon the quantity, quality, and timing of freshwater inflows. In addition, the importance of Texas estuaries can be measured by financial benefits resulting from commercial fishing, sportfishing, other recreational activities, and commerce.

The same rivers that are vital to the health of our bays are also critical to upstream industrial, municipal, and agricultural users. As the state's population and economy continue to grow, the demand for water supplies to meet the needs of upstream consumers will also grow. Historically, many of these needs were met through the use of ground water. However, in recent times we have seen a significant reduction in the levels of several aquifers within the state, which has led to cessation of spring flows in parts of west and central Texas and subsidence along parts of the upper coast. One solution to providing a dependable water supply has been the construction of reservoirs on the major tributaries feeding the coastal waters. But reservoir development has also affected estuarine systems by increasing consumptive use of water, by increasing evaporation, and by entrapping nutrients and sediments essential to the maintenance of a diverse coastal ecosystem.

In 1975, the Texas Legislature enacted Senate Bill No. 137, which mandated comprehensive studies of "the effects of freshwater inflow upon the bays and estuaries of Texas." These studies were to address the relationship of freshwater inflow to living estuarine resources and to present methods of providing and maintaining a suitable ecological environment. Data collection was completed by December 1979, and the last individual estuarine report was finalized in February 1983. After legislative review and input from many federal, state, and local entities, the consensus supported expanding the studies to further define the needs of the estuarine systems. In 1985, the Texas Legislature enacted additional legislation which provided for further studies to gather supplemental data necessary for development of improved methods for determination of freshwater inflow needs to maintain "healthy and biologically productive coastal ecosystems." The bill called for studies to be completed by December 1989. A report for the state legislature is currently being developed and will provide the following types of information:

- Qualitative and specific quantitative relationships among freshwater inflows and selected physical, chemical, and biological processes essential to the productivity of coastal bays and estuaries;
- Impacts of normal flow variations (drought to flood conditions) on bay environments and their living resources;
- State-of-the-art tools for addressing decision-makers' questions about the impacts of water development, as well as other human activities, on the bays and estuaries.

Providing freshwater inflows to maintain the biological integrity of estuarine systems has been the source of considerable controversy. As with many finite



resources, priority for using fresh water has been placed on meeting the needs of man's activities, to the exclusion of the natural system. Only recently has the question been asked: How do we balance the freshwater needs of man with those of the fish and wildlife resources of our rivers and estuarine systems?

The preservation and regulation of freshwater inflows to the estuaries are very dependent upon economic considerations and upstream water demands. Potential opportunities for providing freshwater inflows into Texas estuaries may come with direct appropriations, purchase, and/or water use permit constraints. Given the limitation and nature of statutes designed to protect the estuaries and the independent nature of river basins, it would appear that efforts to ensure freshwater inflow may best be approached on a case-by-case basis for each of the basins draining into Texas bays and estuaries.

## Nonpoint-Source Pollution

Nonpoint-source pollution (NPSP) is the pollution that water picks up as it flows across the surface of the land. It has also been defined as pollution which cannot be tied to a specific location, but which enters the environment over a broad area. Pollutants may include "stuff" that is washed off lawns, streets, construction sites, and agricultural and industrial areas. These materials present a problem to both surface and groundwater supplies and, as they travel through the riverine systems, to coastal waters as well.

The Federal Water Quality Act of 1987 stated in part: "It is the national policy that programs for the control of nonpoint-sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this Act to be met through the control of both point and nonpoint-sources of pollution." Specifically, the Act required states to complete two reports by August 4, 1988: an assessment report describing the state's NPSP problems, and a Management Report explaining the state's plans for addressing NPSP during the subsequent four fiscal years.

The Texas reports were drafted by the Texas Water Commission in consultation with other state resource agencies and submitted to the Environmental Protection Agency in August 1988. The assessment and the ground water and agricultural portions of the management report were approved by the Region VI office of the EPA in August 1989. The silvicultural management program, locally implemented NPSP programs, and further ground water milestone work were approved in January 1990. Recent appropriations by Congress will provide federal grant money for individual projects and work plans aimed at abating NPSP.

In early 1989, the Texas Water Commission established the Nonpoint-Source Pollution Advisory Committee to aid in the development and long-term direction of the program. The 27-member Advisory Committee was complemented by four subcommittees: Monitoring and Database Development; Best Management Practices (BMPs), Case Studies, and Demonstrations; Education; and Funding. These subcommittees worked to monitor specific problem areas, organize and track information through a database system, develop methods or BMPs aimed at preventing or reducing NPSP, raise public awareness and educate landowners about NPSP, and determine funding levels to support the program.

SB 493, passed by the 69th Texas Legislature, mandates that all state-owned tracts leased for agricultural and grazing purposes have Soil and Water

Conservation Plans. Currently, approximately 290,000 acres under surface lease in manageable tracts have Soil and Water Conservation Plans developed by the Soil Conservation Service.

Many small and scattered leases surrounded by large private tracts do not have plans, because they are not considered manageable units of land. In cases such as these, the General Land Office requires that lessees follow minimal guidelines to protect the land from erosion and overgrazing. Letters of understanding are signed by the lessee and the director of the Uplands Division stating that the lessee will follow these guidelines.

It is the environmentally harmful actions of individuals that cause nonpoint-source water pollution. Ultimately, it is up to the people who live in an area of nonpoint-source water pollution to better the quality of their water by changing their habits. This is the basis of the Texas Water Commission's Nonpoint-Source Pollution Management Program.

The General Land Office fully supports the state's efforts to develop an NPSP Management Plan. The agency's main interest lies in the protection of bays and estuaries that are directly impacted by NPSP. As custodian of Texas' beaches and coastal areas, the General Land Office will encourage BMPs as they pertain to these areas.

Hazardous waste under federal law includes waste that may cause or contribute to death or to incurable or incapacitating illness, or that may pose a substantial threat to human health or the environment when improperly managed. Waste is hazardous if it is ignitable, corrosive, toxic, or reactive or if it has been predetermined to be hazardous and is listed by the Environmental Protection Agency. Hundreds of chemical wastes including synthetic organic industrial and agricultural chemicals, toxic metals, inorganic sludge, solvents, waste oils, and chemically contaminated industrial wastewater fall into the hazardous category.

In 1987, Texas industries generated more than 60 million tons of hazardous waste. Although there are over 4700 generators of hazardous waste in Texas, 246 facilities account for 99.87 percent of this waste stream. The vast majority of hazardous waste generated by these facilities — almost 75 percent — is produced by chemical plants and petroleum refineries along the Texas Gulf Coast.

Hazardous waste is disposed of by landfilling, incineration, and deep well injection. Many hazardous wastes can be neutralized or otherwise treated to render them non-hazardous or recycled to recover usable constituents such as solvents or metals. A very large percentage of the hazardous waste generated in Texas is never disposed of, but is rendered non-hazardous through treatment and recycling. In 1987, 74 percent of the hazardous waste generated went to aqueous treatment where it was rendered non-hazardous and put back into the waters of the state. An additional 2 percent was recycled.

Federal and state regulations concerning the disposal of hazardous waste have been tightened over the years, and programs for remediation at abandoned sites are ongoing. While most programs are concerned with pollution control activities such as recycling, treatment, and disposal, efforts have begun at the state and federal levels to encourage industries to reduce the generation of hazardous waste. The EPA has created the Office of Pollution Prevention to

## Hazardous Waste Generation and Disposal



develop and implement a hazardous waste reduction program across all media, in addition to requiring all facilities seeking permits to have a waste minimization plan.

In Texas, waste reduction efforts include the establishment of a Waste Minimization Unit in the Texas Water Commission (TWC) and a Waste Reduction Advisory Committee. The Waste Reduction Advisory Committee, appointed in December 1989, is charged with advising the TWC and Interagency Coordinating Council (ICC) on matters relating to waste minimization programs. The Waste Minimization Unit, established in September 1989, has grants from the EPA to begin a technical assistance program for industry. Some of the unit's responsibilities are to develop a waste minimization plan, manage the Resource Exchange Network for Eliminating Waste program (RENEW), process and analyze the waste minimization forms industry is required to submit, and prepare the Capacity Assurance Plan for hazardous waste management in Texas.

New laws and regulations adopted in the last few years have dramatically affected hazardous waste management. For example, all new landfills and surface impoundments must meet minimum technology standards such as clay and synthetic liners, leachate collection (for landfills), and leak detection systems. Existing surface impoundments were required to retrofit to these standards by November 1988, or close. Of 149 facilities with land disposal units in 1988, about 100 are expected to discontinue land disposal of waste. In addition, the EPA is requiring the treatment of most hazardous waste to much safer levels before burial. This will significantly limit the types of hazardous waste that can continue to be disposed of on land. Meanwhile, the remediation of historic problem sites continues through vigorous enforcement actions initiated by the TWC and/or through federal and state "Superfund" initiatives.

Injection of hazardous wastes into geological formations deep in the subsurface is another method of hazardous waste disposal favored by industry. Texas ranks first in the nation in the use of underground injection wells for disposal of hazardous waste, and there are 25 hazardous waste injection wells currently operating in Texas coastal counties. The 1989 Capacity Assurance Plan for the state of Texas, issued by the Texas Water Commission, reports that almost 15 million tons of hazardous waste were disposed of by this method in 1989.

Incineration is the treatment technology most commonly used to destroy hazardous waste. In 1987, only a small percentage of hazardous waste was destroyed, compared to the much larger quantity that was buried, but new federal regulations banning the land disposal of some hazardous wastes will likely result in increased incineration. One advantage of incineration is that the volume of waste is reduced dramatically—90 percent reduction for liquids, 50 percent reduction for sludge, and 20 percent reduction for contaminated soils—leaving only the resulting ash for land disposal. Also, the ash can be treated further for safer disposal. However, air quality concerns must be a part of any hazardous waste incineration program.

One all-too-frequent disposal method is the illegal "midnight dumping" of abandoned drums, some of which contain hazardous wastes. Common dumping spots include county roads, unfinished development projects, and, in particular, areas already subject to trash dumping. Even urban residential streets can become targets.

Frequently, drums of hazardous waste from oil rigs, seagoing vessels, or land-based facilities are found on the shoreline. Drums have also been dumped in ditches which drain to coastal areas. Since materials in discarded drums present potential public health and environmental threats, the drums must be sampled and disposed of properly. Several state and federal agencies are involved in such cleanups from time to time.

The generation and disposal of large amounts of hazardous waste on the Texas coast increases the threat of environmental degradation in bays, estuaries, wetlands, marshes, and the Gulf itself. The regulatory efforts of the TWC have resulted in safer hazardous waste management practices in Texas, and the TWC has set a goal of reducing hazardous waste generation by 50% in Texas by 1995. Still, as industrial activity on the Texas coast grows, so does the generation of hazardous waste.

There is a growing awareness that the traditional "end-of-pipe" regulation for controlling pollution is not the most effective way to deal with the toxic materials in industrial and municipal waste. Industry and the general public can significantly reduce the amount of waste requiring disposal by eliminating wasteful practices and by reusing and recycling discarded materials. Cultural changes as well as financial incentives are needed to promote these programs.

No matter how great a waste reduction and recycling effort is undertaken, however, residues will remain which require disposal. Also, waste reduction and recycling programs are prospective rather than retrospective. Texas still has problem waste sites which require remediation, and the state cannot afford to allow pollution from these sites to spread. Texas needs to explore the best available technology to mitigate our known problems and to treat the hazardous wastes currently generated.





## APPENDIX I

### The Consensus-Building Process



In the summer of 1990, the GLO employed the Office for Strategic Studies in Resource Policy at Texas A&M University to help achieve a consensus for policy actions on three critical issues facing the Texas coast: erosion/dune protection, wetland loss and beach access. The office used the Alternative Futures Assessment (AFA) Process, a computer-assisted workshop procedure, as a means to incorporate the concerns of the coastal community into the plan. The ultimate goal was to build a consensus on strategies to resolve these three important issues confronting the Texas Gulf Coast.

Clearly this process was not an effort to solve the technical problems of the coast, but an effort to bring a broad group of interests together to air opinions and to find common ground on policy actions for the different subjects. The participants were not a technical group, though some had strong scientific backgrounds. Despite differences, the effort succeeded in producing a consensus on a general strategy to begin dealing with these issues for the Texas Gulf Coast.

An ideal strategy balances the needs of affected interests and inspires their active support. The strategy should also include practical courses of action to achieve the primary goal, as well as actions to anticipate and mitigate unwanted side effects. The workshop participants strived to develop a strategy that comes close to the ideal.

**The Alternative Futures Assessment (AFA) Process** is a computer-aided approach for bringing concerned parties together in a workshop setting to resolve complex issues. The process helps participants pool their knowledge and experience and develop a detailed mutual understanding of the issue under consideration. It also assists them in exploring the potential consequences of alternatives so that they can develop policies. Finally, it provides them with an opportunity to recommend funding priorities for research in specific areas.

The computer software used in the AFA Process is a cross-impact simulation language that shows how variables interact over time. It runs on an IBM-compatible personal computer. The software includes artificial intelligence to aid participants in using their knowledge and experience to build a computer model that describes the issue and formalizes their understanding of it. The participants also can quickly and easily make changes in the model as they learn from one another. Thus the participants use their model to evaluate courses of action they recommend for resolving the issue.

**A series of five workshops** was held to address the three target issues on the Texas Gulf Coast. The first three were Foundation Workshops, followed by a Strategy Workshop on each issue, and finishing with a Capstone Workshop. Similar to a pyramid, the process rests upon information generated in the Foundation Workshops and becomes more focused in subsequent workshops. The purpose of the Foundation Workshops was to clarify how each issue affects

a particular region of the coast. Recommendations to resolve the issue were also considered. Therefore, Foundation Workshops were conducted in three geographic regions: the lower, middle, and upper coast. Each Foundation Workshop for the Texas Gulf Coast included up to 28 participants who represented a wide array of interests in the region.

The Foundation Workshops were organized to gather as much information as possible from the participants in one day. The most important information provided by the participants was a ranked list of variables defining their interests and concerns. They also identified the top problems affecting their region with regard to erosion, wetlands, and beach access and recommended courses of action to resolve those problems.

The purpose of the Strategy Workshop was to build a computer model to evaluate the potential consequences of proposed strategies for resolving each issue. Participants also specified their objectives and prepared a preliminary policy. The information and ideas generated in the Foundation Workshops served as the starting point. The Strategy Workshop participants were divided into 15 stakeholder groups, representing the principal interests involved in the issue. Some participants in the Strategy Workshop also took part in the Foundation Workshops.

The purpose of the three Capstone Workshops was to build a consensus on a realistic strategy to resolve each target issue for the Texas Gulf Coast. The workshops also identified gaps in knowledge and recommended priorities for future research. The preliminary policy developed in the Strategy Workshops served as the starting point for the Capstone Workshops. Most of the participants took part in both the Strategy and Capstone Workshops. They were divided into the same 15 stakeholder groups in both workshops. The Capstone Workshop produced a consensus among participants on a recommended policy and courses of action to resolve the target issue (coastal erosion, wetlands or beach access) for the Texas Gulf Coast.

Funding for this project was provided by an interagency contract between the Texas General Land Office and the Texas Water Development Board. Matching support came from the Office for Strategic Studies in Resource Policy at Texas A&M University. Appendix II is a list of participants in the AFA workshops who contributed their time and efforts to assist in resolving the shoreline erosion/dune protection, wetlands, and beach access issues.





## APPENDIX II

### Coastal Management Plan Workshop Participants

36

Ray Allen, Central Power & Light  
 Fred Anthamatten, U.S. Army Corps of Engineers  
 John Arrington, Beachfront Land Owner  
 Dana Barbie, U.S. Geological Survey  
 J. C. Barr, Mayor, City of Port Aransas  
 Gary Becher, City of South Padre Island  
 Deyaun Boudreaux, Texas Environmental Coalition, Port Isabel  
 Peter Bowman, University of Houston, Clear Lake  
 Joey Bennett, Senator J. E. (Buster) Brown  
 Tom Calnan, Texas General Land Office  
 Jack Campbell, Brownsville Economic Development Council  
 Mary Lou Campbell, Sierra Club, South Padre Island  
 Paul Carangelo, Port of Corpus Christi  
 Darlene Carnes, South Padre Island National Seashore  
 Jay Cassel, Texas Midcontinent Oil & Gas Assn.  
 Lenny Chambers, MEPUS (Mobil Oil)  
 John Cheesman, Galveston Bay Foundation  
 Ken Conway, Director, Cameron County Parks  
 Marty Conway, Senator Carl Parker  
 Ed Cooper, Valley Sportsmen's Club  
 Barbara Crews, Mayor, Galveston  
 Ken Cross, Texas Attorney General's Office  
 Dan Currens, Amoco Production  
 David Dale, National Marine Fisheries Service  
 John Damon, Judge, Brazoria County  
 Niels Daugbjerg, Lafayette Landing  
 Sally Davenport, Director, Texas General Land Office  
 Kathy Dean, U.S. Soil Conservation Service  
 George Deshotels, Matagorda County Commissioner, Precinct 2  
 Laurell Devaney, U.S. Fish & Wildlife Service  
 Don Dial, State Department of Highways & Public Transportation  
 Terry Doyle, Enron  
 Jim Drone, Hollywood Marine  
 Carl Duncan, Commissioner, San Patricio County, Precinct 2  
 Dale Durr, Chevron Chemical Co.  
 John Eberling, Gulf Coast Rod, Reel & Gun Club  
 Russell Eitel, Galveston Beach Environmental Committee  
 Mike Farmer, Frontera Audubon Society  
 Merriwood Ferguson, Frontera Audubon Society  
 Joe Foggard, Beachfront Property Owner  
 Richard Franke, Franke Realty  
 Frank Frankovich, Dannenbaum Engineering  
 J. A. Garcia, Jr., Judge, Kenedy County  
 Antonio Garza, Judge, Cameron County  
 Mark Gerding, Texas Railroad Commission  
 B. C. Gersch, State Department of Highways and Public Transportation  
 Rick Guiffre, Quintana Petroleum Corporation

Eustolio Gonzalez, Raymondville Resident  
 Richard Gorini, Port of Houston  
 Tom Grahl, U.S. Fish & Wildlife Service  
 Wayne Halbert, Manager, Harlingen Irrigation District  
 Pat Hallisey, Galveston County Parks Board  
 Mike Hightower, Deputy Director, Sea Grant College Program  
 Henry Hildebrand, Ret. Professor of Biology, Texas A&I Univ.  
 Vick Hines, Senator Carlos Truan  
 Harold Holmes, Galveston Urban Planning Department  
 William Holmes, Jr., Boating Trades Association of Texas  
 Sandra Hoover, Houston Audubon Society  
 Herb Houston, City Alderman, South Padre Island  
 Neal Hunt, Senator Chet Brooks  
 James Hury, Representative, Texas House of Representatives  
 Robert Jones, UT Marine Science Institute  
 B.D. King, U.S. Fish & Wildlife Service  
 Larry Land, U.S. Geological Survey  
 Dana Larson, Rigs to Reefs  
 Chris Lawrence, Commissioner J. P. Luby  
 Richard LeBlanc, Jr., Judge, Jefferson County  
 Jim LeGrotte, Federal Emergency Management Agency  
 Kenneth Lester, Mayor, Port Lavaca  
 Terry Lockamy, Texas A&M Agricultural Extension Service, San Benito  
 Eddie Long, Secretary-Treasurer, Texas Pipe Trades Assn.  
 J. P. Luby, Commissioner, Nueces County  
 Mary Magee, Commercial Fishing, Portland  
 Andrew T. Mangan, Deputy Commissioner, Texas General Land Office  
 Garry Mauro, Texas Land Commissioner  
 Richard McInnis, Gulf Coast Conservation Assn.  
 Kimberly McKenna, Texas General Land Office  
 James McNicholas, Commissioner, Drainage District No. 6  
 David Meyer, U.S. Soil Conservation Service  
 Joe Moseley, Shiner, Moseley, and Assoc., Inc.  
 Charles Moss, Texas A&M Agricultural Ext. Service, Brazoria County  
 Bruce Moulton, Texas Water Commission  
 Gretchen Mueller, Houston Audubon Society  
 Lou Muller, Galveston Park Board of Trustees  
 Lloyd Mullins, Texas General Land Office, Aransas Pass  
 Diana Munoz, Representative Larry Warner  
 Mario Munoz, Senator Kenneth Armbrister  
 Bob Nailon, Texas A&M Sea Grant Advisory Service, Anahuac  
 Ron Neighbors, Director, Houston-Galveston Subsidence District  
 Tom Northrup, Northrup Associates Planning Consultants  
 Obie O'Brien, Mitchell Energy and Development  
 Karen O'Neal, Houston-Galveston Subsidence District  
 June O'Quinn, Texas General Land Office  
 Bill Osborne, Enron Gas  
 Ken Pagans, Texas A&M Sea Grant Advisory Service, Corpus Christi  
 Jeffrey Paine, Bureau of Economic Geology  
 Robert Pinkerton, Mayor, South Padre Island  
 Pete Pranis, Council for South Texas Economic Progress  
 Sonny Ramirez, San Benito Resident  
 Mike Reuwsatt, Kleberg County Park System  
 George Fred Rhodes, Attorney, Port Lavaca  
 Leland Roberts, Texas Parks & Wildlife Department  
 Hermann Rudenburg, Sierra Club, Galveston

37



**Mel Russell**, Galveston County Marine Agent  
**C. F. (Dick) Schendel**, Soil & Water Conservation Board  
**A. R. (Babe) Schwartz**, Attorney, Galveston  
**Malon Scogin**, Texas Agricultural Ext. Service, Jefferson County  
**Norman Sears**, Environmental Protection Agency  
**Eddie Seidensticker**, U.S. Soil Conservation Service, Anahuac  
**Linda Shead**, Executive Director, Galveston Bay Foundation  
**Chuck Smith**, National Audubon Society  
**Gwyn Smith**, League of Women Voters  
**Larry Smith**, Kemah Resident  
**Sam Smith**, Jefferson County Drainage District #6  
**Michael Speed**, Conrad Blucher Institute, Corpus Christi State Univ.  
**Harrison Stafford, II**, Judge, Jackson County  
**C. L. Standley**, Commercial Fishing, Dickinson  
**Sharron Stewart**, Texas Environmental Coalition, Freeport  
**Charles Stone**, Judge, Refugio County  
**Robert Stroder**, County Engineer, Jefferson County  
**Robert Story**, Freeport City Attorney  
**Penny Sturdivant**, Floodplain Administrator, Brazoria County  
**Rusty Swafford**, National Marine Fisheries Service  
**Sidney Tanner**, U.S. Army Corps of Engineers  
**Mary Thorpe**, Department of Geology, Del Mar College  
**Gary Valentine**, U.S. Soil Conservation Service  
**Steve Valerius**, Hollywood Marine, Inc.  
**Rex Wahl**, National Audubon Society  
**Yu Hwa Wang**, Maritime Systems Engineering Department  
**John Watson**, Mitchell Energy & Development  
**Roe Wauer**, National Audubon Society, Corpus Christi  
**Sharon Weaver**, Representative Robert Earley  
**Gene Webb**, Gulf Coast Conservation Association  
**Kerry Whelan**, Houston Power & Light  
**William Younger**, Texas A&M Marine Advisory Service, Port Lavaca



## APPENDIX III

### Coastal Responsibilities of Texas State Agencies



The **Texas Legislature** has distributed authority for coastal resource management among a number of state agencies. This system has evolved historically with no formal coordination mechanism to ensure a consistent management approach.

Under the Texas Clean Air Act, the **Texas Air Control Board** is responsible for safeguarding the air resources of the state. A permit must be obtained from the Board for the construction and operation of any facility that emits air pollutants. The concentration of petrochemical firms and other heavy industries on the coast has created a substantial community of permit holders regulated by the Texas Air Control Board.

The **Texas Antiquities Committee**, created by the Texas Antiquities Code, is responsible for preserving and protecting the state's historical and archaeological resources. The Committee requires permits for activities involving salvage or study of state archaeological landmarks, including historical sites and artifacts of interest such as sunken ships, buried treasure, and art works. The Committee issues eight types of permits covering virtually every aspect of historical and archaeological investigation, including reconnaissance, testing, excavation, and destruction.

The **Texas General Land Office**, in conjunction with the **School Land Board**, manages the state's coastal public lands. The Board may grant leases to certain governmental bodies for public purposes; leases for mineral exploration and development; easements to littoral landowners; channel easements to surface or mineral interest holders; leases to educational, scientific, or conservation interests; and permits for limited use of previously unauthorized structures. The Commissioner of the General Land Office may issue permits for geological, geophysical, and other investigations within the tidewater limits of the state. The Commissioner may also grant easements or leases for rights-of-way across state lands for pipelines and other transmission lines. In addition, he is responsible for technical assistance and compliance under the Dune Protection Act and implementation of the Texas Coastal Preserve Program with the Texas Parks and Wildlife Department.

The **Texas Department of Health** administers programs to protect and promote public health, including occupational safety and health, radiation control, regulation of municipal solid waste, shellfish processing, licensing of drinking water and wastewater plant operators, and approval of plans and specifications for public drinking water and sewage disposal systems. The Department may also close polluted rivers to shellfish harvesting.

The **Texas Department of Parks and Wildlife** operates the state parks system and wildlife refuges. It also enforces fish and game regulations throughout the state and provides for licensing of hunting and sportfishing. A permit must be



obtained from the Department for the disturbance or dredging of sand, shell, or marl in public waters not authorized by other state or federal agencies. Public waters are defined as all the salt and fresh waters underlying the beds of navigable streams under the jurisdiction of the Parks and Wildlife Commission. The Department is responsible for reviewing and commenting on state and federal permits affecting Texas wildlife resources and for protection of endangered or threatened species.

The **Texas Railroad Commission** has extensive authority in the oil and gas industry and in pollution prevention and abatement through regulations governing well casing, cementing, well abandonment, saltwater disposal, inspections and reporting procedures. The Commission also regulates intrastate natural gas pipelines and issues drill permits for oil and gas wells. In addition, the Commission regulates surface mining for lignite, uranium, and iron ore to make sure that the resources are properly developed and the environment protected.

The **Texas Department of Highways and Public Transportation** is responsible for road construction and planning. The Department administers federal funds for mass transit and may plan, purchase, construct, lease, and contract for public transportation systems in the state. The Department constructs and maintains bridges and ferries, serves as the state sponsor of the Gulf Intracoastal Waterway, and can acquire easements and rights-of-way from the General Land Office for channel expansion, relocation, or alteration.

In the management of coastal hazards, the **Department of Public Safety** is particularly concerned with the timely initiation and efficient execution of the evacuation process in the event of a hurricane. The Department is responsible for keeping the highways open and for providing the public with the latest information on recommended escape routes. The Division of Emergency Services, within the Department, coordinates state and local response to natural and man-caused disasters.

The **Texas Water Commission** has the responsibility of protecting surface and groundwater quality. The Commission issues wastewater treatment plant operator certifications, regulates water well drilling and petroleum storage tanks, and sets water rates for certain privately owned public water/wastewater systems. The Commission also has jurisdiction over water quality monitoring and management, hazardous and industrial solid waste management, abandoned waste site cleanup, and oil and hazardous material spill response coordination. In addition to these responsibilities, the Commission oversees surface water rights administration, dam safety management, the National Flood Insurance Program and flood control improvement project administration, injection well program administration, waste minimization initiatives, and water district supervision.

The **Texas Water Development Board** is responsible for development of the state water plan. The Board must also monitor the effects of the plan on the bays and estuaries and arms of the Gulf of Mexico. In cooperation with the Texas Department of Parks and Wildlife, the Board is responsible for conducting studies pertaining to the effects of and needs for freshwater inflows to bays and estuaries for purposes of maintaining economically important fish and wildlife.

The **Texas Attorney General's Office** is not a regulatory agency, but it has a role in resource management as the state's enforcement agency for the Open Beaches Act and other coastal legislation. The office protects the public's beach

access rights and can bring suit on behalf of other state agencies to enforce state laws.

The **Bureau of Economic Geology at The University of Texas** is responsible for much of the mapping of coastal resources, energy, minerals, land, geology, and biology. It also monitors erosion along the Texas Gulf Coast.

The **Governor's Office of Budget and Planning** prepares recommendations for the budget and is responsible for administration of state review and comment procedures for all federal or federally funded projects.





THE TEXAS COASTAL MANAGEMENT PLAN  
IS A PUBLICATION OF THE  
TEXAS GENERAL LAND OFFICE,  
RESOURCE MANAGEMENT AND DEVELOPMENT  
GARRY MAURO, COMMISSIONER  
1700 NORTH CONGRESS AVENUE  
AUSTIN, TEXAS 78701-1495  
512-463-5001

