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16. Abstract The purpose of this project was to investigate and determine hazards to navigation (encroachments) in the Texas Portion of the Gulf Intracoastal Waterway (GIWW) that originate from shore, and to make recommendations for mitigating these hazards in the future. The research team collected various types of data to identify encroachment hazards and understand how and where obstacles are built including incident data from the U. S. Coast Guard; survey information from vessel operators; data from physical inspection of the waterway; survey information from developers, economic development corporations, and shippers; survey information from county and local officials in all coastal counties; and information on permitting procedures data from the various federal, state, and local jurisdictions involved with shoreline development. This study concludes that the major problems caused by development of structures that encroach into the waterway are the narrowing of the channel, lack of strategic mooring or push-in (hold-up) places needed in inclement weather, and congestion caused by additional inexperienced recreational boaters. This study results in a guidebook for permittees and a guidebook for developers on the types and quantity of structures that should be permitted along the GIWW. The guidebooks should help develop and permit "smart" development with regard to navigation through better cooperation between governmental agencies on permitting development and a focus on the agglomeration, clustering, and density of development on the waterway, and increased cooperation between developers, governmental agencies, and the barge industry in maintaining the GIWW for its primary use of moving goods effectively and efficiently to promote and support Texas and U.S. commerce.					
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# **ANALYSIS AND RECOMMENDATIONS ON PROTECTING WATERWAYS FROM ENCROACHMENT**

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The researcher in charge of this project was Joan P. Mileski, PhD.

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# EXECUTIVE SUMMARY

## PROJECT BACKGROUND

The purpose of this project is to investigate and determine hazards to navigation (encroachments) in the Texas portion of the Gulf Intracoastal Waterway (GIWW) that originate from shore, and to make recommendations for mitigating these hazards in the future. Under the 1975 Texas Coastal Waterways Act, the Texas Department of Transportation (TxDOT) is the state agency charged with fulfilling the non-federal sponsorship of the GIWW in Texas by providing the safe, effective, and efficient movement of goods along the Texas portion of the GIWW (Behrens, 2006). This project seeks to guide TxDOT by providing criteria to evaluate shoreline proposals along the GIWW. The goal is to protect the navigation corridor for commercial traffic for the industries vital to the Texas economy that rely on the GIWW for the transport of raw materials and finished products.

## STAKEHOLDERS

The research team identified and determined the magnitude of stakeholder issues and the identity of major stakeholders through the recommendations by the project advisors for this project, actual site visits, and United States Coast Guard incident data. Additionally, the team focused on identifying sensitive issues with stakeholders—issues that interfere with navigation on the GIWW—and explored them further through physical inspection and interviews to determine what all shoreline stakeholders consider as factors that interfere with navigation on the GIWW. Preserving the waterway corridor is important to many stakeholders. Identification of the appropriate stakeholders was key to developing the right guidelines for all.

In identifying stakeholders, the researchers looked broadly for those parties impacting navigation in the GIWW. The parties impacting navigation were those parties affecting the “process of planning, recording, and controlling movement of a craft” (vessel) along the waterway (Bowditch, 2002). On the advice of the project advisors during the first project meeting on October 27, 2008, in College Station, Texas, the team identified the following stakeholders as relevant to determining the impact of shoreline development/encroachment on commercial navigation in the GIWW. They fell into two basic categories (although there is overlap):

- those who use, regulate, maintain, and police the waterway, and
- those who use and regulate the shoreline.

Shareholders include real estate developers and the economic development organizations in the coastal areas, coastal county governments, port authorities, barge operators, coastal waterborne shippers, TxDOT, the Texas General Land Office (GLO), the United States Army Corps of Engineers (Corps), and the United States Coast Guard.

## DATA COLLECTION

The research team collected various types of data to identify encroachment hazards and understand how and where obstacles are built. First, the team collected incident data from the United States Coast Guard to review where navigation incidents such as allisions, collisions, or other problems occurred in the Texas portion of the GIWW. Next, the team collected, via survey instrument, information from vessel operators on the locations of concern and types of structures

considered problematic. The team then physically inspected the waterway, noting the areas of concern of the vessel operators and the location of previous incidents reported by the Coast Guard. Next, the team surveyed developers, economic development corporations, shippers in the areas of concern, and county and local officials in all coastal counties on potential development and their concerns. Finally, the research team collected information on permitting procedures data from the various federal, state, and local jurisdictions involved with shoreline development.

## **AREAS OF CONCERN**

From the various sources of data collected, the team concluded that Calhoun County is an area of high concern for development. However, all counties should continue to be monitored for development along the GIWW. Two conclusions are prominent from all the data sources. First, the accumulated effect of development on the GIWW has a dramatic impact on the ability of barge operators to navigate the waterway. Second, the type of structure also has a profound impact on navigation.

## **PERMITTING OF STRUCTURES**

[Appendix 5](#) is a template of criteria for current permitting practices by all agencies that evaluate development on the GIWW.

## **PLANNED DEVELOPMENT**

The major problems are narrowing of the channel, lack of strategic moorings or push-in (hold-up) areas needed in inclement weather or traffic congestion, and the congestion caused by additional inexperienced recreational boaters. Length, construction material, and design of these structures may impede navigation in the waterway. Additional recreational traffic may create congestion adding to the hazards to navigation.

## **RECOMMENDATIONS FOR PERMITTERS**

1. The Army Corps of Engineers along with TxDOT should act as coordinators for interagency cooperation addressing the accumulative effects of development on the GIWW. It is clear that there is a need to develop a corridor strategy for the GIWW, establishing a multi-jurisdictional approach ([Hard et. al., 2008](#)). There is a clear need for a master plan to create zones of non-development in order to allow for strategic mooring locations for traffic, weather issues, and safe bridge approaches. The use of the Coastal Coordination Council may provide a venue to address this needed cooperation. The industry recommends and the research team concurs that TxDOT create and sanction a formal design review team that includes developers, public authorities, industry members, and other waterway users. This team would be required to develop a master plan and to review all future development plans having potential impact on navigational operations on the Gulf Intracoastal Waterway, including “best practices.”
2. A more aggressive review of the “public use” and “reduction in navigable capacity” criteria under the permitting regulations of the U.S. Army Corps of Engineers should be pursued in granting permits. According to [Dolan Dunn \(2009a\)](#) of the Corps, comments about encroachment receive more weight in a permit’s evaluation if the comment comes from the Corps in its Operations Division. TxDOT should work closely with the Operations Division of the Corps to evaluate the accumulative and types of structure



effects on the waterway and develop preferred types of structures. The preferred structure recommendations should include:

- a. Structures that do not protrude at all into the canal or all waters that are navigable along the GIWW;
  - b. Setbacks, buffer zones, and protective cells to avoid damage from vessel rakes (the part of a vessel not perpendicular to the keel);
  - c. Limits on future construction on both sides of the waterway;
  - d. Limits on structures that impede channel access. Areas of egress and ingress into the GIWW have been shown to be the areas with the greatest number of incidents as reported by the U.S. Coast Guard. Therefore, structures, and in particular marinas, should be designed to improve sight distance and better channel access. Recommended features include:
    - i. downward lighting,
    - ii. electronic alert systems, and
    - iii. guides parallel to shore to assist movement in the channel for speed and direction;
  - e. Sufficient undeveloped areas around bridges to allow for a safe approach for barges or other navigational vessels;
  - f. Limits on sharp edges that can puncture;
  - g. Materials that help dissipate wave energy and are impact resistant;
  - h. Radar reflective material and U.S. Coast Guard approved lighting on the structure;
  - i. Structures that do not generate debris into the waterway due to constant interaction with the water;
  - j. Structures for which these recommendations may apply: bulkheads, revetments, shoreline protection, groins, docks, boat sheds and lifts, piers, entrance channels, fishing piers, housing, commercial buildings, marinas, parking lots, fuel tanks, recreational areas, storm sewer outfalls, and fencing.
3. The Texas General Land Office (GLO) should take a more proactive role in permitting by reviewing the impacts of structures on state commerce, mindful of the accumulative and locational effects of development particularly with regard to the reduction of navigable capacity under Section 403 of Title 33 of the U.S. Code.
  4. County judges should be made aware of the commerce impacts on Texas and their counties of the placement and scope of construction of development along the waterway, emphasizing the importance of waterborne freight to Texas.
  5. There needs to be a better mechanism for policing of permits after they are issued. It is perceived by various stakeholders that there is no mechanism currently to determine if the structure was built according to the approved permit.
  6. The water transportation industry (such as industry organizations and not merely another division of the U.S. Army Corps in its Navigation and Operations Division) needs to have input in the permitting process.

7. A developer guidebook should be made available to each developer and property owner along the GIWW.
8. Time limits may be required on permits in order to better coordinate development along the waterway.

## **RECOMMENDATIONS FOR DEVELOPERS**

1. In their master plans for a developing community, developers must include undeveloped sections along the waterway that can be used for strategic mooring of commercial vessels to hold up or push in during inclement weather. The areas should also include mooring buoys in strategic locations.
2. Avoid placing any *additional* structures in GIWW navigable waters where they could expose people or property to potential harm from barge traffic. All development should occur far enough from the waterway to provide land protection between barge traffic and any structures, mooring areas, or inhabited spaces. No vessel mooring areas should be placed in GIWW navigable waters.
3. Setbacks should be planned on shoreline development of at least 75 ft. Some barges have raked bows that extend over the front of the vessel as much as 75 ft. Consider the use of deed restriction setbacks from the waterway to ensure no hazards to the traffic in the GIWW in perpetuity. Consider zoning laws and permitting restrictions to maintain enforcement over time.
4. Do not provide marina access to the GIWW near bridge approaches or bends in the waterway.
5. Avoid all further development near bridge approaches or bends in the waterway.
6. Do not place lighting immediately adjacent to the waterway in a manner that could impact night vision of mariners.
7. Consider installation of barge-friendly bank erosion protection adjacent to new developments, such as articulated concrete mats.
8. Provide narrow, well-defined access points to GIWW, with physical speed restrictions.
9. Install signage at appropriate marina locations warning of the hazards of interaction between barge and recreational traffic, and detailing proper procedures and rules of the road. Consider not only installation of signage but maintenance of the signage as well.
10. Consider disclosure to the buyer on every transfer of property on the GIWW as to the hazards and liability for navigation of certain structures and/or the lack of setbacks constructed on or near the waterway and the potential risks to the landowner. Further, prior to selling, renting, or leasing marina properties, consider requiring an orientation or training that emphasizes safe operations relative to barge traffic. Brochures and videos would be part of this education.

11. At marina entrances, consider use of visual, automatically controlled traffic signals to warn recreational vessels of approaching barge traffic. Areas of egress and ingress into the GIWW have been shown to be the areas with the greatest number of incidents as reported by the U.S. Coast Guard. Additionally, consider nonvision-impairing lighting, electronic alert systems, and guides parallel to the shore to assist movement in the channel for speed and direction.
12. In the construction of structures along the shoreline, consider limits on sharp edges that can puncture, materials that help dissipate wave energy and are impact resistant material, radar reflective material, and materials that do not generate debris into the waterway due to constant interaction with the water. Consider these aspects for all structures that may include but are not limited to: bulkheads, revetments, shoreline protection, groins, docks, boat sheds and lifts, piers, entrance channels, fishing piers, housing, commercial buildings, marinas, parking lots, fuel tanks, recreational areas, storm sewer outfalls, and fencing. Consider installation of U.S. Coast Guard approved obstruction lighting on jetties or other structures that may extend outward from the bank.

### **IMPACT OF THE STUDY**

The impact of this study is to begin to develop and permit “smart” development with regard to navigation. Smart development includes development that allows navigation along the GIWW not only along the 125-ft channel but along all of the navigable water capable of use for commercial navigation ([Taylor Engineering, 2007](#)) in the waters of GIWW. Hopefully, there will be better cooperation between governmental agencies on permitting development and a focus on the agglomeration, clustering, and density of development on the waterway. Additionally, there should be increased cooperation between developers, governmental agencies, and the barge industry in maintaining the GIWW for its primary use of moving goods effectively and efficiently to promote and support Texas and U.S. commerce.



# CHAPTER 1: INTRODUCTION, BACKGROUND, AND PURPOSE OF THE GULF INTRACOASTAL WATERWAY

## 1.1 INTRODUCTION

The Gulf Intracoastal Waterway (GIWW) is a thoroughfare for materials and products essential to commerce in Texas. There is concern that, without proper planning, the essential travel conducted on the GIWW will be impeded through severe encroachment by various non-transportation-related land uses. This encroachment can lead to effectively restricting the waterway, causing navigation hazards, reducing navigable capacity and operating efficiency, and possibly resulting in loss of property and life. This study addresses these concerns.

The benefits of intracoastal waterways in the United States were identified by early settlers who used natural lakes and rivers to cheaply transport goods and people on shallow draft vessels instead of more expensive vessels that traveled on open waters. Businessmen, politicians, and engineers who envisioned a nationwide canal system that connected the entire east coast to inland rivers and the Great Lakes realized the benefits of this type of waterway. This vision was explained in a report submitted in 1808 by then Secretary of the Treasury Albert Gallatin titled, “Public Roads and Canals.” It was not until 1909, however, that Congress authorized a survey for a possible inland canal from Boston, Massachusetts, to Brownsville, Texas.

“In 1850, Texas coastal interests began to connect portions of the state’s coastline by dredging links between the natural bays, lakes, rivers, and bayous” (Behrens, 2006). When the federal government passed the River and Harbors Act of 1873, funds were appropriated to connect the inland waters from Donaldson, Louisiana, to the Rio Grande River in Texas. This marked the beginning of the development of the Gulf Intracoastal Waterway system (Behrens, 2006).

In the early 1900s, the Interstate Inland Waterway League (now known as the Gulf Intracoastal Canal Association, or GICA) played a vital role in the creation of the Gulf portion of the Intracoastal Waterway by publicizing the benefits over rail transportation, encouraging involvement of local governments, and placing political pressure on Congress to get project funding. During the first half of the 20<sup>th</sup> century, portions of the Gulf Intracoastal Waterway were slowly expanded and channels were dredged connecting the various ports. The economic benefits reaped from the successful movement of products (particularly petroleum products) along the waterway were often credited as having more than offset the monetary cost of canal development (Alperin, 1983). As a result, the core function of the GIWW has been to enhance the transportation of goods to promote commerce.

The waterway also played an important role in the nation’s defense (Alperin, 1983). During World War II, the presence of German submarines along the eastern and Gulf shores of the United States demonstrated the extreme vulnerability of coastal traffic. More than two dozen merchant ships were sunk in the Gulf of Mexico, severely disrupting commerce. Towboats, tugs, and barges were pressed into service on the protected inland waterways to deliver essential commodities for wartime production.

In 2006, the Center for Transportation Research (CTR) at the University of Texas at Austin conducted a study on the Value of Texas Seaports in the Environment of Increasing Global

Trade (Siegesmund et al., 2006). The report presented the estimated GIWW national economic impact. It showed that the economic effect of limiting navigability on the GIWW is estimated to be \$190,136,000 a year (Siegesmund et al., 2006). A contemporaneous report indicated that for every ton left behind due to reduced navigability, there was an estimated increase in the cost of transporting goods along the waterway of 0.03 per ton-mile (Behrens, 2006).

Navigability can be limited by the lack of dredging as addressed in the CTR study, but it can also be limited by hazards in the waters. In order to discuss hazards to navigation, navigation first requires a definition. According to one source, “navigation is the process of planning, recording, and controlling the movement of a craft or vehicle from one place to another” (Bowditch, 2002). Using this definition, when navigation is limited by the inability to control the process, there are negative consequences.

An example of these consequences was the 1996 incident of a Liberian freighter in New Orleans. The Liberian freighter “Bright Field” struck the Poydras Street Wharf, Riverwalk Marketplace, and the New Orleans Hilton Hotel in New Orleans. Although the cause of the allision appeared to be mechanical failure, the National Transportation Safety Board (NTSB) also determined that inadequate risk assessment was done by the regulators and owners of the shore development as to the placement of the development in an area vulnerable to vessel strikes (NTSB, 1998). An additional example of consequences from navigation hazards was the allision of a barge tow with the Alligator Head Fishing Club in Port O’Connor in 2004, in which the club was damaged. In the years 2002–2005, there were 40 total allisions in the GIWW (Texas Department of Transportation, 2007).

In order to understand the hazards to navigation, we must define navigable waterway and encroachments. The United States Army Corps of Engineers (Corps) uses the definition of navigable waterway as found in Section 10 of the Rivers and Harbors Act, specifically “those waters subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.” This is a broad definition applicable to vessels of any size. A vessel operator would regard a navigable waterway as one where a vessel can be maneuvered freely and which may be marked or buoyed to define a channel or other clear passage across a body of water.

The navigable corridor that a vessel may pass through unimpeded, however, includes water areas outside of a buoyed or marked waterway, where vessels may have maneuverability. Further, the waters adjacent to the areas outside of the markers and buoys, where vessels may push in under adverse weather conditions, constitute the outer boundary of the corridor. The definition of navigable corridor, once determined, does not change by later events or encroachments. It should be noted that the natural course of a waterway may change as a result of a natural phenomena (e.g. a river which changes its course and/or dimensions over time).

For purposes of this report, protection of waterways from encroachment means protection of the navigable corridor. Encroachments are defined as, but not limited to, structures and activities such as piers, wharfs, docks, dolphins, mooring pilings, breakwaters, excavation, dredging,

filling, riprap, revetments, retaining walling, marinas, and marina/canal connections (Taylor Engineering, 2007) in the water of the GIWW. Not only does an encroachment potentially pose a navigation hazard, but an encroachment may attract additional recreational traffic that may impede commercial navigation since large commercial vessels require large stopping distances, have substantial blind spots, and lack the maneuverability of recreational boats (Taylor Engineering, 2007).

## 1.2 STUDY BACKGROUND

The purpose of the overall project is to investigate and determine hazards to navigation (encroachments) in the Texas portion of the Gulf Intracoastal Waterway that originate from shore and to make recommendations as to mitigating these hazards in the future. Under the 1975 Texas Coastal Waterways Act, TxDOT is the state agency (through the Texas Transportation Commission) charged with fulfilling the non-federal sponsorship of the GIWW in Texas by providing the safe, effective, and efficient movement of goods along the Texas portion of the GIWW (Behrens, 2006). This project seeks to guide TxDOT by providing criteria to evaluate shoreline proposals along the GIWW. The goal is to protect the navigation corridor for commercial traffic for the industries vital to the Texas economy that rely on the GIWW for the transport of raw materials and finished products.

The Texas Transportation Commission (TTC) is required to perform certain functions under Title 4, Chapter 51 of the Texas Transportation Code. One of these functions includes evaluating and reporting the impact of the GIWW on the state (§51.007). The purpose of the non-federal sponsor is to “support the marine commerce and economy of this state by providing for the shallow draft navigation of the state’s coastal waters in an environmentally sound manner”; “prevent waste of publicly and privately owned natural resources”; “prevent or minimize adverse impacts on the environment”; and “maintain, preserve, and enhance wildlife and fisheries” (§51.003). As a part of those functions, TxDOT is charged with the short- and long-term management and preservation of the GIWW corridor in Texas.

Corridor management is the management of waterfront development in concert with design, access control, and traffic operations along an existing transportation corridor (Hard et al., 2008). As Hard et al. state, “the objective of corridor management is to protect the capacity, mobility, and safety of a transportation facility such that it will retain its intended function as adjacent development and redevelopment occur over time. The long-term objective includes creating mutually sustainable land development and transportation facilities that remain viable and functional into the future.”

Corridor preservation is the practice of acquiring, preserving, or protecting right-of-way (ROW) needed for future transportation (Hard et al., 2008). Corridor preservation also focuses on long-range transportation planning. Long-term consequences of failing to manage land use and development along a transportation corridor include decreased mobility, increased congestion, and increased accidents (Hard et al., 2008). Corridor problems on the GIWW occur from encroachment into the corridor, lack of dredging and material placement areas, and increased traffic. These issues are related to both management and preservation. TxDOT Research Project 0-6225 was undertaken to investigate the increasing concern of shoreline development along the GIWW as an impediment to marine commerce and the economy of the State of Texas.

The Research Project Statement for Project 0-6225 discusses the need and purpose of the study:

Texas has a system of navigable waterways that are used for safely and efficiently moving bulk commodities that would be difficult and hazardous to move overland. While the waterways were established by Army Corps of Engineers to serve an essential transportation function, the popularity of water recreation has led to severe encroachment by various non transportation related land uses. This has the effect of narrowing the useable dimensions of the waterways through certain sections and causing a safety hazard as barges must maneuver around residential and commercial developments and the associated pleasure boat traffic.

As freight volumes continue to surge, careful planning must be undertaken to ensure that needed capacity is not permanently removed by ill-advised commercial and residential development. As more and more projects are developed, safety issues are developing for navigation interests. The potential for collisions between vessels in the GIWW and/or allisions with shoreline developments is increasing. (An “allision” occurs when a vessel strikes a stationary object.) The GIWW is an essential “freeway” for the raw materials and finished products of coastal industry—especially the petrochemical industry. To maintain the state’s waterway as a viable transportation corridor, future shoreline development must be designed in a manner that minimizes or avoids navigation safety issues.

...While certain stretches of the waterway, such as the Laguna Madre, are wide enough to tolerate a limited amount of encroachment, most waterway stretches are dredged to be just wide enough for barges to safely operate. Therefore, any width encroachment poses a safety issue.

As Texas population has increased, there has been an increased demand to build residential and commercial structures along coastal areas, which include the Gulf Intracoastal Waterway. Increased populations in coastal areas have also led to an increase in recreational traffic on the water. More vessels, more piers, etc. in the water and fewer places to safely hold up or push in on the GIWW have created difficulty for barge operators when operating during times of inclement weather or heavy traffic.

In May 2007, Taylor Engineering, Inc. prepared a study addressing shoreline development along the GIWW between Mobile Bay and Wolf Bay ([Taylor Engineering, Inc., 2007](#)). The study recommends many options for management of the GIWW with shoreline developers. The most significant outcome of the study is the effect it had on developer and waterway user discussions and cooperation for smart development. Smart development tries to minimize the impact on commercial users of the GIWW ([Butler, 2009a](#)).

The economic importance of the GIWW to Texas, the Gulf region, and the entire country cannot be over emphasized. A report by the Texas Transportation Institute (TTI) reported that in 2006, more than \$25 billion dollars worth of goods was transported on the Texas portion of the GIWW ([TTI, 2007](#)). The GIWW is the third busiest waterway in the country ([Behrens, 2006](#)). Efficient



navigation of the GIWW is necessary to ensure the economic benefits of the canal continue into the future.

The movement of goods along waterways has an economic benefit over roadway or railway. The Texas portion of the GIWW allows businesses to use barges to move goods in a manner that is more cost-effective and environmentally friendly than other modes that use railroads or highways. One barge can carry the same amount of cargo as 15 railcars or 60 trucks. One gallon of fuel can move one ton of cargo 576 miles on a barge, 413 miles by rail, and only 155 miles by truck. Based on ton-miles, barges produce 40 percent less air emissions than trucks and 16 percent less air emissions than railcars (TTI, 2007). Thus, reducing the efficiency of the GIWW by creating hazards in the waterway from shoreline development encroachment diminishes overall transportation effectiveness.

### **1.3 REPORT OUTLINE**

The remainder of this report is organized as follows. [Chapter 2](#) focuses on stakeholder concerns and responsibilities as they relate to impacts on the Texas portion of the GIWW. Specific focus is on the identification of stakeholders and what they may add to protecting the waterway from encroachment and navigation hazards. [Chapter 3](#) discusses the methodologies of data collection including survey populations, validity, reliability, and human subjects oversight. [Chapter 4](#) shows the findings of the various datasets, including the opinions of vessel operators, officials, and developers. [Chapter 5](#) describes how structures are permitted by various government agencies along the waterway. [Chapter 6](#) looks at the navigation impact of planned future developments on the waterway, including increased traffic from recreational boating. [Chapter 7](#) defines the conclusions and impact of the study and addresses the need for future study.



## **CHAPTER 2: STAKEHOLDERS AND STAKEHOLDER CONCERNS AND RESPONSIBILITY**

### **2.1 INTRODUCTION**

The project team identified and determined the magnitude of stakeholder issues and the identity of major stakeholders through the recommendations of the project advisors for this project, actual site visits, and United States Coast Guard incident data. Additionally, research focused on identifying sensitive issues with stakeholders and being able to explore them further through physical inspection and interviews about what shoreline stakeholders consider as factors that interfere with navigation on the GIWW. Preserving the waterway corridor impacts many stakeholders. Identification of the appropriate stakeholders was key to developing the right guidelines for all.

Unlike railway, roadway, air, or pipeline traffic, waterway traffic in the GIWW regularly uses the area adjacent to the actual shipping lanes defined in navigation charts (Woodruff, 2008). This is often due to weather conditions that barges face due to their size and other factors. There are no specific “rules of the road” that apply to the GIWW, only the general rules of good seamanship (McMullen, 2008).

### **2.2 IDENTIFICATION OF STAKEHOLDERS**

In identifying stakeholders, the project team looked broadly for those parties impacting navigation in the GIWW. Those impacting navigation were entities that affect the “process of planning, recording, and controlling movement of a craft” (vessel) along the waterway (Bowditch, 2002). On the advice of the project advisors during the first project meeting on October 27, 2008, in College Station, Texas, the team identified two basic categories of stakeholders most relevant to determining the impact of shoreline development/encroachment on commercial navigation in the GIWW. These stakeholders are those who use, regulate, maintain, and police the waterway and those who use and regulate the shoreline. They include entities such as real estate developers and the economic development organizations in the coastal areas, coastal county governments, port authorities, barge operators, coastal waterborne shippers, TxDOT, the Texas General Land Office, the United States Army Corps of Engineers, and the United States Coast Guard.

### **2.3 IDENTIFICATION OF STAKEHOLDER RESPONSIBILITIES**

The following paragraphs provide a discussion of how each of these groups contributes to the discussion of corridor maintenance and navigation on the GIWW. The “public at large” is represented by its governmental and commercial representatives. The research team believes these representatives to have the most knowledge on events and plans that may affect the commercial navigation on the GIWW. Focusing on these stakeholders is the most efficient way to collect data and information during the timeframe of the research project.

#### **Texas Department of Transportation**

TxDOT has easements over the GIWW right of way, and under the 1975 Texas Coastal Waterways Act, TxDOT acts as the state’s agent in fulfilling the non-federal sponsorship of the GIWW in Texas. TxDOT is required to continually evaluate the GIWW as it relates to Texas,

including identifying major problems. Therefore, TxDOT is a major stakeholder in the GIWW navigation.

### **United States Coast Guard**

The U.S. Coast Guard is responsible for policing traffic in the GIWW. As such, the Coast Guard has the authority to impose restrictions on traffic (U.S. Coast Guard, 2009a). Therefore, the Coast Guard is a key stakeholder in how the GIWW is preserved for navigation and in how to ensure that traffic through the GIWW flows quickly, efficiently, and safely.

As a result of its policing responsibilities, the Coast Guard requires the reporting of certain incidents that occur on the waterways. Form 2692 requires vessel operators to report any incident involving property damage of \$25,000 or higher or any incident that results in injury.

### **General Land Office**

The Texas General Land Office (GLO) grants leases for residential and commercial shoreline developments along the waterway. Therefore, the GLO is a key stakeholder in determining the impacts on GIWW navigation of shoreline development. The GLO Permitting Assistance Center for the upper Texas coast resides on the campus of Texas A&M University at Galveston. A good source of information on gaining a permit from the GLO is its website at <http://ww.glo.state.tx.us/psc>.

In general, the GLO coordinates with the Corps on issuing permits along the GIWW. According to Tammy Brooks of the GLO (2008), the GLO's policy for development on GIWW is found in the Texas Administrative Code at Title 31 Natural Resources and Conservation, Part 16 Coastal Coordination Council, Chapter 501 Coastal Management Program, Subchapter B Goals and Policies, Section 501.24 Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands. This policy has specific information about what is required based on the type of project, such as a marina or pier/dock. This policy states that structures built must not impede commercial navigation. This policy is also part of a greater coastal management program, Title 31 Natural Resources and Conservation, Part 6 Coastal Coordination Council, Chapter 501 Coastal Management Program, Subchapter B Goals and Policies.

### **United States Army Corps of Engineers**

The United States Army Corps of Engineers has jurisdiction over the GIWW right of way and disposal easements. The Corps is responsible for operating and maintaining the GIWW (U.S. Army Corps, 2008a). As such, the Corps is a major stakeholder in how GIWW navigation is impacted by shoreline development.

In general, 33 CFR Part 322 discusses when a permit is needed and the processing steps (U.S. Army Corps, 2008b). CFR 33 Part 329 discusses navigation and navigable waters. Chapter (or Section) 9 under Title 33 of the U.S. Code looks at protection of navigable waters and of harbor and river improvements generally. Finally, "the permitting rules regarding obstruction of navigable water generally, wharves, piers, etc. and excavations and filling" is found under 33 USC, Chapter 9, Subchapter I Section 403. Section 403 states that "the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is prohibited; and it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures

in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbor or refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same.”

In a conversation held on November 25, 2008, Janet Botello of the Galveston Corps District listed other factors considered when issuing a permit for development along the GIWW:

- Each permit is reviewed on a case-by-case basis.
- Each project is subject to internal review by the Corps.
- Each project is sent to the Corps’ environmental department for review.
- All structures must be at least 50 ft from the top cut of the GIWW channel.
- The Corps’ navigation/operations division reviews the project plan for navigation hazards.
- All lights on the plan must be directed downward.
- Loose riprap is not allowed in any development plan.
- Any permits issued require “no wake” zones in and around neighborhood developments along the GIWW.
- The Corps meets regularly with the Gulf Intracoastal Association to discuss pending development along the GIWW.
- The Corps reviews closely any development permit request for its proximity to bridges with strong current, to bends within the channel, and to any known navigation hazards.

On follow-up with the Corps in an email dated July 23, 2009, Dolan Dunn of the Corps has indicated that the Corps also considers two additional factors for each permit. The Corps internally coordinates with the Corps Real Estate Division and its Programs/Project Management Division. Dolan Dunn indicated in a November 12, 2008, email to the research team that the Corps has a legal right to deny a poorly designed project based on solid information. The Corps has begun to develop and refine a navigation system computer simulation to assist in its duties in permitting (Lisney, 2005). Additionally, the Corps keeps a library of digital photos that show all the features they have constructed and maintained (channels, disposal areas, etc.) marked on aerial photos (U.S. Army Corps, 2008c).

### **Barge Operators and Industry Associations**

Barge operators are the largest group of commercial navigators in the GIWW. They understand the coastal industry requirements for waterborne shipping in Texas, and their expertise can assist with the development of the proper design of any encroachments on the waterway. The operators are key to the discussion of navigation hazards in the GIWW.

There are two industry associations identified as most important to the discussion of navigation on the GIWW. They are the Gulf Intracoastal Canal Association (GICA) and the Texas Waterway Operators Association (TWOA). Between these two organizations approximately 80 percent of the operators in the Texas portion of the GIWW are members.

### *Gulf Intracoastal Canal Association*

The primary representative of the barge operators is the Gulf Intracoastal Canal Association. According to the GICA website (GICA, 2008), the GICA seeks “a comprehensive, coordinated, and consistent approach across the Gulf Coast that allows development to safely coexist with barge transportation on the Gulf Intracoastal Waterway. We must work together with development interests to insure that the primary purpose of the Intracoastal Waterway is preserved” (GICA, 2008). The website states that the GICA would like to see, at a minimum, that the waterways are without obstructions within reach of barges; have plenty of room for barges to be able to pull aside for other traffic, wait on weather, stand by for locks; and have no blinding lights or confusion at bridge approaches. Additionally, the GICA looks for education of recreational boaters, a presence of enforcement personnel, monitoring of conditions as development progresses and a consistent plan across the Gulf Coast administered by the Corps (GICA, 2008).

### *Texas Waterway Operators Association*

The research team presented the findings to date and solicited the members’ opinions of the Texas Waterway Operators Association, an additional organization of barge operators, at their monthly meeting on January 13, 2009. There is a great deal of overlap in membership with the GICA and TOWA.

### **County and Municipal Officials and Port Authorities**

County representatives not only permit and police shoreline development, but they represent the public at large for use of the shoreline. These officials can identify prospective development, zoning, and subdivision regulations that may impact GIWW navigation. Therefore, this group of stakeholders is a key group in determining the impacts on GIWW navigation of shoreline development.

### **Developers/Economic Development Corporations**

Development of the shoreline may lead to encroachment into the GIWW and affect navigation. Therefore, developers must be included in any discussion of plans along the GIWW. The structures that may be built into the waterway include piers, wharves, docks, dolphins, moorings, pilings, breakwaters, excavation, dredging, filling, riprap, revetments, retaining, walling, marinas, and marina/canal connections (Taylor Engineering, 2007). These encroachments may pose a navigation hazard particularly to commercial navigation since commercial vessels require large stopping distances, have substantial blind spots, and lack the maneuverability of a recreational boat (Taylor Engineering, 2007). Therefore, coastal developers and the economic development groups that represent them are important stakeholders in maintaining the GIWW corridor.

### **Shippers**

The shippers whose goods represent the largest amount of traffic and who represent the coastal industries are important to the discussion of planned development and projected commercial traffic needs in the GIWW. The traffic needs have an impact on the navigation.

## **2.4 SUMMARY**

Each stakeholder has various constituencies to whom they are beholden. In the discussions and permitting of developments along the GIWW, these constituents' concerns were balanced.





## **CHAPTER 3: METHODOLOGIES OF DATA COLLECTION**

### **3.1 INTRODUCTION**

The overriding impact to navigation in the GIWW initially indicated by the various stakeholders was from man-made obstacles in the waterway created by shoreline development. Some areas of the GIWW are wider than other areas or have various other natural navigation hazards. Thus, the location and type of current and potential encroachment are critical to navigation in the GIWW. Therefore, the research team focused its efforts on identifying the placement and type of shoreline development that encroaches in the waterway and becomes a hazard to navigation.

The researchers collected various types of data to identify encroachment hazards and understand how and where obstacles are built. First, the research team collected incident data from the U.S. Coast Guard to review where navigation events such as allisions, collisions, or other problems occurred in the Texas portion of the GIWW. Next, the team collected, via survey instrument, information from vessel operators on the locations of concern and types of structures considered problematic. Based on the information collected, the team then physically inspected the waterway, noting the areas of concern of the vessel operators and where previous Coast Guard incidents were reported. Next, the research team surveyed developers, economic development corporations, shippers in the areas of concern, and county and local officials in all coastal counties on potential development and their concerns. Finally, the researchers collected permitting procedures data from the various federal, state, and local jurisdictions involved with shoreline development. The following sections provide an explanation of the methodology of how each data type was collected.

### **3.2 COLLECTION OF INCIDENT DATA**

As a result of its policing responsibilities, the U.S. Coast Guard requires the reporting of certain incidents that occur on the waterways. These incidents are required to be reported using U.S. Coast Guard Form 2692. The requirements of reporting incidents to the U.S. Coast Guard can be found in 46 CFR 4.05. Incidents to be reported include:

... (1) an unintended grounding, or an unintended strike of (allision with) a bridge; (2) An intended grounding, or an intended strike of a bridge, that creates a hazard to navigation, the environment or the safety of a vessel, or that meets any criterion of 3 through 8; (3) A loss of main propulsion, primary steering, or any associated component or control system that reduces the maneuverability; (4) An occurrence materially and adversely affecting the vessel's seaworthiness or fitness for service or route, including but not limited to fire, flooding, or failure of or damage to fixed fire-extinguishing systems, life-saving equipment, auxiliary power-generating equipment, or bilge-pumping systems; (5) a loss of life; (6) An injury that requires professional medical treatment (treatment beyond first aid) and, if the person is engaged or employed on board a vessel in commercial service, that renders the individual unfit to perform his or her routine duties; or (7) An occurrence causing property-damage in excess of \$25,000, this damage including the cost of labor and material to restore the property to its condition before the occurrence, but not including the cost of salvage, cleaning, gas-freeing,

drydocking or demurrage; and (8) An occurrence involving significant harm to the environment as defined in section 4.03-65.

The researchers collected these incident data from the Coast Guard's Marine Information for Safety and Law Enforcement database for the period of December 2001 through October 2008. The purpose of this data collection was to identify recent problem areas or areas of concern for navigation to be further investigated. The team attempted to identify reasons for any high levels of incidents in particular areas along the GIWW.

Once collected, the data were converted to a usable form and projected onto a map using Environmental Systems Research Institute, Inc., (ESRI) Geographic Information Systems (GIS) software, ArcGIS. Data were reduced to only display incidents that occurred within the coastal counties of Texas. Data were then categorized into the type of incident as follows: collisions (accidental contact between ships which causes damage), allisions (accidental contact between a ship and a fixed object, including moored vessels, structures, bridges, etc.), flooding, sinking, or restricted maneuverability (due to a mechanical failure), and intentional groundings. The incident data were mapped onto an image of the Texas coastline.

Other data used to enhance the incident maps included digital orthophotos and county borders from the Texas Natural Resources Information System and a projection of the GIWW and ship channels from the Louisiana Geographic Information Center. Permitting data were also collected (see [Section 3.5](#)) and added to the mapped incident data.

### **3.3 SURVEY DEVELOPMENT AND ADMINISTRATION WITH VALIDITY AND RELIABILITY**

In order to collect information about activities impacting the waterway, a set of survey questions was developed for use with the various stakeholders. These stakeholders included vessel operators through their industry associations, developers and economic development corporations, and county and port authority/navigation district officials. Vessel operators received one set of questions relating to their concerns for navigation in the GIWW. The developers, economic development corporations, county and local officials, port authorities, and navigation districts received a letter relating to concerns on navigation but emphasizing and requesting information on potential development. County and local officials were asked for data on permitting practices for development. This process will be discussed later in the chapter.

The issues related to this type of data collection methodology include three concerns. First is the need to have confidence in the information collected and that it is not biased. Second is that the information measured across all respondents be consistent and comparable. Third is that data collected under this method be consistent with other non-survey-based data sources ([Fowler, 1993](#)).

To ensure that these concerns were addressed, the research team conducted the surveys in the following manner. First, the team determined the population to interview. Second, the team designed questions and looked at the reliability and validity of those questions across the interviewees. Third, the team looked at the response rate of the surveys and determined whether the rate led to a conclusion with bias.

To gather information on the concerns of the vessel operators, the research team surveyed the population of commercial Texas Gulf Intracoastal Waterway users using the entire combined list of members of the Gulf Intracoastal Canal Association and the Texas Waterway Operators. (The list of member emails is available only with the organization's permission.) These two groups represent approximately 80 percent of the total commercial operators (Butler, 2009b). Most members belong to both groups. Operators not represented generally include small companies. However, for the purpose of hazards to navigation the size of the organization to which the vessels belong is irrelevant. All vessels face the same navigation concerns regardless of ownership. Therefore, the research team does not anticipate any bias due to the frame selection of the population for survey (Fowler, 1993).

To gather information on the concerns of developers, shippers, and officials, the research team sent surveys to the entire population of Texas coastal county judges who know the permits requested by developers and the amount of business activity generated by shippers in their jurisdictions. The team surveyed the entire population of economic development corporations in the Texas coastal counties. By administering the survey to the entire population any bias to due the frame selection of the population for the survey should be minimized (Fowler, 1993). From the officials and economic development corporations the research team identified the various developers and shippers to survey in the areas of navigation concern noted from the responses to the operators' survey and from the physical inspection data collection results. The team did not survey all coastal developers and shippers, as there is no comprehensive list of such stakeholders and therefore the findings may be biased to the responses from large developers and shippers. However, the research team believes that this bias does not impact the findings of this study, as the emphasis was on hazards to navigation caused by encroachment.

On January 13, 2009, four members of the research team (Dr. Joan Mileski, William McMullen, Robert Thrailkill, and Jack Lane) attended the monthly meeting of the Texas Waterway Operators Association at Brady's Landing in Houston, Texas. Joan Mileski gave a presentation to the association outlining the research project and the input needed from the vessel operators. Appendix 1 represents the slides used in the presentation. Letters were handed to the members to solicit more comprehensive information returned via email to Dr. Mileski.

Additionally, Dr. Mileski worked with Raymond Butler, President of the Gulf Intracoastal Canal Association, to send out second requests for the same information. The email lists provided by Mr. Butler represented a combined list of all members of the Gulf Intracoastal Canal Association and the Texas Waterway Operators Association. Again the list of email addresses and names of the members is only available with permission from the organization. The total number of member emails on the combined list is 236.

A U.S. Mail letter followed by an email message with the survey questions was sent to the county judges, port officials, and economic development corporations of all Texas coastal counties. Second requests were followed up by research team member Joshua Gunn via phone. Mr. Gunn arranged to meet with various county officials and economic development corporations to gain the information if this method provided more expedient access. The team focused and particularly pressed for information from those official and economic development corporations in areas that the vessel operators indicated in their responses to the survey, and were noted in the physical inspection of the GIWW, as areas of navigation concern. If the officials

and/or economic development corporations led the team to particular developers, information was solicited from those developers.

The team concluded that this methodology of collection of survey responses for all respondents does not bias the responses. Entire populations were surveyed causing no sampling bias. The letters were consistent from respondent to respondent and the interviewer remained constant from respondent to respondent, causing no survey interviewing bias.

Failure to collect data from a high percentage of those surveyed can create a bias in the information collected (Fowler, 1993). Those who do not respond may represent a systematically different group from those who respond. Results of the requests for information from vessel operators result in 11 company responses out of a total 60 companies (18.3 percent response rate). Most responses represent a combination of several individual members who responded in one letter as one company response. The identification of who responded is confidential. Previous research shows that total response rates for email surveys for industry surveys approximate 13.35 percent (Hamilton, 2003).

The results of the survey were presented to the entire membership of the GICA on August 13, 2009, at the annual meeting in New Orleans. After lengthy discussions, members concurred with the findings. Therefore, the research team concluded that there is no non-response bias in the vessel operators' survey findings.

The percentage of responses received from the Texas coastal counties on the development survey was 47 percent. Detailed and thorough information was received for Aransas, Brazoria, Calhoun, Galveston, Jefferson, Matagorda, Nueces, and San Patricio Counties. Information received from the counties of Cameron, Chambers, Jackson, Kenedy, Kleberg, Orange, Refugio, Victoria, and Willacy were deemed low priority for development on the GIWW. This was due to the scarcity of vessel incidents from the U.S. Coast Guard data. All county officials received a request for information but little or no information was received from the low-priority counties. The research team deemed that due to the lack of incidents in these counties no further requests on development data collection were needed. As such, the research team concludes that there is no non-response bias on developments and potential navigation hazards in the GIWW.

In order to ensure that measurement across all respondents is consistent and comparable, the validity and the reliability of the survey instruments must be addressed. Validity refers to the ability of the question in a survey instrument to measure what it purports to measure (Academic.Luzerne.edu, 2005). Reliability refers to the ability of the question to provide consistent measures in comparable situations (Fowler, 1993).

The type of validity applicable in both surveys is content validity which focuses on the content of the information being asked (Academic.Luzerne.edu, 2005). The survey instruments in this study both ask for factual information from the respondent. In order to increase the validity of the instruments under this circumstance, the research team had to make sure that the respondents understood the questions, knew the answers, and were willing to reveal their knowledge (Fowler, 1993).

To increase validity the research team took the following steps. First, the researchers tested the questions with members of the project advisory committee and received feedback as to the wording of questions, who should be asked based on who was knowledgeable on these matters in each organization, and who would be most likely to share the knowledge. The findings were confirmed with the respondents to ensure that the team understood information would be shared. Therefore, the team concluded that the survey instruments were valid.

To ensure reliability, the first step was to ask each respondent the same set of questions. The second step was to make sure the questions mean the same thing to every respondent. The third step was to make sure that the appropriate type of response is communicated consistently to and from all respondents. The research team asked the same questions of each respondent in each survey. The meaning of the questions was reviewed with the advisory board as described above to ensure that the meaning was consistent to the potential respondents. Finally, the team reviewed all responses and summarized them. Summarized responses showed that the respondents consistently reported similar knowledge in the same manner. Therefore, it appeared to the research team that the instruments were reliable.

Surveys conducted on human subjects may be subject to the rules under the 1981 U.S. Policy for the Protection of Human Subjects (Title 45, Part 46). Therefore, the research team members participating in the survey administration and results evaluation were trained in human subjects research. The team filed the appropriate application, an “Application for the Exempt Use of Human Subjects in Research,” with and received approval from the Texas A&M University Office of Research Compliance.

### **3.4 PHYSICAL INSPECTION OF THE WATERWAY**

The research team, after reviewing the incident data and the survey data from the vessel operators, determined that the areas identified from these sources of data as areas of high concern would be physically inspected. As part of selecting the areas to be inspected, the entire charting system of Texas GIWW was reviewed by the research team using the Nautical Charts of the Texas Golden Waterways: Sabine River to the Rio Grande, Texas published by [Ultra-Graph-Tech, Inc. \(1983\)](#). [Appendix 2](#) contains scanned paper charts that show areas of concern that were physically inspected by the team. The first is labeled “Blackberry Island.” This chart shows the narrowing of the GIWW in this area along Blackberry Island and a concern that development on Blackberry Island (there is none to date) could hamper navigation. The second is labeled “GIWW\_468” for mile marker 468. This chart showed an area identified as a shoaling problem area. The third is labeled “Freeport Entrance.” This chart showed an area of concern from bridges at Freeport to the Brazos River. The research team concluded from review of the charts that these areas should be physically inspected as well as the areas identified by the vessel operators’ responses and the incident data. The area deemed to be of high concern includes mile marker 394 to 555 along the GIWW.

Research team members Captain Karl Haupt and Captain Robert Thrailkill traveled the Texas GIWW via boat and barge provided by the Kirby Corporation from mile marker 555 to 394. Captain Haupt boarded the Ms. Susan of the Kirby Inland Marine at the Port O’Connor area and headed south; Captain Thrailkill boarded the Dixie Traveler of the Kirby Inland Marine at Corpus Christi and headed north. They each traveled for two days along the GIWW. The research team determined whether an area was of high, medium, or low concern for navigation

problems. The majority of concern for navigation was the reduction in channel width from encroachments in the waterway. However, other problems such as shoaling were also noted.

The researchers determined from review of incident data and survey data that there were two other areas of concern for navigation along the Texas GIWW. They were the Galveston causeway area and the Beaumont area. The team did not physically inspect these other two problem areas. After inspection of the navigation charts, the team determined the following conclusions. First, the Galveston concerns stem from the causeway bridge and traffic using the Houston ship channel, not shoreline development. Second, Jefferson and Orange County area problems are traffic-related pertaining to the Golden Triangle industry, not shoreline development.

### **3.5 COLLECTION OF PERMIT DATA**

The purpose of collecting permit data was to determine current standards, regulations, and structural forces for the evaluation of the shoreline development projects by the Army Corps of Engineers, General Land Office, counties, etc. and develop a current standards template.

#### **Army Corps of Engineer Standards, Regulations, and Practices**

The U.S. Army Corps of Engineers is given authority to regulate certain activities in the nation's waterways under 33 CFR Part 320. The waterways are protected for navigation under Section 10 of the Rivers and Harbors Act of 1899 that states it is unlawful to build any structure in or over waterways except on plans approved by the Corps. Thus, a permit is needed for any construction in waterways.

The research team's primary contact at the Army Corps of Engineers was Janet Botello. Ms. Botello described the Corps permitting procedures in an interview with research team member Joshua Gunn on April 21, 2009. Dolan Dunn reviewed the preliminary report on the permitting procedures and provided comments and corrections in an email to the research team dated July 13, 2009. [Norman Rondeau \(2009\)](#) at the Corps supplied the research team with the Corps' collection of permit data (actual permit sites along the Texas portion of the GIWW) for the period of September 2007 to June 2009.

The research team collected archival data on the Corps' permitting process from the Permit Service Center (PSC) website ([U.S. Army Corps, 2009](#)). The center is designed to provide assistance and advice to applicants located within the Coastal Management Program Boundary along the entire Texas Coast.

#### **General Land Office Standards, Regulations, and Practices**

The Texas GLO administers the Coastal Management Program in the state of Texas. "The purpose of the Texas Coastal Management Program (CMP) is to improve the management of the state's coastal natural resource areas and to ensure the long-term ecological and economic productivity of the coast" ([Texas GLO, 2009a](#)). In the Texas Administrative Code, the provision dealing directly with waterfront structures is found in Title 31 Natural Resources and Conservation, Part 16 Coastal Coordination Council, Chapter 501 Coastal Management Program, Subchapter B Goals and Policies, Rule Section 501.24 Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands. Tammy Brooks of the GLO provided information on regulation practices of shoreline development along the GIWW in an interview



with research team member Joshua Gunn on April 21, 2009. The research team collected archival data on the GLO permitting and regulation processes on shoreline development from its website ([Texas GLO, 2009b](#)).

### **Counties' Standards, Regulations, and Practices**

The research team requested information from Texas coastal counties where development appears to be growing based on the survey of the vessel operators and from the team's own observations during the physical inspection of the GIWW. Information was initially requested from the county officials/port authorities as described in [Section 3.3](#) of this report. However, each letter that did not receive a response was followed up with an email and/or a personal interview by a research team member. The following list represents the methods of collection of data from the various counties and port authorities:

- Aransas County Engineer, David Vyoral, personal interview with Joshua Gunn, April 24, 2009;
- Brazoria County, David Knuckley, Director of Engineering and Construction at the Port of Freeport, an email to the research team dated June 5, 2009;
- Calhoun County, Arlene Marshal, President of the Calhoun County Development Corporation, email to the research team dated June 1, 2009;
- Galveston County Engineer, Mike Fitzgerald, phone interview with Joshua Gunn, April 21, 2009;
- Jefferson County Engineer, Don Wayle, phone interview with Joshua Gunn, April 21, 2009;
- Matagorda County official, Owen Bludau, email to research team dated March 30, 2009;
- Nueces County Public Works, Melina Michael, phone interview with Joshua Gunn, April 21, 2009; and
- San Patricio, website information, ([Live Oak Preserve, Corpus Christi, 2009](#)).

### **Cities' Standards, Regulations, and Practices**

Texas cities and other municipalities create ordinances regarding construction in their respective jurisdictions. Only four cities responded to our requests for information: the City of Port Lavaca, the City of Port Arthur, the City of Galveston, and the City of Port Aransas. Given the limited number of responses, this information cannot be generalized to all Texas cities.

The following list represents the methods of collection of data from the cities:

- City of Galveston, Planning Supervisor, Lori Swartz, personal interview with research team member Leslie Olson, August 5, 2009;
- City of Port Arthur, City Manager, Steve Fitzgibbons, personal interview with Leslie Olson, August 13, 2009;
- City of Port Lavaca, City Manager, Gary Broz, personal interview with Leslie Olson, August 12, 2009; and
- Port Aransas, Planning and Projects Manager, David Parsons, personal interview with Leslie Olson, August 5, 2009.

### **Navigation Districts' Standards, Regulations, and Practices**

The authority over construction along waterways by navigation districts varies by district charter and appears to be dependent on the ownership of submerged lands around the district. The research team received information from two navigation districts: Corpus Christi and Matagorda Bay (LaGuarta, 2009). As such, this information is limited.

### **3.6 CONCLUDING REMARKS**

The overriding impact to navigation in the GIWW initially indicated by the various stakeholders to the research team was from man-made obstacles created by shoreline development. The main concern expressed was the location and type of obstacles. Some areas of the GIWW are wider than other areas or have various other natural navigation hazards. Thus, the location and type of current and potential encroachment are critical to navigation in the GIWW. The research team collected various types of data to identify navigation hazards due to encroachment.



## CHAPTER 4: AREAS OF CONCERN

### 4.1 INTRODUCTION

The chapter describes results of the various data collection methodologies. As stated in [Chapter 3](#), the research team collected various types of data to identify encroachment hazards and understand how and where obstacles are built. First, the team collected incident data from the U.S. Coast Guard to review where navigation events such as allisions, collisions, or other problems occurred in the Texas portion of the GIWW. Next, the team collected, via survey instrument, information from vessel operators regarding the locations of concern and types of structures considered problematic. The researchers then physically inspected the waterway noting the areas of concern of the vessel operators and where previous Coast Guard incidents were reported. Next, researchers surveyed developers, economic development corporations, shippers in the areas of concern, and county and local officials in all coastal counties on potential development and their concerns. Permitting data will be addressed separately in [Chapter 5](#).

### 4.2 INCIDENT DATA FINDINGS

Incident data were collected from the U.S. Coast Guard and mapped on the Texas portion of the Gulf Intracoastal Waterway using GIS software and satellite imagery (see [Appendix 3](#)). The purpose of this activity was to identify problem areas to be further investigated to determine the reasons for high levels of incidents in a given area. The incidents mapped include allisions (incidents where a vessel strikes a fixed object), collisions (incidents where vessels hit each other), flood/sink incidents (where vessels have either taken on water or sunk), and vessel maneuver incidents (where vessels have been unable to maneuver appropriately because of too much traffic or because of steering or propulsion malfunctions). The last map of [Appendix 3](#) contains all incidents.

### 4.3 VESSEL OPERATORS' SURVEY FINDINGS

Results of the requests for information sent to the barge operators/industry associations described in [Section 3.3](#) resulted in 11 company responses out of a total 60 companies that were contacted (18.3 percent response rate). Most responses represent a combination of several individual members who responded in one letter as one company response. The following list is a summary of the responses by question. The identity of each respondent is confidential.

1. List the problems your company sees with navigation through the Texas GIWW, other than maintenance dredging or current alignment. What problems have been brought to your organization's attention? How? (e.g., capacity, congestion, development and construction in water, other man-made obstacles). The responses on navigation concerns include:
  - a. Physical obstructions that may impede navigation in land cut areas. The land cut areas provide safe inclement weather areas for all vessels.
  - b. Navigation in open bay areas is not impeded by physical obstructions. However, these areas are still subject to weather concerns.
  - c. An increasing amount of traffic in the GIWW.
  - d. A lack of stand-by capacity in the Houston harbor.
  - e. A lack of buoy replacement and marked aids to navigation

2. List the areas along the Texas GIWW which provide your company concern for navigation. Why? The responses on the areas of concern along the GIWW include:
  - a. The Galveston Causeway Railroad Bridge is considered the worst obstacle on the Texas GIWW.
  - b. Brazos Floodgates, mile marker 401. Lock design is poor and mooring buoys are missing.
  - c. The West Port Arthur Bridge is also considered an obstacle of great concern at mile marker 289.
  - d. The Port O'Connor area has many structures along the waterway from mile marker 473 to 475.
  - e. Matagorda Ship Channel at mile marker 471 is a concern for shoaling.
  - f. Caney Creek (Sargent, TX) area has a combination of bridge and structure that compound the risk of navigation incidents from mile marker 415 to 418.
  - g. Colorado Locks are a concern at mile marker 441.
  - h. Bolivar/Crystal Beach, mile marker 343 to 345, is a concern where some pilings are allowed to extend all the way to the waterline of the GIWW. However, Hurricane Ike has changed this landscape.
  - i. Siever Cove, mile marker 342, is a concern where some pilings are actually in the waterway of the GIWW.
  - j. Queen Isabella Bridge at mile marker 665 is a concern.
  - k. Laguna Madre area is a concern.
  - l. Mile marker 420 is a navigation concern due to shoaling and strong currents.
  - m. Mile marker 471 is a navigation concern due to shoaling and strong currents.
  
3. In order of magnitude, what navigation hazards, navigation challenges, bridge approaches, etc. exist along the Texas GIWW? Where are they located? How do they impact your company economically (e.g., speed, type of cargo, etc.)? The responses on navigation hazards, etc. include:
  - a. The most significant area of concern for navigation is the Galveston Railroad Bridge at mile marker 357.
  - b. The Brazos Floodgates have similar issues to the Galveston Causeway Railroad Bridge.
  - c. Caney Creek Bridge at mile marker 418 is a major concern due to the docks located on either side of the bridge.
  - d. The Bolivar area at mile marker 350 is a challenge due to pilings in the water.
  - e. West Port Arthur Bridge at mile marker 289 is a concern due to development around the bridge.
  
4. What kinds of incidents has your company seen or been involved in that cause concern for safe navigation in the Texas GIWW? What kind of economic impact resulted from the incidents? The responses on incidents include:
  - a. Towing companies are insured so when man-made obstructions such as boat docks and camps are damaged from an impact or a surge from a barge, the company is held responsible for the damage. Structures should be built to withstand certain impacts.
  - b. Numerous groundings in and around Bolivar buoy line.
  - c. Numerous collisions and near misses at West Port Arthur Bridge.

- d. Allisions with the Brazos Floodgates.
- e. Allisions at the Galveston Causeway.
- f. Matagorda Ship Channel Crossing collisions.
- g. A number of soft groundings.
- h. Concern that an incident similar to the *Bright Field* incident in New Orleans could occur in Texas.
- i. An allision with a boat dock in the Port O'Connor area, which caused over \$25,000 in damages in January 2009.

Economic costs include:

- a. Several hundred thousand dollars in repairs from allisions.
  - b. Delays due to restrictions to traffic.
5. Do your answers change to questions 1-4 based upon certain events (wind direction, current) or time of the year? Responses include:
- a. The GIWW is more hazardous during the winter months due to the weather concerns.
  - b. The GIWW is more hazardous during the summer months due to the increase in pleasure craft. Pleasure craft operators may not be well versed in seamanship rules.
  - c. Wind (spring and summer) and currents (fall and winter) have an impact on navigation.
6. Is your firm aware of a permitted or projected shoreside development that may impact the Texas GIWW? How? What impact does your organization foresee on navigation? Why? What impact does the project have on your firm economically? The responses on known development problems include:
- a. Many structures that may not have a permit so the impact on navigation is not considered.
  - b. One permit application in Matagorda County (SWG-2009-00034), which is too close to waterway, is typical of a problem structure for navigation (see attachment labeled Permit application in [Appendix 4](#)).
  - c. Potential condominiums, mixed use, and marina developments from Port O'Connor to San Antonio Bay, that further constrict a tight waterway area.

Economic concerns include:

- a. Insurance and damage costs due to allisions.
  - b. Costs from reduced speed of freight.
7. What can be done to the Texas GIWW to alleviate your organization's safety concerns? How can TxDOT assist? The responses on channels width, dredging, permitting, development, education of the public and bridges indicate that channel width should include:
- a. Bridges that offer adequate width for vessel passage.
  - b. Structural designers mindful of the fact that much marine traffic carries petroleum, chemical, and petrochemical cargo and avoid sharp edges, etc. that could cause a spill.
  - c. No man-made obstructions protruding into the canal.

Dredging:

- a. Is important for normal operations.
- b. May show a need for increased infrastructure.

Permitting:

- a. Should prevent all structures encroaching on the waterway.
- b. Should require the barge/boat industry to be informed about potential/new structures.
- c. Should have the industry in a proactive role.

Development/structures should:

- a. Be built in a manner so as not to protrude into the waters that are navigable and waters that are actually used for navigation.
- b. Be set back from the prevailing shoreline.
- c. If they are designed for use of the general public for non marine purposes, have setback requirements, buffer zones, fendering protective cells, etc.
- d. Have lighting restrictions.

Education of the public should include:

- a. Owners of crafts 26 ft or greater in length that must have training on general seamanship.
- b. Larger craft should be required to have VHF radio and the ability to communicate in English.
- c. Sponsored education on interacting with large commercial vessels.
- d. Information to the GICA and the TOWA as permits are proposed.

Bridges:

- a. Replace Galveston Railroad Bridge.

#### **4.4 PHYSICAL INSPECTION FINDINGS**

The research team physically inspected the areas that were identified by the vessel operators as problematic due to shoreline development. The physical inspection results were correlated with mile markers along the GIWW using the charting systems from the Coast Guard, Google mapping, and other sources.

To gain an appreciation of the channel width/encroachment concerns, Mr. Butler provided in an email dated December 19, 2008, the industry specifications on barges typically found on the GIWW. This information assisted the research team in the next task of evaluating the physical locations significant to navigation on the GIWW. The specifications are:

- Typical barge dimensions on the GIWW:
  - Dry Cargo Barges:
  - 195-ft long by 35-ft wide by 12-ft deep
  - Max loaded capacity: 1500 tons
- Flat Deck, Aggregate Barges:
  - 250-ft long by 52-ft wide by 12-ft deep Max loaded capacity: 2500 tons

- Typical Tow Configurations:
  - 6 Pack Dry Cargo:
    - 6 each, arranged 3 long and 2 wide, Made up of 195 ft by 35 ft barges, pushed by an 1800 HP boat
  - or
  - 2 liquid barges:
    - 297-ft long by 54 ft, arranged end to end or side by side, pushed by an 1800 HP boat
- Maximum Tow Dimensions on the GIWW: 1080-ft long, including the boat, and 54-ft wide. 750-ft long, including the boat 70-ft wide.
- Rake barges are a particular concern in that rakes can reach up to 75 ft over the front of the vessel (Woodruff, 2009).

### Inspection of Navigations Charts

Electronic navigation charts are available, offshore and on the vessels, as seen in [Figure 1](#).



Figure 1. Electronic Chart.



Figure 1 shows an electronic chart on the, *Dixie Traveler*, of mile marker 485. Figure 2 shows another example of electronic charts. This figure represents the electronic chart from the Ms. Susan of the Brazos River locks at mile marker 400. The old route on the chart indicates a straighter route than the current actual route, which requires two difficult turns.

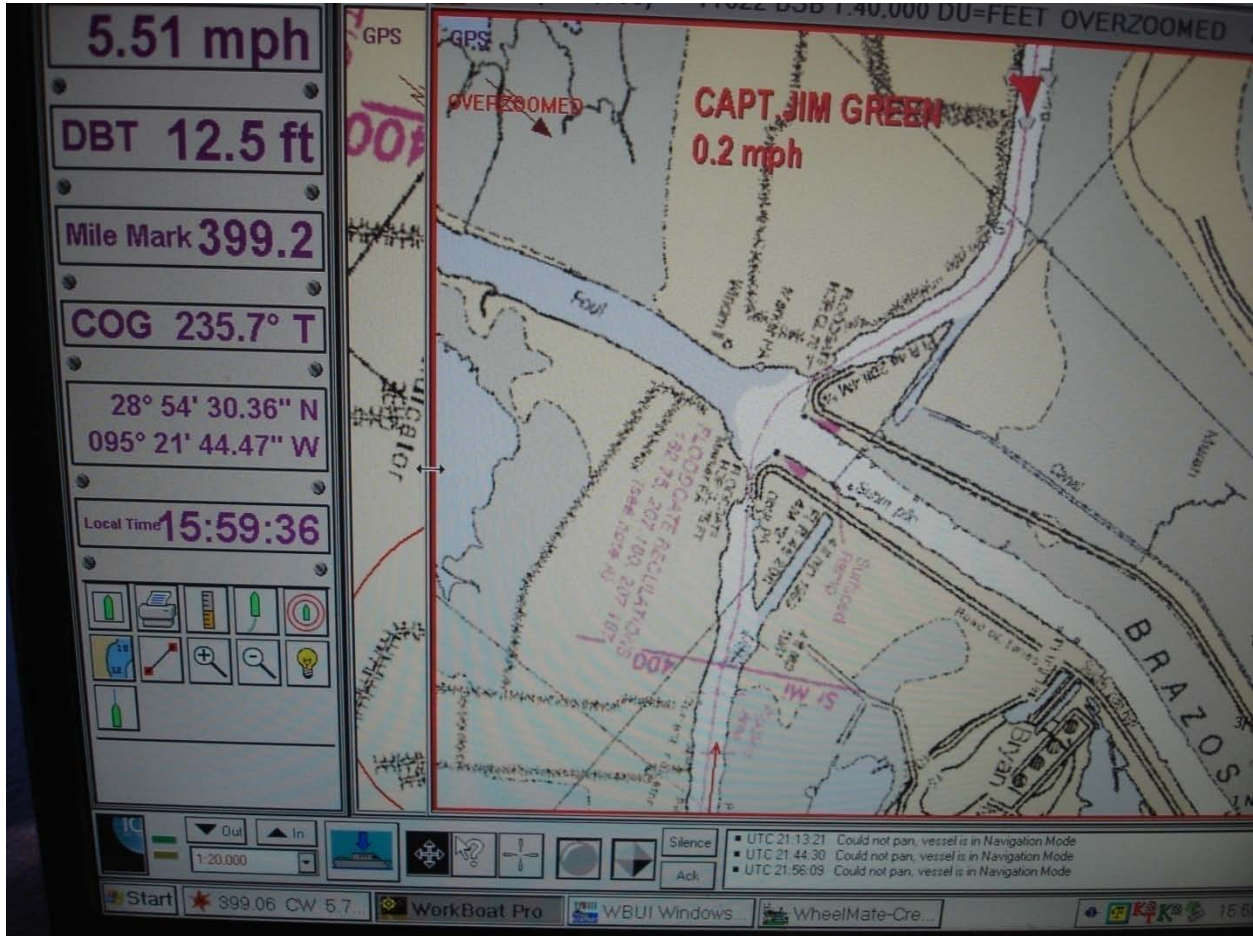


Figure 2. Electronic Chart – Mile Marker 400.

The entire charting system of the Texas GIWW was reviewed by the research team using the Nautical Charts of the Texas Golden Waterways: Sabine River to the Rio Grande, Texas, published by [Ultra-Graph-Tech, Inc. \(1983\)](#). The research team reviewed the following items on the charts, detailing the locations:

- inbound and outbound shipping lanes;
- choke points and anchorages;
- areas where the channels narrow;
- areas of environmental concern;
- areas of potential development;
- population centers;
- piers, pipeline outfalls, businesses or parks that impinge within 200 yards of the navigable waterway; and
- height of all bridges crossing the waterway.

There are three scanned paper charts in [Appendix 2](#) that show areas of concern that were physically inspected by the team:

- The first is labeled “Blackberry Island.” This chart show the narrowing of the GIWW in this area along Blackberry Island, which results in a concern that development on Blackberry Island (there is none to date) could hamper navigation.
- The second is labeled “GIWW\_468” for mile marker 468. This chart shows the area identified as a shoaling problem area.
- The third is labeled “Freeport Entrance.” This chart shows an area of concern from bridges as labeled on the chart from Freeport to the Brazos River.

The research team concluded from review of the charts that these areas should be physically inspected as well as the areas identified by the vessel operators’ responses in the section above.

The results of the vessel operators’ survey indicate that there were three major sites to be visited by the research team via barge for visual inspection. These are broadly the Matagorda Bay area including Port O’Connor, Sargent Beach/Caney Creek and Rockport Cut, the Galveston Bay/Galveston Causeway area, and the Orange/Jefferson Counties including Beaumont.

### **Physical Inspection of Noted Problem Areas**

Captain Karl Haupt and Captain Robert Thrailkill traveled the Texas GIWW via boat and barge provided by Kirby Inland Marine from mile marker 555 to 394. Captain Haupt boarded the Ms. Susan of the Kirby Inland Marine at the Port O’Connor area and headed west. Captain Thrailkill boarded the Dixie Traveler of the Kirby Marine Inland at Corpus Christi and headed east. They each traveled for two days along the GIWW.

These areas were physically inspected because they were identified via navigation charts, surveys, and incident reports as the most problematic areas for navigation due to shoreline development along the waterway. The following pictures ([Figures 3–32](#)) from the physical inspection highlight the problem areas and issues for concern. Each area is determined to be of high, medium, or low concern for navigation problems. The primary concern for navigation is channel width. However, one area noted a shoaling problem.

This first set of pictures starts at Corpus Christi, mile marker 555, heading east and ending at Port O'Connor area at approximately mile marker 473.



**Figure 3. Typical View from the Boat.**

Figure 3 represents a typical view from the boat for a vessel operator pushing a typical tank barge. This is the Dixie Traveler heading east on the GIWW. The dimension of the boat is 40-ft wide and 60-ft long, pushing a barge 193-ft long and 50-ft wide.





**Figure 4. Mile Marker 490.**

Figure 4 shows mile marker 490 in the Seadrift area. The GIWW is clear on both shores, and navigation concerns are low.



**Figure 5. Seadrift Area.**

Figure 5 shows the Seadrift area. Please note how close the shoreline is to the GIWW.



**Figure 6. South Approach of Port O'Connor.**

Figure 6 represents the eastbound approach to the area of Port O'Connor (Calhoun County), known by the industry as "Charlie's Fish Camp," which was identified from the vessel operator input as an area of high concern. The construction of piers into the waterway narrows the lane.



**Figure 7. Charlie's Bait Camp.**

[Figure 7](#) represents the area of the Charlie's Bait Camp, near Mile 490, west of the Port O'Connor area. In 2004, a vessel collided with the Alligator Head Fishing Club in this area, destroying it. Please note how narrow the GIWW becomes. This is an area of high concern.





**Figure 8. Close-Up of Charlie's Bait Camp.**

As the vessel traveled through the Charlie's Bait Camp area shown in [Figure 8](#), the wake clearly reached the structures. These structures would have difficulty tolerating large wave energy. The vessels typically travel at speeds of 5 to 6 miles per hour, but in this area they generally travel at 4.5 miles per hour. Slower travel requirements and restricted one-way passage due to these structures add costs. This is an area of high concern. If a vessel were to stop for any reason in this area, the prevailing south wind would force the barges into the structures seen in this photo, destroying them.



**Figure 9. Light Structure.**

Again in the Port O'Connor area, [Figure 9](#) shows another concern for navigation when structures are allowed into the waterway. The presence of bright, fish-attracting lights may blind or confuse pilots. In this case one light is appropriately pointed down, but the other two lights are pointed out, interfering with the sight of a vessel operator.



**Figure 10. Mile Marker 479.**

Moving east to mile marker 479, there appears to be new construction along the waterway, as shown in [Figure 10](#). Currently the area is of medium concern for navigation, as development is still in the planning phase. This very large development is known as the Sanctuary and includes over 1000 lots. It is the first of multiple developments being contemplated for shoreline real estate in Calhoun County. Its ultimate completion and full occupation will most certainly impact commercial navigation on the GIWW and represents the perfect example of the need for foresight and planning.





**Figure 11. Encroachment.**

Taken approximately a mile from [Figure 10](#), the photo in [Figure 11](#) shows that an additional new subdivision is under construction. This area is currently of medium concern, as these structures encroach on the waterway but two barges can pass safely. There is still sufficient area on either side of these structures to push in when needed.





**Figure 12. Canal Built into Land.**

Still heading east an additional mile, another development is being constructed, as shown in [Figure 12](#). This development, however, is of low concern for navigation in that the canal built into the land from the waterway leaves the waterway clear of encroaching structures. The concerns for developments of this type are for the regulation of the large amount of recreational traffic that will accompany the development of the property. Bulkheads adjacent to the waterway should be lighted with U.S. Coast Guard approved lighting.



**Figure 13. Mile Marker 476.**

Figure 13 represents commercial navigation traffic and commercial oil field vessels at mile marker 476. The GIWW passage for traffic is tight, as illustrated by the two barges, but it is still acceptable. Weather may make this area more difficult, making this an area of medium concern for navigation.



**Figure 14. No Place for Push In.**

Just east of the commercial structure, a shoreline development is being constructed as shown in [Figure 14](#). The concern here is that there will be no place on either side of the commercial structure to push in during bad weather or to wait for passing or meeting traffic.



**Figure 15. Mile Marker 475.**

Figure 15 shows mile marker 475, where new communities are being constructed. Please note the boat that sticks out from the pier structure. This area is of high concern because there may be no place for barges/boats to adjust for inclement weather should construction continue in this manner. The concern will be greater if construction occurs on both sides of the waterway. Currently the waterway is restricted to one-way traffic.





**Figure 16. Large Structure.**

In the same area, larger structures that encroach into the waterway continue to be constructed, as shown in [Figure 16](#). Also, there is nowhere on either side of the structure to push in during inclement weather. This is an area of high concern.



**Figure 17. Coast Guard Base.**

Figure 17 shows the U.S. Coast Guard Base at Port O'Connor. Note the construction along the waterway. Damage by a barge in inclement weather would be minimal to this type of construction. It is impact resistant and there are no protruding or sharp items. No part of the structure encroaches into the waterway.



**Figure 18. Private Good Construction.**

Figure 18 shows the same Port O'Connor area near the U.S. Coast Guard base. This as an example of good construction along the waterway. There is no encroachment into the waterway, as evidenced by the boat shed location.



**Figure 19. North End of Port O'Connor.**

Figure 19 represents the older, eastern end of Port O'Connor. Vessel operators indicate that construction should not be allowed to encroach any further into the waterway than existing structures. An area of high concern exists here. Currently, this area is one-way traffic only.





**Figure 20. East of Mile Marker 475.**

Figure 20 shows the area just east of mile marker 475. The vessel is in the process of stopping by beaching on the shoreline. This illustrates the need for unencumbered areas to stop vessels and pull over for oncoming traffic or during poor weather prior to crossing Matagorda Bay.

This second set of pictures show the GIWW starting at Freeport mile marker 394 going west and ending at the Charlie’s Bait Camp area mile marker 485.



**Figure 21. The “Ms. Susan.”**

Captain Haupt boarded the Ms. Susan, shown in [Figure 21](#), heading south on the GIWW. The dimension of the boat is 40-ft wide and 60-ft long. Each barge is 300-ft long and 54-ft wide. Note in the distance the GIWW bridge approach.



**Figure 22. Surfside Bridge.**

[Figure 22](#) shows a picture of Surfside Bridge in Freeport at mile marker 394. As the picture indicates, there is no place on either side of the waterway or on either side of the bridge for a commercial barge to push in on the bank to deal with bad weather or oncoming traffic. This area is of high concern.



**Figure 23. LNG Structure.**

Figure 23 shows a commercial LNG structure at mile marker 396. Construction of this type on the shoreline provides no encroachment into the waterway and is of low concern.





**Figure 24. Bryan Beach Bridge.**

Figure 24 shows Bryan Beach Bridge at mile marker 398. The area is of medium concern. Although the bridge confines the waterway, there is sufficient area on either side of the bridge to assist barges in bad weather or while waiting for traffic. Note that the bridge navigation span pilings are located totally out of harm's way on the bank, rather than in the navigable water where they might be impacted by empty barges. This bridge represents one of the most recent bridge navigation span widening projects on the waterway. The new bridge seen here replaced a former a 125-ft wide pontoon swing bridge.



**Figure 25. Brazos River Locks.**

Figure 25 shows the 54-ft wide tow passing through the 75-ft wide Brazos River Floodgates. The Brazos Floodgates are extremely difficult due to the swift river that separates two non-aligned structures. When the floodgates area was originally constructed in the 1950s, tows were much smaller than today's barges. The size and number of tows on the GIWW have exceeded historical predictions (Dunn, 2009b).



**Figure 26. Old Cut in Brazos River Locks.**

Figure 26 is a picture of the shipyard in the old cut in the Brazos River Locks. Construction does not interfere with the waterway.





**Figure 27. Caney Creek.**

[Figure 27](#) shows the Caney Creek development at mile marker 417 to 420. There is development on both sides of the waterway, and shore lights interfere with navigation where the encroachment on the waterway is high. The level of concern for navigation is high. See [Figure 28](#) for a view of this area during the day.





**Figure 28. Aerial View of Caney Creek.**

Figure 28 shows the Caney Creek development at mile marker 417 to 420. There is development on both sides of the waterway. See Figure 27 for the hazard to navigation this area creates at night. The level of concern for navigation is high.



**Figure 29. Mile Marker 417.**

[Figure 29](#) shows fishing camps at mile marker 417. The large lights are similar to lights used on boats/barges used in navigation. This potential confusion creates a level of high concern.



**Figure 30. Matagorda Ship Channel.**

Figure 30 shows the barge as it passes through the Matagorda Ship Channel at mile markers 468 to 471. This area is a high concern for navigation due to shoaling.



**Figure 31. Mile Marker 478.**

Figure 31 shows new development at mile marker 478. The new shoreline development and the new structure encroach on the waterway, and there is a need for U.S. Coast Guard approved lights on the end of the structures. The area is of medium concern to date, but there is uncertainty as to the level of proposed development.





**Figure 32. Crew Change Area.**

The Ms. Susan changes crew and Captain Haupt disembarks at mile marker 485, shown in [Figure 32](#). The area represents the first safe area for crew changes.

The research team determined that use of the simulator was not necessary, as the actual physical inspection via boat/barge was more valuable than a simulated inspection. The researchers determined from review of incident data that there are the two other areas of concern for navigation along the Texas GIWW. They are the Galveston Causeway area and the Beaumont area. The research team did not physically inspect these problem areas from the water for the following reasons:

- The Galveston concerns stem from the causeway bridge and traffic from the Houston Ship Channel and not shoreline development.
- Jefferson and Orange County area problems are also due to traffic related to the Golden Triangle industry and not shoreline development.
- Hurricane Ike has currently eliminated the Bolivar Peninsula as a navigation problem area.

## 4.5 DEVELOPERS' SURVEY FINDINGS

The research team collected data on proposed development through requests for information as described in [Chapter 3](#). The requests for information were made of developers, economic development groups, shippers, and county and port authority officials. The requests included information on both residential and commercial development.

As described in [Section 2](#) of this chapter, areas of navigation concern were identified by overlaying vessel incident data from the U.S. Coast Guard on a map of the coastal counties of Texas. Section 10 and 404 permit data were retrieved from the U.S. Army Corps of Engineers for coastal county areas that were considered of navigation concern by the vessel operators. Using the incident data and the permit data, the team gathered development data that included proposed developments retrieved from county official information, developer responses, and online research information.

Jefferson/Orange, Galveston, Matagorda, and Calhoun Counties were identified as high concern areas, as indicated in the team's previous findings. However, all coastal county officials and developers were contacted for information. The sections below provide explanations, by county, of the research team findings.

The maps for each county discussed indicate the proposed developments in red, the Army Corps of Engineering permits granted in the last two years (September 2007 to April 2009) in green and the U.S. Coast Guard events (allisions only) over the last seven years (December 2001 to October 2008) in blue. The allision data appear most relevant to hazards to navigation due to encroachment into the waterway.

### **Aransas County**

David Vyoral, county engineer for Aransas County, was interviewed by Joshua Gunn of the research team on April 24, 2009. There are four proposed developments and one newly completed development in the county that may impact the GIWW. First is the Cove Harbor Marina and Drystack, which were completed and can hold 600 vessels in its warehouse. The Marina has 7 piers with 24 slips apiece. Second is the proposed Reserve at St. Charles (Rockport, Texas), which will have 292 single-family homes of which 65 will have access to the water. Third is the proposed Boardwalk at St. Charles, which will have 63 lots with wetlands and bay front access. Fourth is Conrad (Conn Brown) Harbor for which there was little information. These proposed developments appear to have no plans for encroachment into the waterway. However, if the shoreline of the waterway is developed leaving little area for vessel maneuvering during inclement weather, then the Lydia Ann Channel may be used potentially as an alternative route (see [Figure 33](#)).

Although Aransas County had no significant vessel incidents and was not identified by the vessel operators as an area of serious navigation concern, there is much proposed development in the county. Areas of particular concern are where the GIWW borders the mainland on the southern portion of the county before reaching San Patricio County, which is where Cove Harbor Marina is located.



# Shoreline Development in Aransas County

Source: U.S. Army Corps of Engineers, U.S. Coast Guard,  
Texas Natural Resources Information System, and Louisiana  
Geographic Information Center.

Projection: Transverse Mercator  
GCS: North American 1983  
Created in ArcMap, August 2009

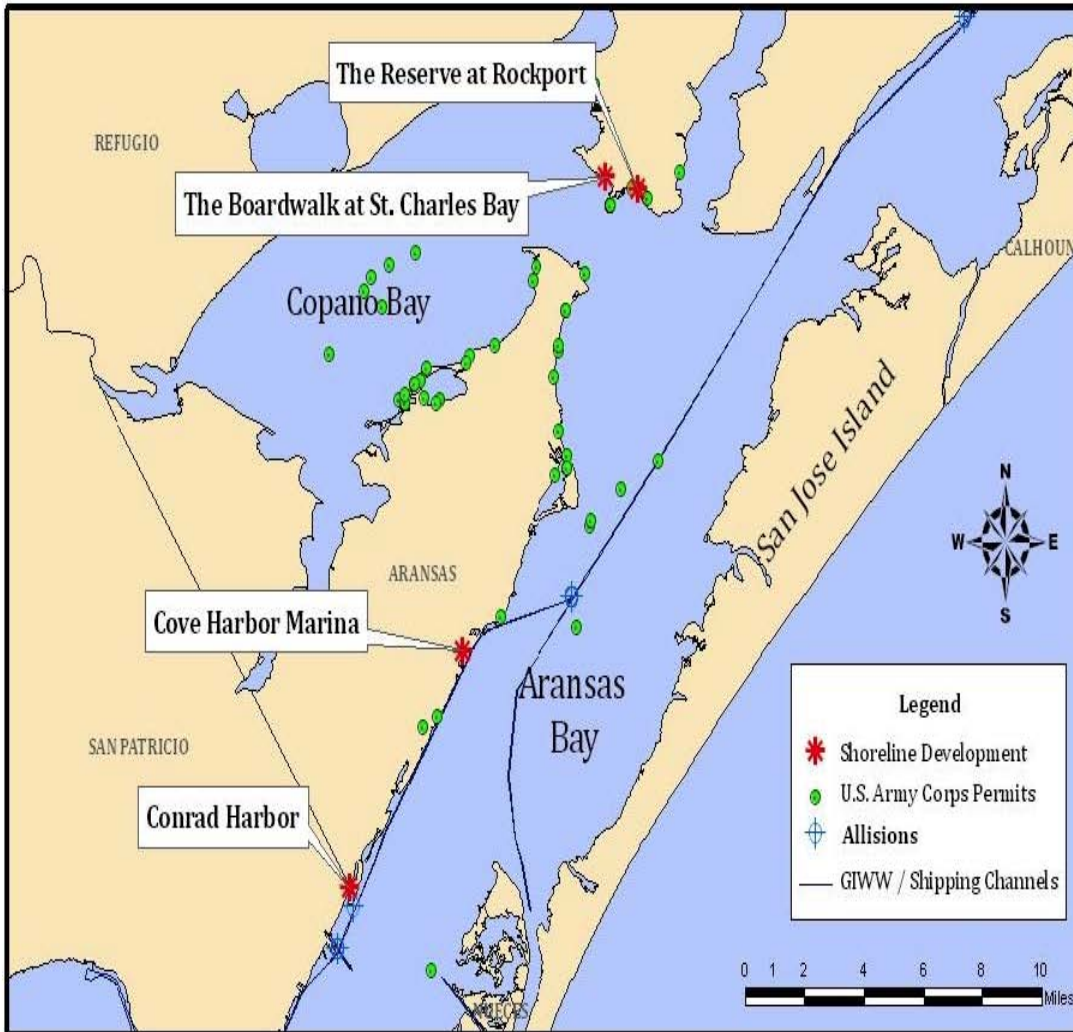
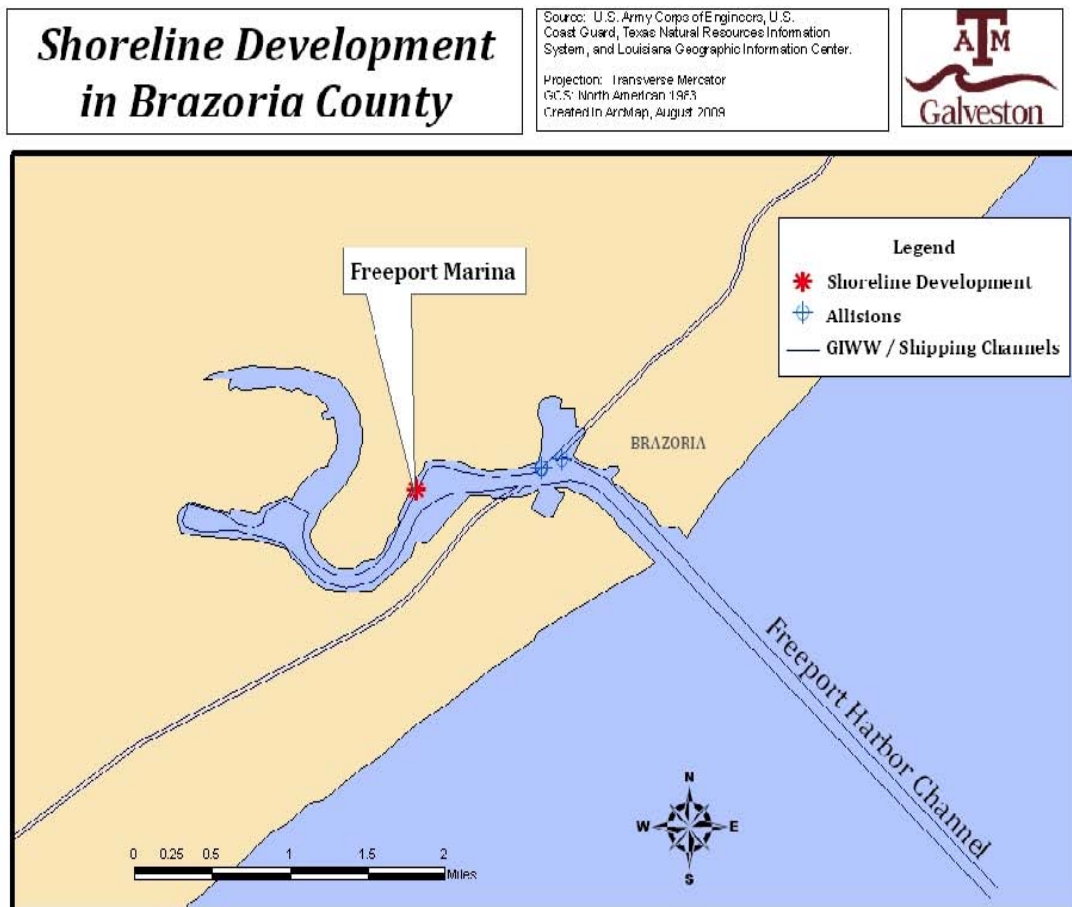


Figure 33. Aransas County Shoreline Development.

## Brazoria County

Robert Worley, president of the Economic Development Alliance for Brazoria County, reported to the research team via email on June 4, 2009, that there were no new coastal developments currently planned in Brazoria County. David Knuckey, director of engineering and construction at the Port of Freeport, confirmed Mr. Worley's comments in an email dated June 5, 2009, stating that the "Port of Freeport is not aware of any planned development on the GIWW that would impact navigation." However, the team notes from Web sources ([City of Freeport, 2009](#)) on Brazoria County that a development may be planned by the Freeport Marina, L.P., but the number of units is yet unknown. This mixed-use marina is planned for the banks of the Brazos River. Brazoria County has very little development planned, and Corps permit data have not been retrieved (see [Figure 34](#)).



**Figure 34. Brazoria County Shoreline Development.**

## Calhoun County

Arlene Marshall, president of the Calhoun County Economic Development Corporation, provided the following information via email on June 1, 2009, on current known developments in Calhoun County that are complete, under construction, or planned/potential that may have an impact on GIWW navigation (see [Figure 35](#)). Additionally, Gary Broz, city manager of Port Lavaca, and Julio LaGuarta provided more detailed descriptions of each development to the research team ([Broz, 2009](#); [LaGuarta, 2009](#)).

### Current (Complete or Under Construction):

1. **The Sanctuary at Costa Grande** (767 lots) is under construction. The plats have been filed. Phase I has been sold, and Phase II sales are underway. The development plan includes two docks extending into the waterway. The site plan is available at [www.costagrande.com](http://www.costagrande.com). This development should have a major impact on the GIWW due to its proximity to the waterway and its construction.
2. **Caracol** (74 lots) is complete and sales continue. The project is located in Port O'Connor, an unincorporated area of Calhoun County. The site plan is available at [www.caracolcoastal.com](http://www.caracolcoastal.com). This development should have a major impact on the GIWW due to its proximity to the waterway.
3. **Swan Point Landing** (89 lots), located north of Falcon Point Ranch, is complete and sales continue. This project is located outside the City of Seadrift. This development should have no direct impact on the GIWW due to its location off the channel.
4. **The Bay Club at Falcon Point** (108 lots) is currently under construction. Three phases have been recorded and sales are underway. This development should have no direct impact on the GIWW due to its location off the channel.
5. **Seaport Lakes** (56 lots) is complete. All lots sold. This development should have no direct impact on the GIWW due to its location off the channel.
6. **Bay Pointe** (99 lots) is located in the county on Highway 316. Fifty-five lots are on the water and some lots are 1, 5 and 10 acres. Roads are paved and electricity and Guadalupe-Blanco River Authority (GBRA) water are in place. There were contracts on all of the lots within a 24-hour period in July 2006. This development should have no direct impact on the GIWW due to its location off the channel.
7. **Blue Heron** (38 lots) is located on Highway 238. This project is in the extra territorial jurisdiction (ETJ) of the City of Port Lavaca. All lots have been sold. Three houses have been built. There are no bulkheads. This development should have no direct impact on the GIWW due to its location off the channel.
8. **Redfish Retreat** (247 1-acre lots) is located near Road 1090 in Port Lavaca. The development plan shows a pier into the off-shore water at Magnolia Beach. This development should, however, have no direct impact on the GIWW due to its location off the channel.

**Planned Developments:** Proposed projects that have taken significant measures toward beginning construction. However, no final plat has been filed nor have sales begun. Examples of significant measures are submittals of Corps permit applications, final planning, and preliminary engineering.

1. ***Two Hotels and a Restaurant*** will be located on 14.04 acres on Texas Highway 35 and US 87. It is expected there will be space left over for a small strip of retail businesses. This development should have no direct impact on the GIWW due to its location off the channel.
2. ***The Sanctuary at Costa Grande Phase III*** (approximately 300 lots) is currently being planned. Phase III will be located adjacent to Phases I and II. This development should have a major impact on the GIWW due to its proximity to the waterway.
3. ***Falcon Point*** (1500 units) is continuing development and the Corps permit application has been submitted. This development should have no direct impact on the GIWW due to its location off the channel.
4. ***Harbor Mist*** (1700 lots) is located between the Victoria Barge Canal and Highway 185 in Calhoun County. Canal permits have been issued by the Corps of Engineers. Phase I will consist of 225 lots. This development should have a major impact on the GIWW due to its proximity to the waterway.
5. ***The Tidelands*** (approximately 82 units) is located in Port O'Connor (Calhoun County). The Corps of Engineers permit approval is expected soon and platting and engineering design have begun. Twenty lots sold. Permits are expected anytime. This development should have a major impact on the GIWW due to its proximity to the waterway.
6. ***Powderhorn Ranch*** is currently planning and has begun preliminary construction of a golf course. The current plan calls for a low-density residential project containing up to 500 units. The ranch is located adjacent to Port O'Connor, Calhoun County. This development should have no direct impact on the GIWW due to its location off the channel.

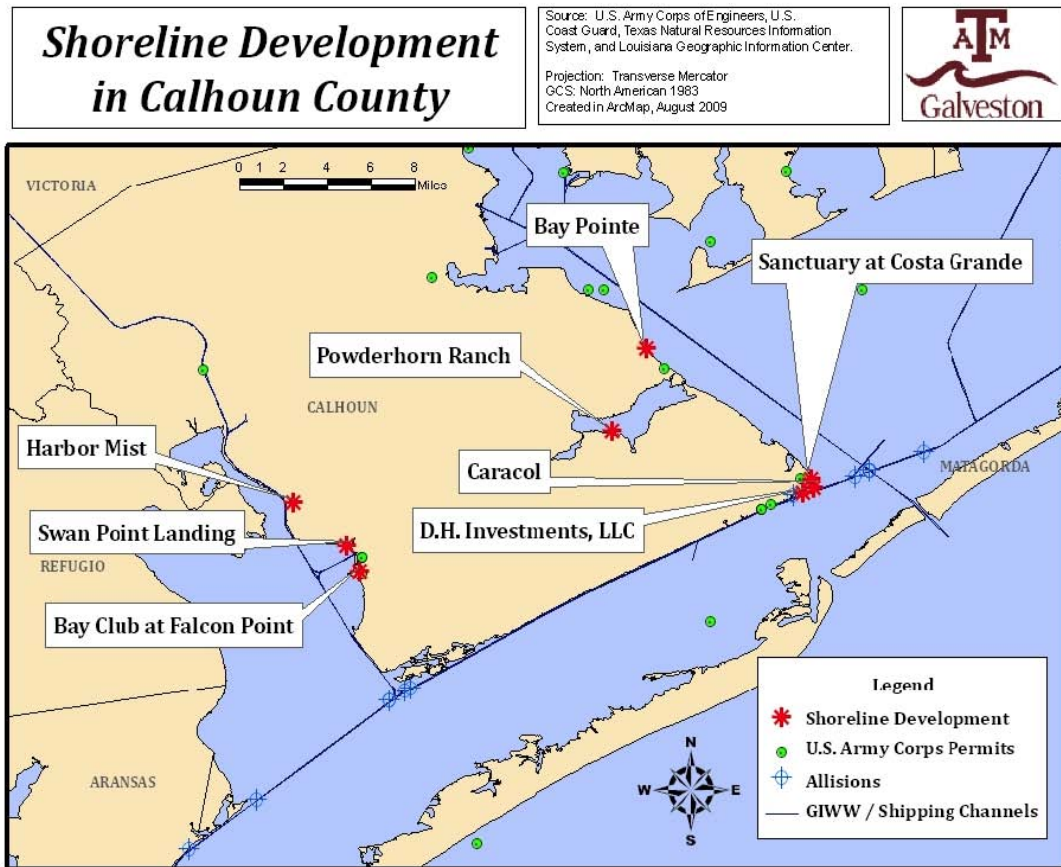
**Potential Developments:** Properties owned by individuals or entities that are actively considering developing the property.

1. ***The Sanctuary at Costa Grande*** consists of 10,000 additional acres that are slated for the development of possibly 8900 units. This development should have a major impact on the GIWW due to its proximity to the waterway.
2. ***Falcon Point Ranch*** owns 4000 acres of additional developable property but no planning is currently underway. This development should have no direct impact on the GIWW due to its location off the channel.
3. ***Powderhorn Ranch*** has significant additional property with extensive water frontage. No plans are currently being pursued. This development should have no direct impact on the GIWW due to its location off the channel.
4. ***The Bindewald Tract*** (300 lots) is currently being planned as a low-density project. This tract is located between Highway 185 and the Victoria Barge Canal. This development should have a major impact on the GIWW due to its proximity to the waterway.
5. ***The Fisher Tract*** (300 lots) is currently being considered for a canal lot subdivision. This tract is located just outside of the City of Seadrift. This development should have no direct impact on the GIWW due to its location off the channel.

6. **Lane Road** is an undeveloped area that is being divided into 5-acre tracts. There is a possibility of up to 300 residential units in this area. This tract is next to the extensive acreage of Costa Grande on Highway 185 outside of the City of Seadrift. This development could have a major impact on the GIWW due to its proximity to the waterway.

**Other Developments:** Noted by the research team via website searches.

1. **D.H. Texas Investments, LLC** is a planned development on the GIWW of 60 acres 4.5 miles west of Port O'Connor ([D. H. Texas Instruments, 2009](#)).



**Figure 35. Calhoun County Shoreline Development.**

Calhoun County contained a large number of vessel incidents, but most of them occurred in open water. Numerous developments are being proposed as indicated above (not all smaller developments are shown). The planned developments that are a major concern to vessel operators are in Port O'Connor and are very close to the GIWW.

## Galveston County

Galveston County was identified as of high concern (see [Figure 36](#)). Captain Mike Mierzwa, deputy port director of the Port of Galveston, informed the research team that he was aware of two projects that may have impact on navigation along the GIWW. The first project would require the harbor channel to be dredged to a depth of 45 ft and cause the closing of some slips for larger vessels. The second project involves widening the railroad bridge along the Galveston causeway.

Jeff Sjostrom, president of Galveston Economic Development Partnership, in an interview on June 7, 2009, with the research team mentioned that there is additional residential development on the island but none on or near the GIWW. The only issue regarding the GIWW that Mr. Sjostrom indicated was a permit issued by the Army Corps of Engineers to deepen the water on the north side of Harborside Drive west of the Pelican Island Causeway. This permit was requested to allow larger vessels in the water to pass. Much of the land in Galveston that is undeveloped along the GIWW is surrounded by protected wetlands. Therefore, Mr. Sjostrom noted that he found it difficult to imagine new development in the area. This information was confirmed by Lori Schwarz, planning supervisor for the City of Galveston ([Schwarz, 2009](#)).

Additional developments discovered by the research team via website searches that may impact the GIWW in Galveston County include the following:

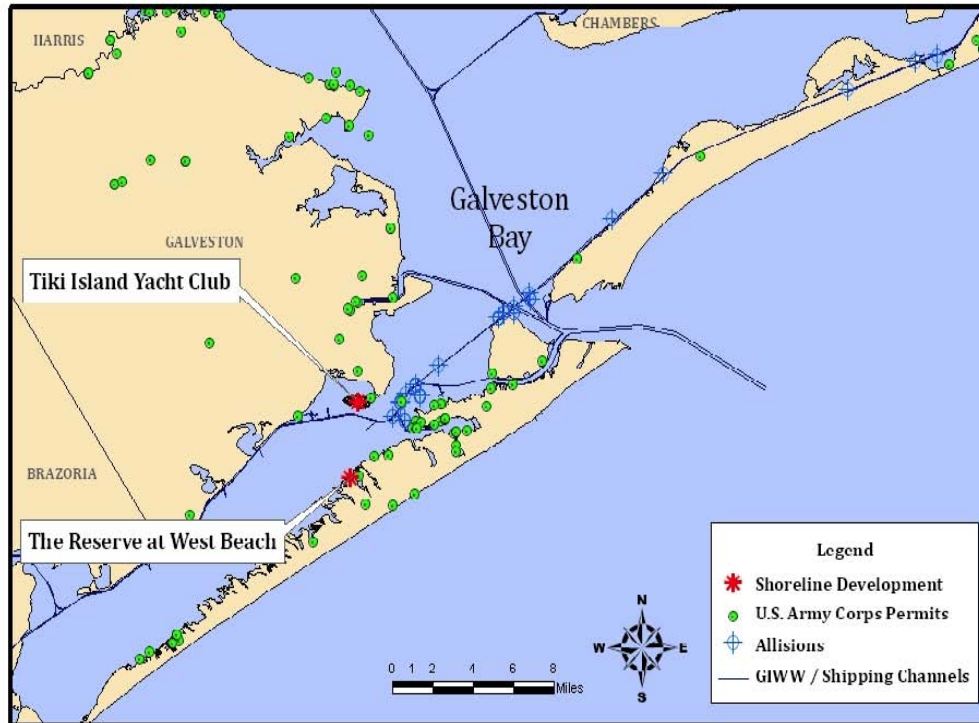
1. ***The Preserve at West Beach***, Mentzel Bayou is a potential development of approximately 35 acres ([Landvision, Inc., 2009](#)).
2. ***The Tiki Island Yacht Club*** is a potential development with a 400-slip marina on the GIWW. The marina on 5 acres along West Bay will include 250 dry slips and 150 covered wet slips for vessels up to 100-ft long ([Tiki Island Yacht Club, 2009](#)).

Areas on the Bolivar Peninsula could become a major area of concern if they are rebuilt with similar structures that existed prior to Hurricane Ike. Also, there is a proposal to develop High Island that could also have a major impact on navigation.



## Shoreline Development in Galveston County

Source: U.S. Army Corps of Engineers, U.S. Coast Guard, Texas Natural Resources Information System, and Louisiana Geographic Information Center.  
 Projection: Transverse Mercator  
 GCS: North American 1983  
 Created in ArcMap, August 2009



**Figure 36. Galveston County Shoreline Development.**

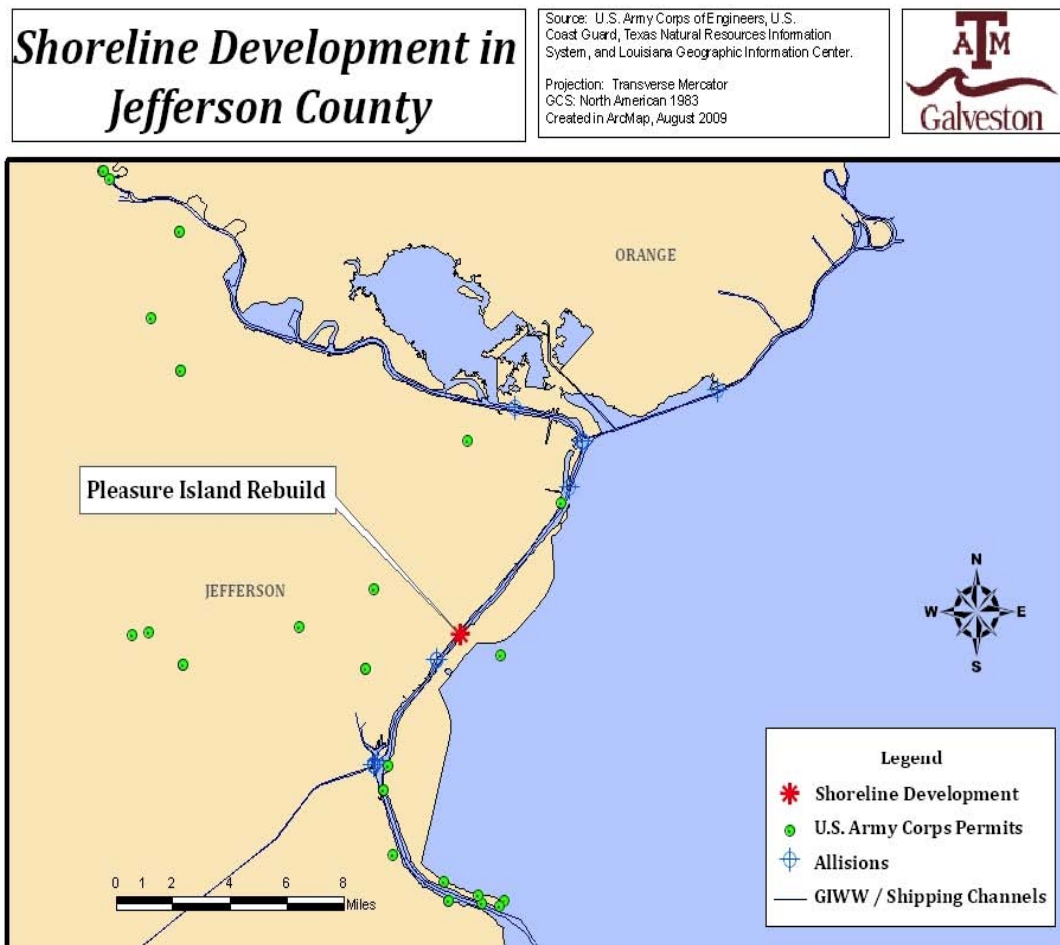
### Harris County

Although not located on the GIWW, the Bay Area Houston Economic Partnership communicated to the research team via an email dated April 30, 2009, its thoughts on developments impacting the GIWW. The only potential development impacting the GIWW that they mentioned is the proposed “Ike Dike.” This partnership is seeking additional information on this project and perceives this project to be similar to the Dutch Delta Works.

## Jefferson County

Colleen Russell, City of Port Arthur Planning Department, indicated to the team via a phone conversation on June 4, 2009, that there were no new developments other than the revitalization plans for the city which include the rebuilding of Pleasure Island. Jefferson County was identified as an area of high concern. Construction along the GIWW seems to be limited to repairs and remodeling rather than new development (see [Figure 37](#)). However, this area remains an area of high concern.

Steve Fitzgibbons, city manager of Port Arthur, and Floyd Baptiste, planner with Port Arthur Economic Development Commission (EDC), indicated that three piers that were destroyed by Hurricane Rita are being replaced. However, these piers are on the lakeside of Pleasure Island. They confirmed that they had no knowledge of any other development efforts along the GIWW ([Fitzgibbons, 2009](#); [Baptiste, 2009](#)).



**Figure 37. Jefferson County Shoreline Development.**

## Matagorda County

Matagorda County was identified as an area of high concern (see [Figure 38](#)). Owen Bludau, executive director of Matagorda County Economic Development Corporation, provided information to the research team in an email dated March 30, 2009. The potential developments in Matagorda County that may impact the GIWW are as follows.

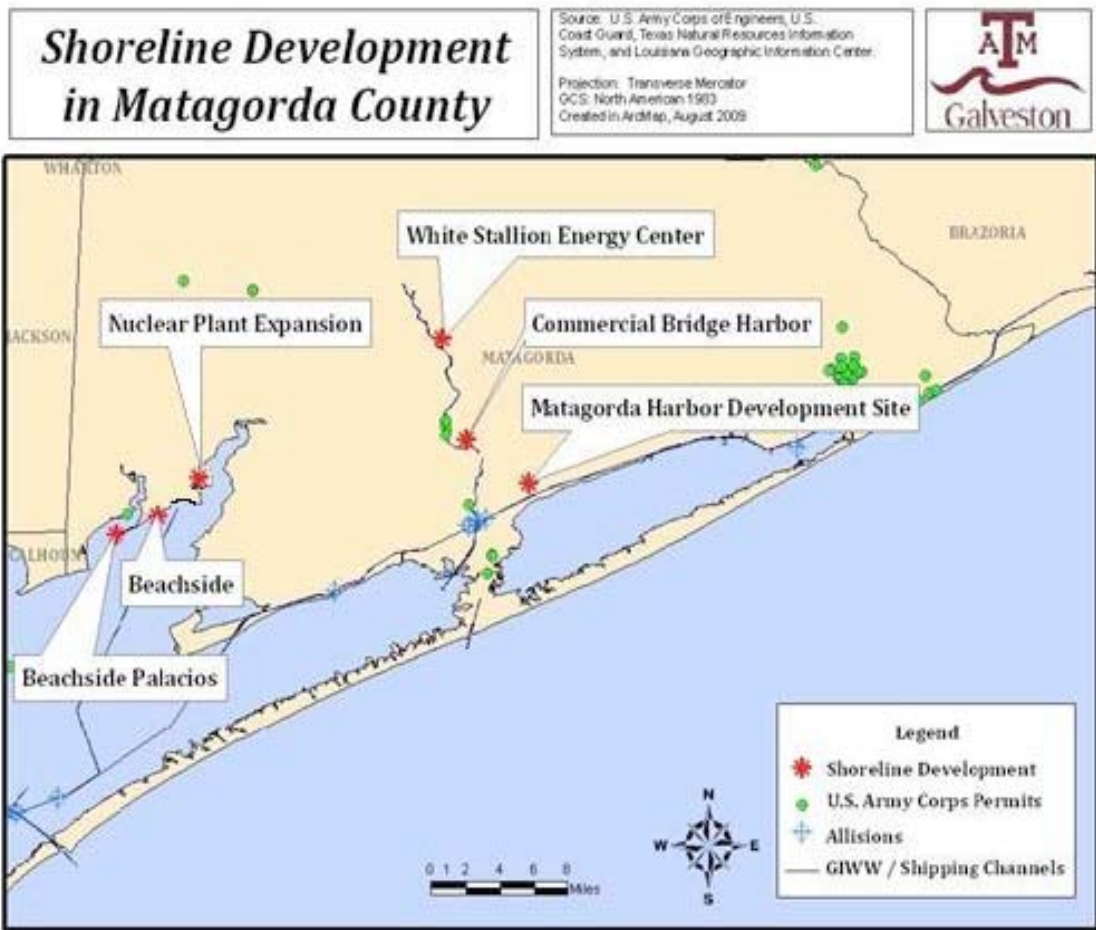
1. ***Texas Project (STP) nuclear plant expansion*** – This \$7 billion project will expand the STP from two nuclear reactors to four. The project application is currently under review by the Nuclear Regulatory Commission. That review is scheduled for completion in late 2010. Safety-related construction is expected to begin in 2011. New nuclear plants are built using modularization of construction components. Depending on where the modularization/assembly yards are located, many of the assembled components may be shipped to the site by commercial barge through the GIWW and the lower part of the navigable Colorado River channel. The county is working with STP to have as many of its new employees as possible live in Matagorda County. It is expected that many of them will own recreational boats and at times travel through the GIWW, thus increasing conflicts between commercial and recreational boat traffic.
2. ***White Stallion Energy Center*** – This project is a coal/pet coke-fueled power generation plant planned for milepost 14 on the navigable Colorado River channel. This \$2.5 billion project is currently in TCEQ permitting processes. The draft air quality construction and operating permit has been issued. It is expected that the final air quality permit will be issued in late 2009, with construction of the facility to begin in early 2010. The plant will use 1000–1500 construction workers from 2010 through 2014. The first generator is planned to begin operation in 2013, followed by the second in 2014. The county wants the tax base and the new jobs. White Stallion proposes to import Illinois Basin coal by commercial barge and railroad, depending on the competitive costs and availability of transportation capacity. White Stallion would require four 200-ft barges of coal per day if only barges are used. It would probably bring several additional barges per day down to Matagorda and store them there until they can be taken up river to an off-loading point. That point will be either at the plant site at mile post 14 or at the Port of Bay City harbor, at mile post 15, on the Colorado River barge channel.
3. ***Barge Harbor at Matagorda*** – The Port of Bay City Authority has acquired property north of Matagorda Harbor just outside Matagorda for construction of a commercial barge harbor. The purpose of the harbor would be for temporary docking of tugs and barges, construction or repair of barges and tugs, fueling of tugs and for related industrial businesses that are served by or serve the commercial barge industry. The Port Authority has retained an engineering firm to contact potential users to determine the size and requirements for designing the barge harbor. Construction of the barge harbor would probably not begin before late 2010.
4. ***New Synthetic Gas Production Plant*** – A synthetic gas (syngas) client has identified a prospective plant site at the Port of Bay City. The project appears financially feasible, and the prospect has the funding to proceed with the plant. A “go/no-go” decision is expected shortly. This plant would obtain industrial by-products from chemical plants and refineries along the Texas coast and incinerate the products to produce syngas. A

customer has been identified to purchase the syngas. It is possible that this plant will use barges to ship raw materials to the plant site. All syngas produced will be shipped from the plant by pipeline. The proposed site is located at mile marker 15 on the Colorado River. The river is navigable by commercial barges to this location.

5. **Beachside** – Beachside is a gated, water- and canal-front community currently under site development in Palacios in Matagorda County. The Beachside site is 1000 acres in size. It is anticipated that at full development Beachside will contain about 3000 housing units used primarily by vacation homeowners and retirees. Two channel connections are planned to link the interior canal system of the first three phases of Beachside with Tres Palacios and Turtle Bays.

One of these two canals will be extended from the development through Tres Palacios Bay to connect with the dredged channel that now links the Port of Palacios with the GIWW. Beachside will be located about 9.5 miles from the GIWW itself. It is anticipated that many of the homeowners will moor large recreational boats at the nearby Port of Palacios and use the GIWW to reach the Gulf or other locations up and down the coast. The first home construction is expected to begin in mid-2009. This development should have no direct impact on the GIWW due to its location off the channel.

6. **Harbor Development Site** – Matagorda Harbor is a recreational boat harbor in Matagorda that opens directly into the GIWW. Matagorda Harbor is owned by the Port of Bay City Authority. The Harbor site has 17 acres of excess land that fronts the GIWW and the harbor. The Port Authority is willing to have the excess land developed into resort retail, restaurant, hotel/motel, condo, and/or single family units. It is expected that this site will receive developer attention when the economy begins to recover. This development could be a major concern for navigation in the GIWW. The current Matagorda Harbor is set back from the GIWW and is not a hindrance to navigation currently.

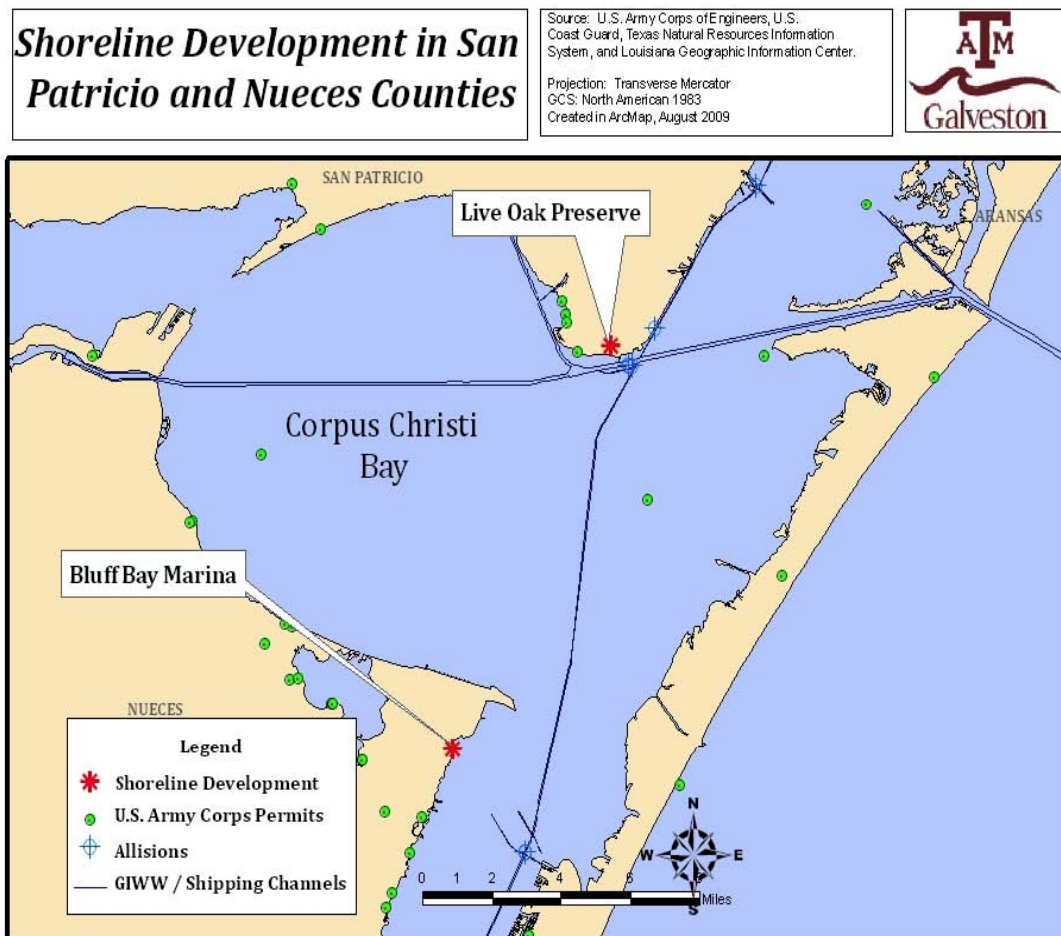


**Figure 38. Matagorda County Shoreline Development.**

Although Matagorda County was identified as an area of high concern, the proposed construction that was identified was not in close proximity to vessel incidents along the GIWW. However, the potential and planned developments indicated above may be of major concern to navigation if structures impede or encroach the waterway.

## Nueces County and San Patricio County

Since these two counties border Corpus Christi Bay, the research team gathered development information (see [Figure 39](#)). However, this area was neither identified as a high concern area due to the lack of incidents recorded by the U.S. Coast Guard nor was it indicated as a high priority area by the vessel operators in the survey. The team noted two developments via web sources. First, the Bluff Bay Marina in Corpus Christi development will be a dry storage facility potentially with capacity of 600 vessels ([Bluff, 2009](#)). Second, the Live Oak Preserve development will have 2974 land units with 800 marina units ([Live Oak Preserve, Corpus Christi, 2009](#)).



**Figure 39. San Patricio and Nueces County Shoreline Development.**



### **Cameron, Chambers, Jackson, Kenedy, Kleberg, Orange, Refugio, Victoria, and Willacy Counties**

The counties of Cameron, Chambers, Jackson, Kenedy, Kleberg, Orange, Refugio, Victoria, and Willacy were deemed low priority for development on the GIWW. This was due to the scarcity of vessel incidents from the U.S. Coast Guard data and the results of the vessel operator survey. Kenedy, Kleberg, and Willacy Counties are sparsely populated and do not represent viable development options. All county officials received a request for information but little or no information was received. However, the research team did learn that cabins in the water are a hazard to navigation in Cameron, Kenedy, and Kleberg Counties (Cantu, 2009a). It is not clear whether these structures are being permitted at all. The research team deemed that due to the lack of incidents in these counties no further work on development data collection was appropriate.

### **Conclusions on Proposed Development**

Figure 40 shows total shoreline development. Calhoun is the county of most concern due to continued new shoreline development near the GIWW. However, development in other counties is increasing. This increase in shoreline development indicates growth will likely continue in these areas and may, in the future, be cause for navigation concern.

# Shoreline Development Along GIWW/Shipping Channels

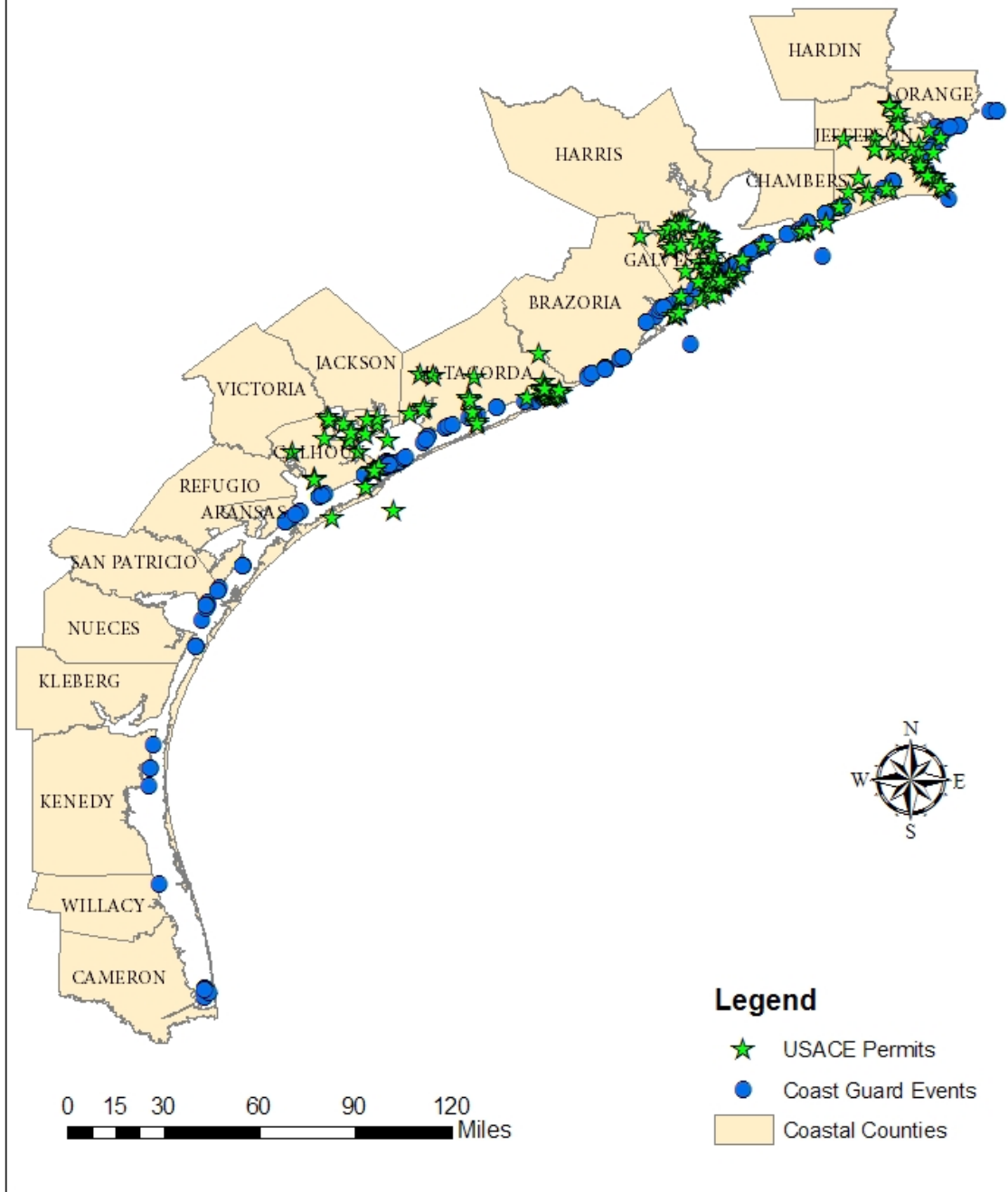


Figure 40. Total Shoreline Development.

#### **4.6 SUMMARY**

From the various sources of data collected, the research team concluded that Calhoun County is an area of high concern for development. However, all counties should continue to be monitored for development along the GIWW. Two conclusions are prominent from all the data sources. First, the accumulated effect of development on the GIWW has a dramatic impact the ability to navigate the waterway. Second, the type of structure constructed also has a profound impact on navigation.



## **CHAPTER 5: PERMITTING OF STRUCTURES AND DEVELOPMENT ALONG THE WATERWAY**

### **5.1 INTRODUCTION**

The focus of the research team in collecting information on the permitting of structures along the waterway was to develop a template of the current standards at the federal, state, and local levels. The purpose of the current template is to understand the process and make recommendations on how to improve the process and the outcome of the location and type of structures permitted (see [Appendix 5](#)). The findings of the permitting process are summarized by governmental level and agency below.

### **5.2 U.S. ARMY CORPS OF ENGINEER STANDARDS, REGULATIONS, AND PRACTICES**

As stated above in Section 2.3, the U.S. Army Corps of Engineers is given authority to regulate certain activities in the nation's waterways under 33 CFR, Part 320. The waterways are protected for navigation under Section 10 of the Rivers and Harbors Act of 1899, which states that it is unlawful to build any structure in or over the waterway except on plans approved by the Corps. Specifically, Section 10 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 403) (hereinafter referred to as Section 10) prohibits unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water of the United States, the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters is unlawful unless the work has been recommended by the chief of engineers and authorized by the secretary of the Army. The instrument of authorization is designated a permit. The authority of the secretary of the Army to prevent obstructions to navigation in navigable waters of the United States was extended to artificial islands, installations, and other devices located on the seabed, to the seaward limit of the outer continental shelf, by Section 4(f) of the Outer Continental Shelf Lands Act of 1953 as amended (43 U.S.C. 1333(e)). (See 33 CFR, Part 322.) Thus, a permit is needed for any construction in the waterways.

The primary thrust of the Corps authority is to protect navigation. However, the Corps is also charged with the responsibility of balancing the favorable and detrimental impacts of projects for the "full public interests." The Corps believes that state and federal regulatory programs should complement rather than duplicate one another and works closely with the Texas General Land Office, including providing a joint permit application (Engineer Form 4345). The form includes all documents for permitting structures in the waterways within the Texas Coastal Management Area (Section 307c of the Coastal Zone Management Act of 1972). The Corps seeks to avoid unnecessary regulatory control and is neither a proponent nor opponent of a permit proposal. The Corps has the authority to issue formal determinations concerning the applicability of the Clean Water Act to any permit proposal.

The criteria on which all permits are evaluated are determined by 33 CFR, Section 320.4. The evaluation is based on five basic criteria:

- First is the review of the interests of the public at large. Under this criterion, the probable impacts (including cumulative impacts) of the proposed activity (project) and its intended use on the public interest are considered. Every application is evaluated for the relative extent of public and private need for the proposed structure or work (the private use of the property versus the public need for a navigable waterway), the practicality of using alternative methods and locations if any conflicts exist, and the extent and permanence of beneficial and detrimental effects on public and private uses.
- The second area for evaluation involves determining the impact of a project on historic, cultural, scenic, or recreational value to the general public. Recognition of these areas may be established at the state and local levels as well as at the federal level. Permitting should be consistent with the purpose of these areas.
- The third area for evaluation involves private property rights. All permit recommendations should consider the inherent aspect of private property and the right to reasonable use. Permits for protection from erosion should generally receive favorable consideration as long as any structures do not adversely affect public safety or other property. Structures cannot interfere with the public's right to navigate the water surface or any authorized federal project
- The fourth area for evaluation involves activities that affect coastal zones such as the Texas shoreline. Permit proposals must be consistent with the Coastal Zone Management Act of 1972 and in the interest of national security. The appropriate state agency must concur with any proposed activity. In the case of Texas, this concurrence is granted through the joint permitting program with the GLO for the Texas coastal zone.
- The fifth and final area for evaluation is navigation. Established harbor lines, where they exist, are used as guidance for accessing navigation impacts of proposed projects. EPA and state interests are considered to avoid substantial impairment of navigation and anchorage.

In this research project, interest centered primarily on the criteria used by the Corps to determine impacts on navigation of a proposed permit for construction of a structure in the waterway. The Corps is authorized under 33 CFR 322 to review and to permit certain structures in the navigable waters. Structures include but are not limited to piers, boat docks, boat ramps, wharves, dolphins, weirs, booms, breakwaters, bulkheads, revetments, ripraps, jetties, artificial islands, and artificial reefs, permanent mooring structures, power transmission lines, permanently moored floating vessels, pilings, aids to navigation, or any other obstacles or obstructions. Corps permits are required for these structures or work in or affecting navigable waters of the United States. However, in the absence of any overriding public interest, favorable consideration will generally be given to applications from riparian owners for permits for piers, boat docks, moorings, platforms, and similar structures for small boats. Criteria for small boat structures include how the location and design prevent obstruction to navigation with respect to the public and any neighboring proprietors' access to the waterway. The obstruction criterion can consider



the interaction of the proposed structure with existing structures in the immediate vicinity and wave action, etc.

The permitting process can include a pre-application consultation for major applications. The Corps' district engineers have the authority to establish local procedures and policies including appropriate publicity programs that allow potential applicants to contact the district engineer to request consultation (Section 325.1). In Galveston, the Permit Service Center (PSC) is designed to provide assistance and advice to applicants located within the Coastal Management Program Boundary along the entire Texas Coast ([U.S. Army Corps of Engineers, 2009](#)).

All applicants generally use the standard Form 4345, but local variations can be made to the form to facilitate coordination of federal, state, and local agencies. In Texas, Form 4345 is a Joint Permit Application Form (JAPF) that lists all required documents for permits and provides additional information on permitting within the Texas Coastal Management Area, including project plans. These documents include ([U.S. Army Corps of Engineers, 2009](#)):

- Letter to Applicant,
- Statement of Compliance with the Texas Coastal Management Plan discussed under the GLO requirements section below,
- Texas State Water Quality Certification of Section 404 Permit,
- Water Quality Certification Checklist for Tier I,
- Water Quality Certification Questionnaire for Tier II Projects,
- Texas Commission on Environmental Quality letter and enclosures,
- Railroad Commission of Texas,
- U.S. Environmental Protection Agency letter,
- Memorandum from U.S. Army Corps Concerning Water Quality Certification, and
- Consistency with Coastal Zone Management Act for Nationwide Permits in Texas.

The applicant must include in the content of the application information to satisfy the requirement of the above forms, including a complete description of the activity with drawings, sketches, etc.; the location, need, and purpose of the proposed activity; scheduling of the activity; names and addresses of adjoining property owners; and location and dimensions of the adjacent structures. All applications must be signed. When an application is received it is reviewed for completeness and, if complete, public notice of the project is issued. If the application is not complete, a request for additional information from the applicant is made within 15 days of receipt (Section 325.2).

In Texas, when the public notice is issued, all documents required by the state under the Joint Permit Application are sent to the appropriate state agencies. The Corps in Texas has joint evaluation monthly meetings with state and federal resource agencies and applicants who sign up to come and talk, to discuss proposed projects, many of which are in the coastal zone projects area. Not all incoming applications are discussed at this forum, only those listed on the schedule at the request of the project proponent. Therefore, the coastal issues on proposed projects are often known prior to formal public notice. After the Corps reviews the application initially, it then solicits reviews and recommendations from all Texas state agencies ([Botello, 2009](#)).

Many structures along the GIWW, however, are authorized by the Corps with a Regional General Permit (RGP) or a Letter of Permission (LOP). The level of detail for the latter two types of permits may vary from that required for a more complicated standard permit. The public notice process is also utilized during the review of a standard permit and not a RGP or LOP (Dunn, 2009b).

The research team's primary contact at the Corps has been Janet Botello. Ms. Botello described the U.S. Army Corps permitting procedures in an interview with research team member Joshua Gunn on April 21, 2009. Dolan Dunn reviewed the preliminary report on the permitting procedures, giving comments and correction in an email dated July 13, 2009, to the research team.

In general, the Corps' approach to permitting in the Texas GIWW according to Ms. Botello (confirmed by Dolan Dunn) is the following:

1. Each case is reviewed separately according to the procedures and criteria discussed above. The Corps understands that no two projects are the same.
2. An internal review of the project is done at the local Corps office, such as Galveston.
3. The Corps then sends the project plan to the Corps Environmental and Real Estate Divisions for review.
4. Next, the Corps has the project plan reviewed by the Navigation/Operations Division to determine whether any navigation hazards exist, including the reduction of capacity concern in Section 403 as discussed above. The impact of the project is reviewed in light of known navigation hazards such as bridges, areas of strong current, bends in the channel, etc. This review is critical because regulators are completely dependent on the comments received from Operations/Navigation Division in determining whether the probability of an intruding structure will become a hazard to navigation. Additional comments may be received from the U.S. Coast Guard. According to Raul Cantu of TxDOT in an email dated July 9, 2009, to the research team, this evaluation is based upon the Corps' GIWW maintained authorized channel and does not incorporate the entirety of navigable waters, which are those U.S. waters that extend from bank to bank.
5. The Operations/Navigation Division provides updates on projects to the Gulf Intracoastal Canal Association. The GICA has access to monitor the Regulatory website for Public Notices of projects that may affect the GIWW.

Each Corps permitting decision is an independent decision. There are certain criteria that are considered essential to permit approval. For example, structures are to be at least 50 ft from the top cut of the channel. This measurement, however, is only verbally advised from the Galveston office and the Operations/Navigation Division. The Operations/Navigation Division had advised a mandatory setback of 155 ft from the centerline of the channel. This policy, however, is not written.

### **5.3 TEXAS GENERAL LAND OFFICE**

The Texas General Land Office administers the Coastal Management Program in the state of Texas. "The purpose of the Texas Coastal Management Program (CMP) is to improve the management of the state's coastal natural resource areas and to ensure the long-term ecological and economic productivity of the coast" (Texas GLO, 2009a). In the Texas Administrative

Code, the provision dealing directly with waterfront structures is found in Title 31 Natural Resources and Conservation, Part 16 Coastal Coordination Council, Chapter 501 Coastal Management Program, Subchapter B Goals and Policies, Rule Section 501.24 Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands.

Rule Section 501.24 states under (a)(6)(A) that “piers, docks, wharves, bulkheads, jetties, groins, fishing cabins, and artificial reefs (including artificial reefs for compensatory mitigation) shall be limited to the minimum necessary to serve the project purpose and shall be constructed in a manner that does not significantly interfere with commercial navigation.” The research team’s point of contact at the GLO for the research team was Tammy Brooks. Ms. Brooks states that the GLO coordinates with the Army Corps of Engineers on issuing permits along the GIWW. She confirms what was reported to the team by the Corps and noted above with regard to procedure and practices.

The GLO Permit Service Center is a resource for applicants during the permitting process. The center is typically used for smaller projects by individuals, small businesses, and local governments who are generally not familiar with the permitting process ([Texas GLO, 2009b](#)). The GLO Permitting Assistance Center for the upper Texas coast resides on the Texas A&M University at Galveston campus and for the lower Texas coast resides on the Texas A&M University – Corpus Christi campus. The centers “serve as a clearinghouse for coastal permitting activities on the lower Texas coast; act as a point of contact with the public to provide basic permitting assistance; offer information, guidance and application forms; establish and maintain the web site for the Joint Permit Application Form (JPAF) and permitting information; receive and review JPAF information for completeness; and forward completed applications to the proper agencies” ([Texas GLO, 2009b](#)). Typically, they provide information, assistance, and guidance to the public on how to complete a permit application. The online questionnaire maintained by the center helps applicants determine which permits they may need ([Brooks, 2009](#)).

The GLO also assists in coordinating all state forms for permits. It is the lead agency to coordinate and develop a long-term plan for the management of uses affecting coastal conservation (Section 33, Subchapter C, Section 33.052 Subsection b of the Texas Administrative Code). The GLO has its own permit application forms ; however, for construction on the GIWW the joint permit application form noted above applies. The forms and documents for the state for permitting structures on the GIWW include Statement of Compliance with the Texas Coastal Management Plan (Consistency with the Texas Coastal Management Program), Texas State Water Quality Certification of Section 404 Permit, Water Quality Certification Checklist for Tier I (Small Projects), and Water Quality Certification Questionnaire for Tier II Projects. Both the Texas Commission on Environmental Quality and the Railroad Commission have water quality authority on projects, depending on the nature of the project. The TCEQ and Railroad Commission review the projects, make recommendations, and certify that they are satisfied with the measures taken by the applicant ([TCEQ, 2009](#)). The criteria for these agencies generally fall under evaluating the project by best management practices and ensuring no discharge into the water. Texas Parks and Wildlife Department requires a sand and gravel permit if appropriate to the project ([Texas Parks, 2009](#)). The details of the non-navigation criteria are listed on the template in [Appendix 5](#).

## 5.4 COASTAL COUNTIES, CITIES, AND NAVIGATION DISTRICTS

### Counties' Standards, Regulations, and Practices

The research team requested information from Texas coastal counties where developments appear to be growing based on the survey of the vessel operators and from the team's own observations during the physical inspection of the GIWW. It appears that most of the counties rely on the Corps and GLO joint permitting process (Vyoral, 2009; Fitzgerald, 2009; Wayle, 2009; Bludau, 2009; Melina, 2009). The coastal counties currently providing information on waterway structure permitting include Aransas, Galveston, Jefferson, Matagorda, and Nueces. These counties have seen the most growth in development along the GIWW (Cantu, 2009a). Cameron, Kenedy, and Kleberg have some development with regard to cabins in the waterway (Cantu, 2009a).

Exceptions to the general finding of reliance on the joint permitting process include areas designated as flood plain areas and some local zoning requirements. If an area is designated as a flood plain, a county or municipality generally requires elevation permits or certificates for shore facilities, and the county or municipality may make recommendations on a given plan to the Corps. However, it appears that no county has specific requirements for structures in the water. In areas where zoning is in place there are currently no standards or criteria for evaluating the impacts of development on the GIWW.

### Cities' Standards, Regulations, and Practices

Cities have authority to create ordinances regarding construction of structures in their jurisdictions. For example, the City of Galveston requires a permit for construction of any structure either over or under water in the Galveston jurisdiction. This permit is in addition to other required state or federal permits (Schwarz, 2009). Similarly, the City of Port Lavaca has additional permit requirements (Broz, 2009); however, the City of Port Arthur does not (Fitzgibbons, 2009).

### Navigation Districts' Standards, Regulations, and Practices

The authority over construction along the waterway by navigation districts varies by district charter and appears to be dependent on the ownership of submerged lands around the district. For example, the port facilities at Corpus Christi are removed from the GIWW, and neither the port nor the city is involved in permitting development or construction along the GIWW (Parsons, 2009). On the other hand, the Matagorda Bay Navigation District is unique in that it has ownership of all submerged land in the area, and it requires any submerged land supporting a structure to be leased from the Navigation District (LaGuarta, 2009).

## 5.5 SUMMARY

Appendix 5 is a template of current permitting practices by all agencies to assist with the evaluation of development on the GIWW.

## **CHAPTER 6: FUTURE PROBLEMS FROM PLANNED DEVELOPMENT**

### **6.1 INTRODUCTION**

This chapter addresses the hazards to navigation caused by identified encroachment of shoreline development into the waterway. The major problems, noted in this study, are the narrowing of the channel and the lack of strategic mooring or push-in (hold-up) places caused by the poor location of development, the types of structures that further navigation hazards, and the congestion caused by additional inexperienced recreational boaters. Each of these problems is described below.

### **6.2 LOCATION OF COASTAL PLANNED DEVELOPMENT**

Through physical inspection, surveys and interviews, and review of the incident data, the research team determined that the main navigation concern in the Texas portion of the waterway is the reduced width of the navigable waterway channel due to shoreline encroachment. The proper location of future development on the GIWW is critical to future navigability. What has not been considered by both developers and permittees to date is the agglomeration effect of development along the waterway.

Because waterfront property is more valuable than off-waterfront property, developers tend to maximize the number of residential units on the water, creating higher demand for permits for shoreline structures. Developments cluster for a variety of reasons. There may be access to infrastructure and services in one area that is not available in others. For example, many of the responses from the vessel operators noted that developments around bridges (which are already inherently more difficult to maneuver near due to the bridge structure encroaching into the waterway) cause hazards to navigation. Developments tend to cluster near bridges for access to roadway transportation.

Because permittees review permits for structures on a case-by-case basis, the accumulation of many structures in the same location can easily occur. It is perceived by various stakeholders that permittees currently do not look broadly at an area for existing structures when considering new permits. Permittees are in the business of granting permits. This responsibility may be in conflict at times with their regulatory responsibilities. Equity concerns among private property owners make it more difficult to grant a permit to one owner yet deny a permit to another owner in order to provide a strategic location for mooring (push-in) for commercial vessels in inclement weather or for traffic concerns or to provide clear bridge approaches.

### **6.3 STRUCTURE TYPE**

Through physical inspection, surveys and interviews, and review of the incident data, the research team noted that not only the presence of structures that encroach on the waterway create hazards to navigation but the type of structure can enhance or mitigate the problem. Two factors are important. First, the length of the structure from or along the shoreline is important to navigation. Second, the type of material and construction of the structure can create more difficult navigation.

With regard to length of the structure, as noted in [Chapter 4](#), the maximum tow length on the GIWW is 1080-ft long, including the boat, and 54-ft wide or 750-ft long, 70-ft wide, including

the boat. However, as noted by a representative of the Texas Waterways Operators Association, Matt Woodruff (2009), rakes can reach up to 75 ft from the bow of a barge. Therefore, if structures are designed for use by the general public for non-marine purposes, setback, buffer zones, and fendering would enhance safety. In general, navigation would be enhanced if structures did not protrude into the waters at all. However, where areas of high concern already exist, future construction on both sides of the waterway should be limited in length.

The type of material and construction of the structure can create hazards to navigation. Sharp edges on structures that can puncture should be avoided. Lighting should not impair the vision of mariners. Materials that help dissipate wave energy and are impact-resistant should be used. The structure should be marked with radar-reflective material and lit in accordance with U.S. Coast Guard specifications. The structure should not be made of material that generates debris into the waterway due to its interaction with the barge/vessel.

#### **6.4 TRAFFIC IMPACT**

In addition to identifying navigation concerns due to physical encroachment on the GIWW of shoreline development, the team has attempted to address the additional recreational traffic that proposed development would place on the waterway. The research team did not, however, attempt to measure the GIWW's capacity, commercial or otherwise, as that is beyond the scope of this project.

Further investigation and analysis of traffic capacity are needed to assess GIWW for viable two-way traffic. For example, the existing dimensions of GIWW and waterfront development encroachments limit some areas to one-way traffic, which would not take into account the occupation of a dredge during maintenance dredging operations. The research team used 2008 boat registrations by county from the Texas Parks and Wildlife Boat Statistical Analysis (Salazar, 2009) as a starting point for existing recreational traffic. In order to address increased recreational traffic, the team assumed one additional boat registration for each proposed residential unit with access to the waterway and one additional boat registration for each additional proposed marina slip. Table 1 shows existing traffic, proposed traffic, and total new potential traffic.

The proposed developments amount to approximately 16 percent of existing registrations. The team included registrations from Harris and Victoria Counties even though they are not on the coast but are adjacent to the coast and appear to have high boater registration.



**Table 1. Projected Traffic.**

<b>County</b>	<b>2008 Amount</b>	<b>Proposed Development</b>	<b>Total Potential Traffic in GIWW after Development</b>
ARANSAS	2556	728	3284
BRAZORIA	10079		10079
CALHOUN	1906	15360	17266
CAMERON	4590		4590
CHAMBERS	1251		1251
GALVESTON	12583	400	12983
JEFFERSON	8512		8512
KENEDY	8		8
KLEBERG	640		640
MATAGORDA	2459	3000	5459
NUECES	8935	800	9735
ORANGE	6475		6475
SAN PATRICIO	3095		3095
WILLACY	445		445
Total Coastal Counties	63534	20288	83822
HARRIS	61030		61030
VICTORIA	3273		3273
Total all counties that impact GIWW	127837	20288	148125

## 6.5 SUMMARY

This chapter highlights the problems that can be caused by structures that encroach on the GIWW from the shoreline. Length, construction material, and design of these structures may impede navigation in the waterway. Additional recreational traffic may create congestion adding to the hazards to navigation.



## **CHAPTER 7: CONCLUSIONS**

### **7.1 INTRODUCTION**

The importance of the GIWW to trade and commerce in Texas and the United States cannot be overemphasized. It is the metric that the federal government utilizes to determine waterway maintenance funding. Therefore, it is imperative that the GIWW and other Texas commercial waterways do not get overconsumed by waterfront development. Waterfront development should be done smartly to co-exist with commercial traffic. This study discusses the stakeholders in the waterway, the concerns they have about hazards to navigation, and the recommendations to permittees and developers on ways to improve the maintenance of this transportation corridor.

The research team reviewed its findings with various stakeholders through the project close-out meeting on July 16, 2009, via webinar. The team presented the project and its recommendations to the GICA at its annual meeting in New Orleans on August 13, 2009.

### **7.2 IMPACT OF STUDY**

The impact of this study is to begin to develop and permit “smart” development with regard to navigation. Hopefully, there will be better cooperation between governmental agencies on permitting development and a focus on the agglomeration, clustering, and density of development along the waterways. Additionally, there should be increased cooperation between developers, governmental agencies, and the barge industry in maintaining the GIWW for its primary use of moving goods effectively and efficiently to promote and support Texas and U.S. commerce.

This study has:

1. Identified specific areas of concern for navigation through the use of incident data, survey findings, and physical inspection. These areas include Aransas, Calhoun, Matagorda, Galveston, and Jefferson Counties. In Galveston and Jefferson Counties, the cause of concern relates to a high volume of commercial traffic and bridge infrastructure in the waterway. In the other counties, the main cause for concern is the shoreline development that brings structures into the waterway and creates a hazard for navigation.
2. Identified potential future development that would negatively impact navigation in the GIWW.
3. Illuminated the current permitting process for shoreline structures along the water, recommending additional criteria for consideration.
4. Recommended better coordination of permitting among government agencies.
5. Recommended better disclosure to property owners of the risks to structures near and in the waters.
6. Suggested a better type of structure and locations to be considered by developers.
7. Suggested that the accumulated effects of all permits should be considered in new permit applications.

### **7.3 FUTURE QUESTIONS THAT NEED TO BE ADDRESSED**

Several questions that are beyond the scope of this project surfaced and potentially need more study. They are:

1. Should vessel operators promote educational programs for recreational boater safety?
2. Should a monitoring program for vessel traffic levels and operations be employed to better understand the concerns to navigation?
3. Should an evaluation of the efficiencies or capacity of the waterway (including the total miles of shoreline development and number and location of current mooring facilities) be made?

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**Appendix 1:**  
**Slides of Presentation to TWOA**





# Protecting Waterways from Encroachment

Texas Waterway Operators Association  
Texas A & M University at Galveston  
Texas Transportation Institute



## Purpose of the Project

- Evaluating GIWW shoreline development
- Determine which development may impede transportation in the waterway
  - Identification of “hot spots”
- The objective is efficiency and capacity of the waterway
- Protect the corridor for Texas Department of Transportation input

## The TAMUG Team

- Joan Mileski, PhD
- Capt. Robert Thrailkill
- RADM William T. McMullen, PhD
- Capt. John Lane
- Joshua Gunn(graduate student)

# The TTI Team

- C. James Kruse
- David H. Bierling

## Importance of the GIWW to Texas Transportation

- Most cost effective transportation of cargo
- Most environmentally friendly transportation
- Approximately \$25 Billion goods transported on Texas portion of GIWW
- Important as an international trade corridor
- Sustainability of land development and transportation facilities



## Those Who Regulate, Maintain and Police the Waterway

- Coast Guard
- Army Corps of Engineers
- TxDOT

# Those Who Regulate the Shoreline

- County
- GLO
- Army Corps of Engineers

## Recent Incidents in the Waterway

- May 4, 2004 – Port O'Connor
- January, 2009 – Port O'Connor
- West Galveston Bay under I45
- Western flood gates of Brazos River

# Stakeholder Organizations

- Shippers
- Developers
- County officials
- GLO
- Army Corps of Engineers
- Port Authorities
- Industry Associations (GICA)
- Economic Development Corporations
- Texas Waterway Operators

## The Tasks of the Project

- Identify and determine through interviews, site visits and incident data magnitude of stakeholder issues
- Interview vessel navigators, inspect physical locations, charts, etc. and identify problem areas including shoaling, width of channels, etc.
- Determine current standards, regulations and structural forces for evaluation of projects by Army Corps of Engineers (Corps), General Land Office (GLO), Counties, etc., and develop a current standards template

## The Tasks (cont.)

- Determine proposed/envisioned development focusing on high growth areas
- Synthesize findings and develop guidelines for TxDOT to use in evaluating safety of potential developments; review findings with stakeholders



# Findings to Date

## Allisions







# Vessel/ Maneuvers



# All Incidents



# Handouts

- List of questions to stakeholders
- Contact information

[mileskij@tamug.edu](mailto:mileskij@tamug.edu)

409-740-4978

**Appendix 2:**  
**Nautical Charts**





# Blackberry Island

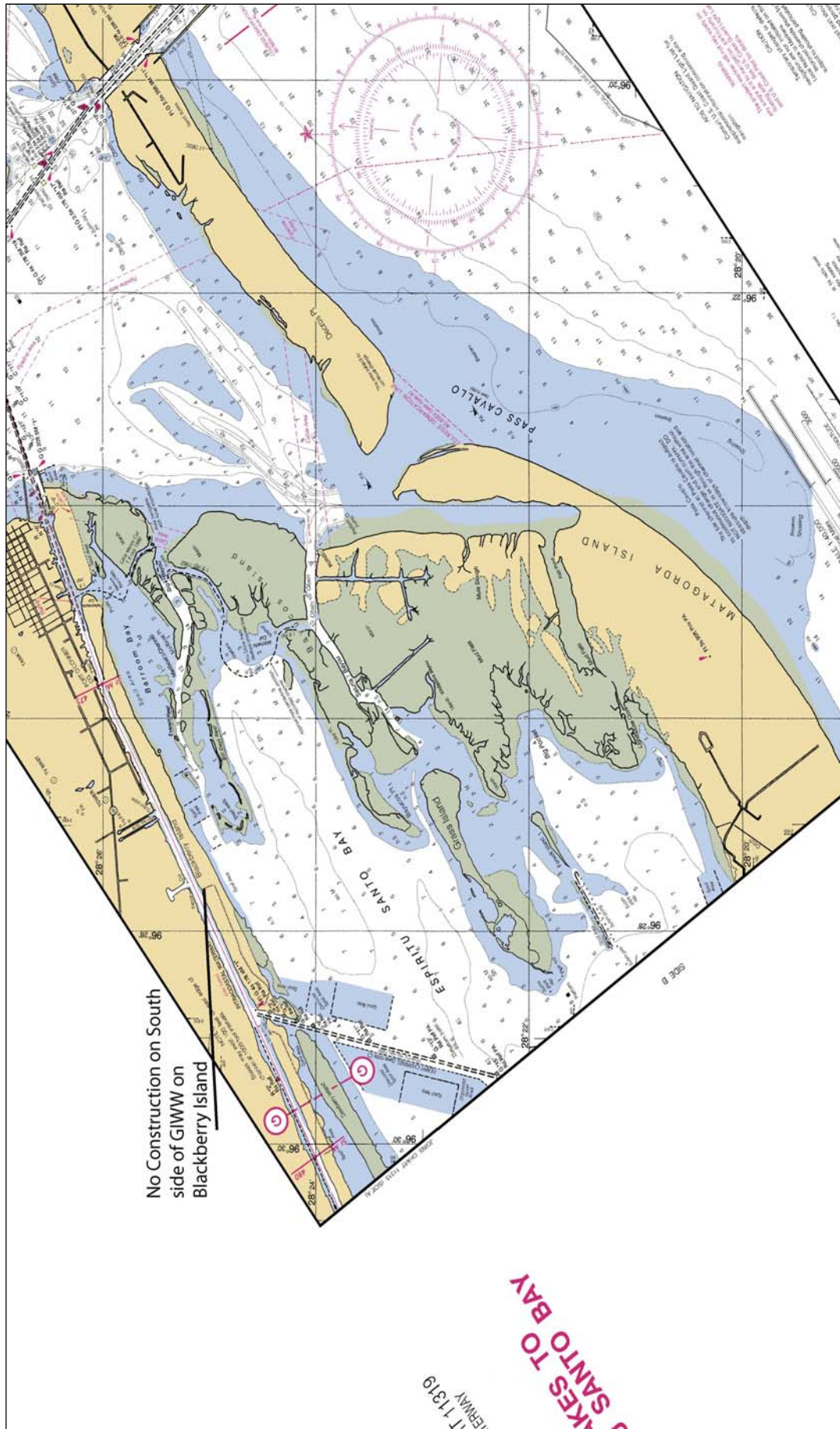
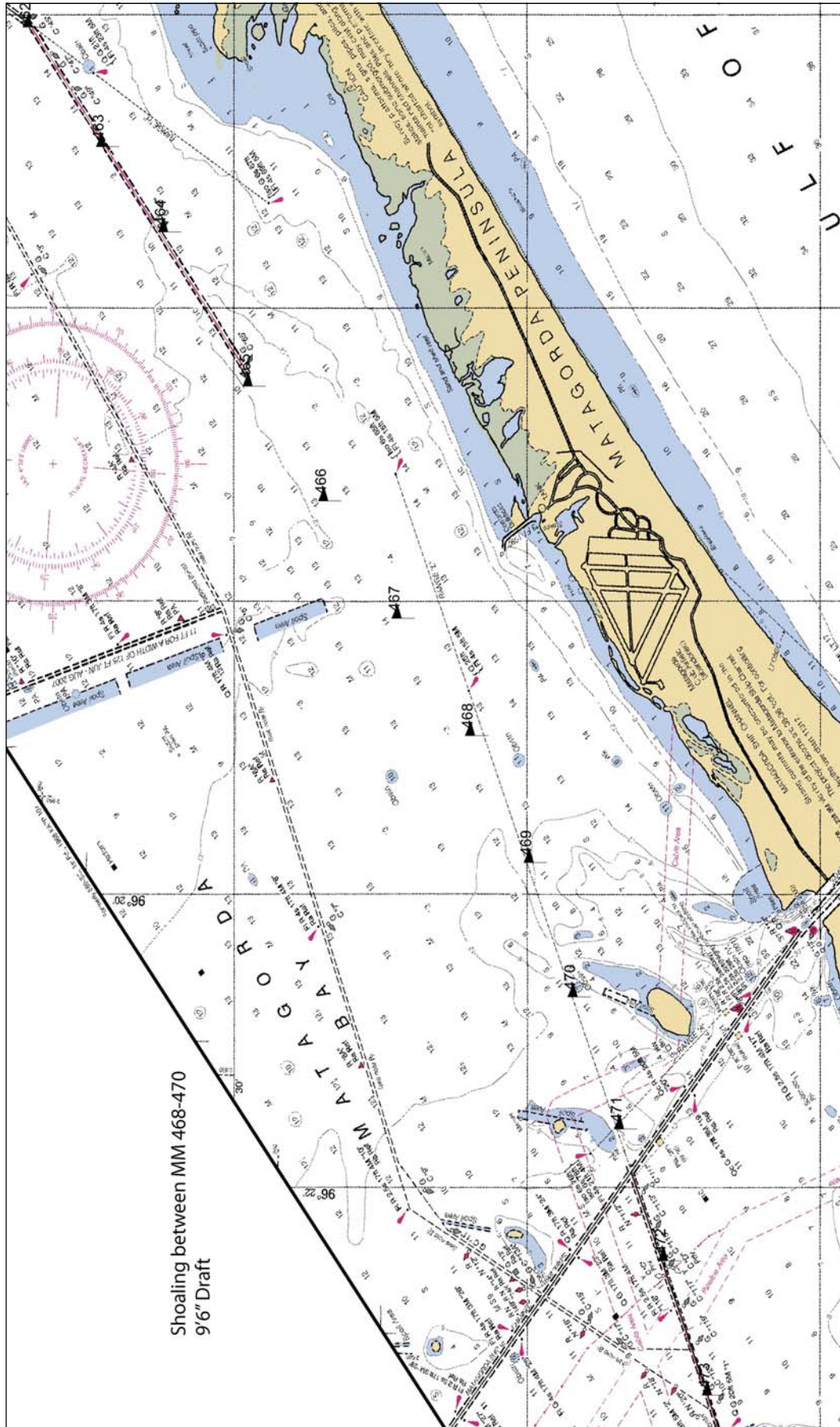


CHART NO. 11319  
SANTO BAY

GIWW\_468



Shoaling between MM 468-470  
9/6" Draft







**Appendix 3:**  
**Incident Data Maps**

## Allisions

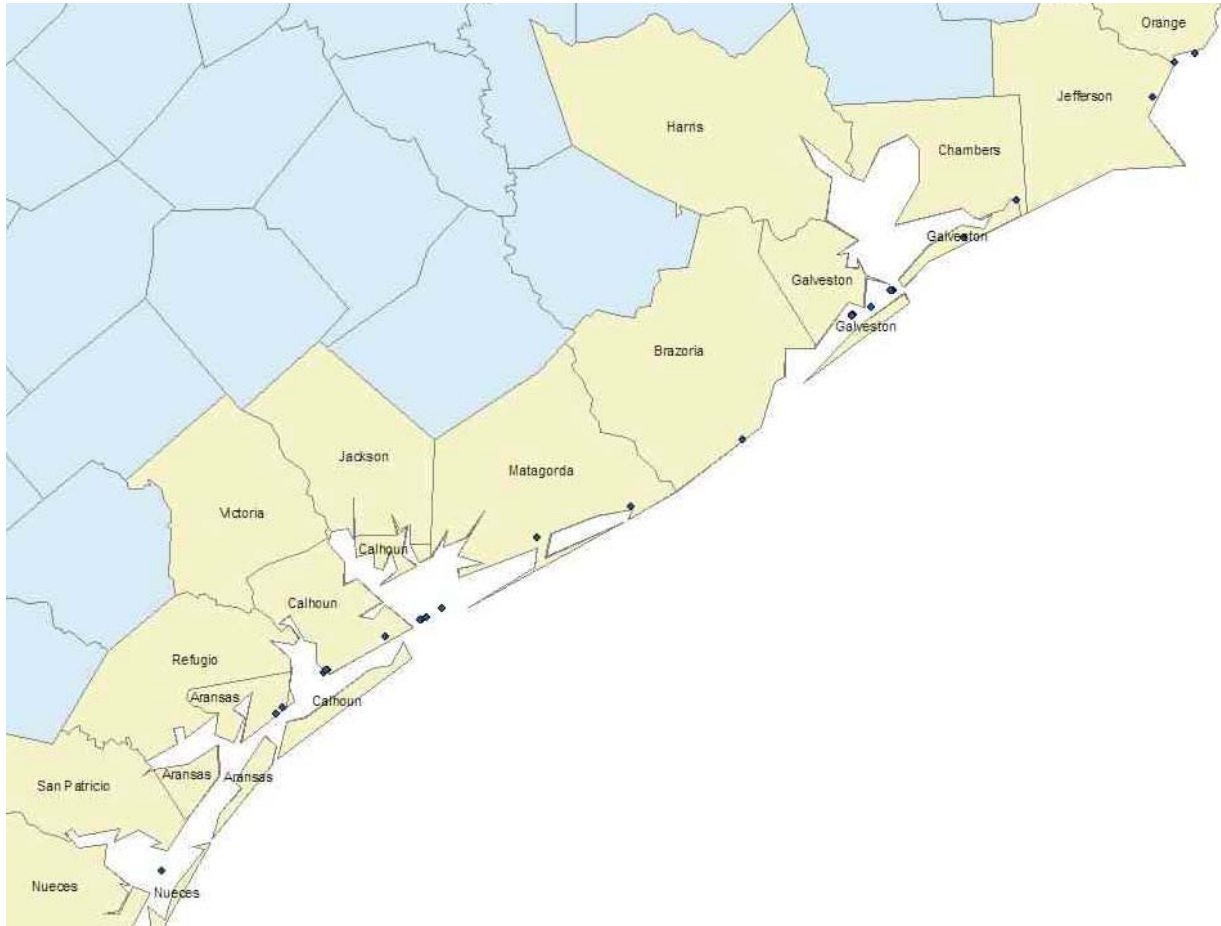




## Collisions



# Flood Sinks



## Vessel Maneuvers



All Incidents



**Appendix 4:**  
**Permit Application in Matagorda County (SWG-2009-00034)**



REPLY TO  
ATTENTION OF:

DEPARTMENT OF THE ARMY  
GALVESTON DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 1229  
GALVESTON TX 77553-1229

INTERAGENCY COORDINATION NOTICE  
FOR  
LETTER OF PERMISSION

Evaluation Section

5 February 2009

**SUBJECT:** Permit Application No: SWG-2009-00034

**APPLICANT:** Marilyn King  
735 Private Road 675  
Sargent, Texas 77414-4287

The applicant is requesting to construct two 4-foot-wide by 24-foot-long walkways 15 feet apart in the Gulf Intracoastal Waterway (GIWW). The project is located in the GIWW at 1782 Intracoastal Drive in Sargent, Matagorda County, Texas. The project can be located on the U.S.G.S. quadrangle map entitled: Sargent, Texas. Approximate UTM Coordinates in NAD 27 (meters): Zone 15; Easting: 242605; Northing: 3184666. A copy of the plans, in 5 sheets, is enclosed for your review. Please respond within 15 days from the date of this letter.

This application is being evaluated under Section 10 of the Rivers and Harbors Act of 1899.

During evaluation of the previous permit, the staff archeologist reviewed the latest published version of the National Register of Historic Places, lists of properties determined eligible, and other sources of information. There are no previously recorded historic properties known to exist within the proposed permit area. In addition, the proposed work and/or structures are of such limited nature and scope that little likelihood exists for the proposed project to impinge upon a historic property, even if present within the affected area.

Preliminary indications are that no known threatened and/or endangered species or their critical habitat will be affected by the proposed work.

The State of Texas Coastal Management Plan consistency is required. The applicant has stated that the proposed activity complies with Texas' approved coastal management program and will be conducted in a manner consistent with said program.



This coordination letter initiates the Essential Fish Habitat consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Our initial determination is that the proposed action would not have a substantial adverse impact on Essential Fish Habitat or federally managed fisheries in the Gulf of Mexico. Our final determination relative to project impacts and the need for mitigation measures is subject to review by and coordination with the National Marine Fisheries Service.

The Project Manager is Kristy Farmer and may be reached at 409-766-3935.

A handwritten signature in black ink that reads "Janet Thomas Botello". The signature is written in a cursive style with a large initial "J".

Janet Thomas Botello  
Leader, Central Evaluation Unit

THESE AGENCIES SHOULD RECEIVE THIS NOTICE:

U.S. Fish and Wildlife Service, Houston, TX

Texas Parks and Wildlife Department, Dickinson, TX  
Texas Parks and Wildlife Department, Austin, TX

Texas Commission on Environmental Quality, Houston, TX  
Texas Commission on Environmental Quality, Austin, TX

Environmental Protection Agency, Dallas, TX

National Marine Fisheries Service, Galveston, TX

Texas General Land Office, Austin, TX  
Texas General Land Office, La Porte, TX  
Permitting Assistance Group, GLO, Galveston, TX

Texas Historical Commission, Austin, TX

Holly Houghten Jr.  
Interim Tribal Historic Preservation Officer  
Mescalero Apache Tribe  
P.O. Box 227  
Mescalero, New Mexico 88340-0227

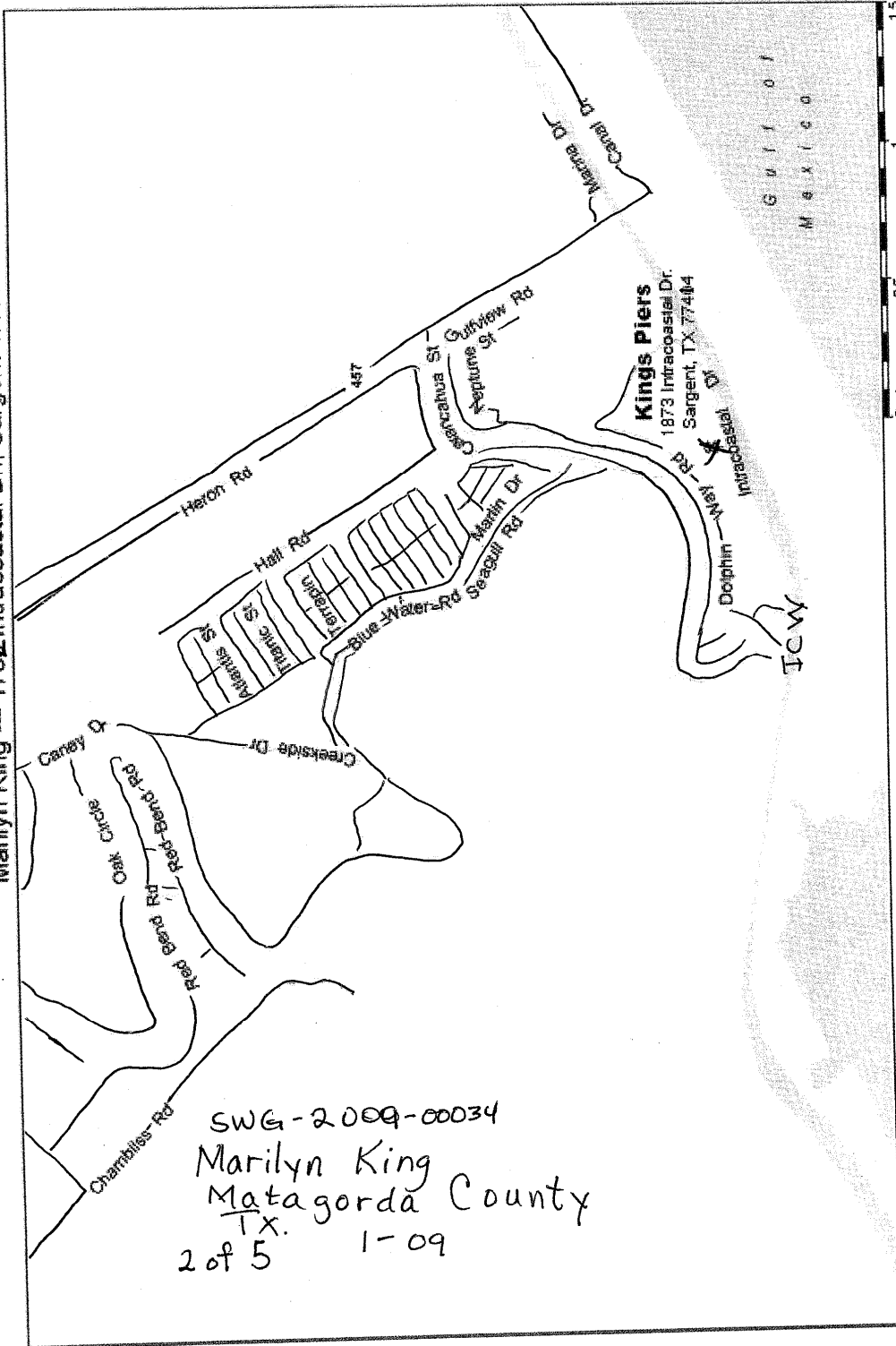
Tom Mele  
25910 Chapel Ridge Lane  
Spring, Texas 77373-3173



16.

17.

Marilyn King --- 1782 Intracoastal Dr., Sargent TX 77404

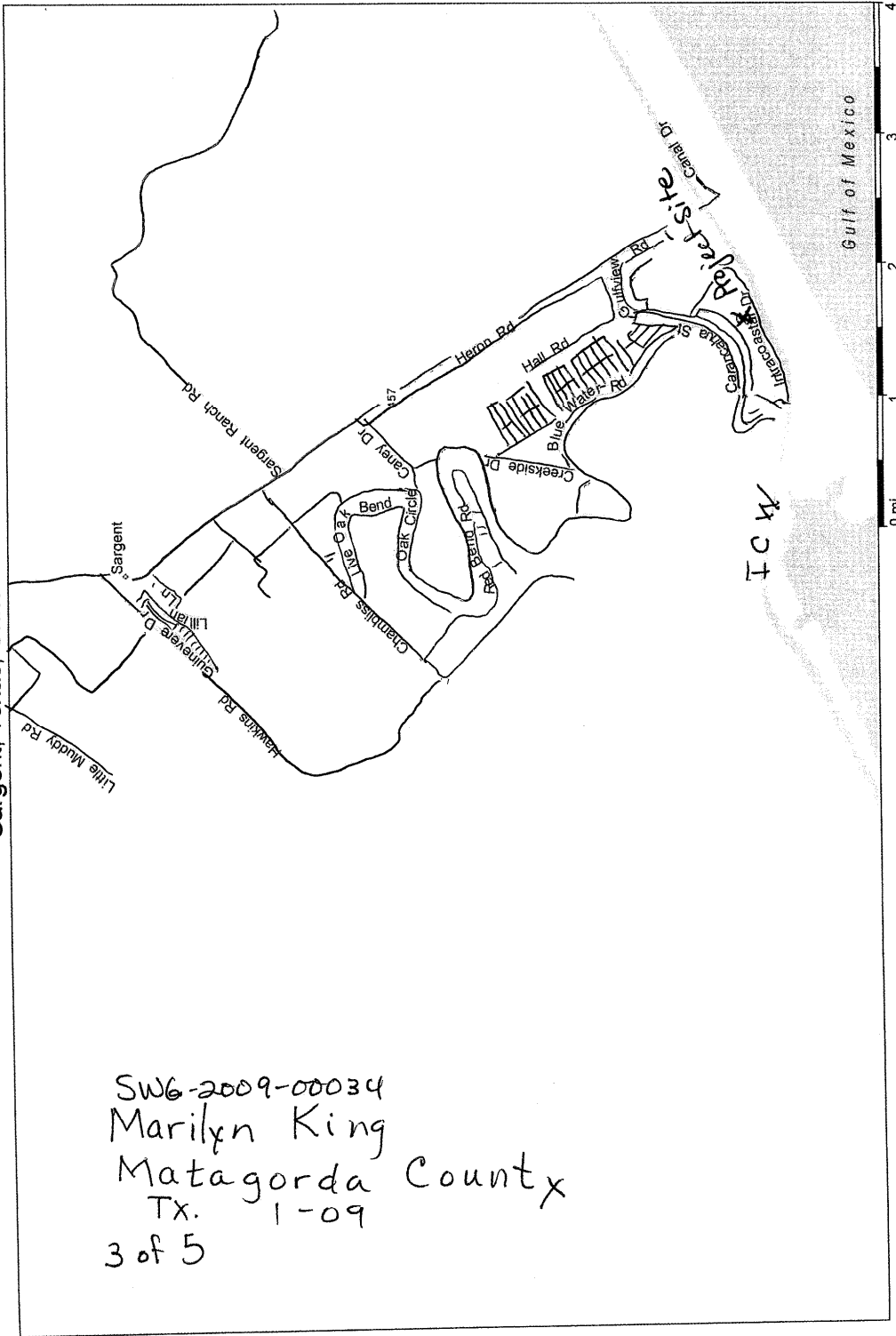


SWG-2009-00034  
 Marilyn King  
 Matagorda County  
 Tx.  
 2 of 5 1-09

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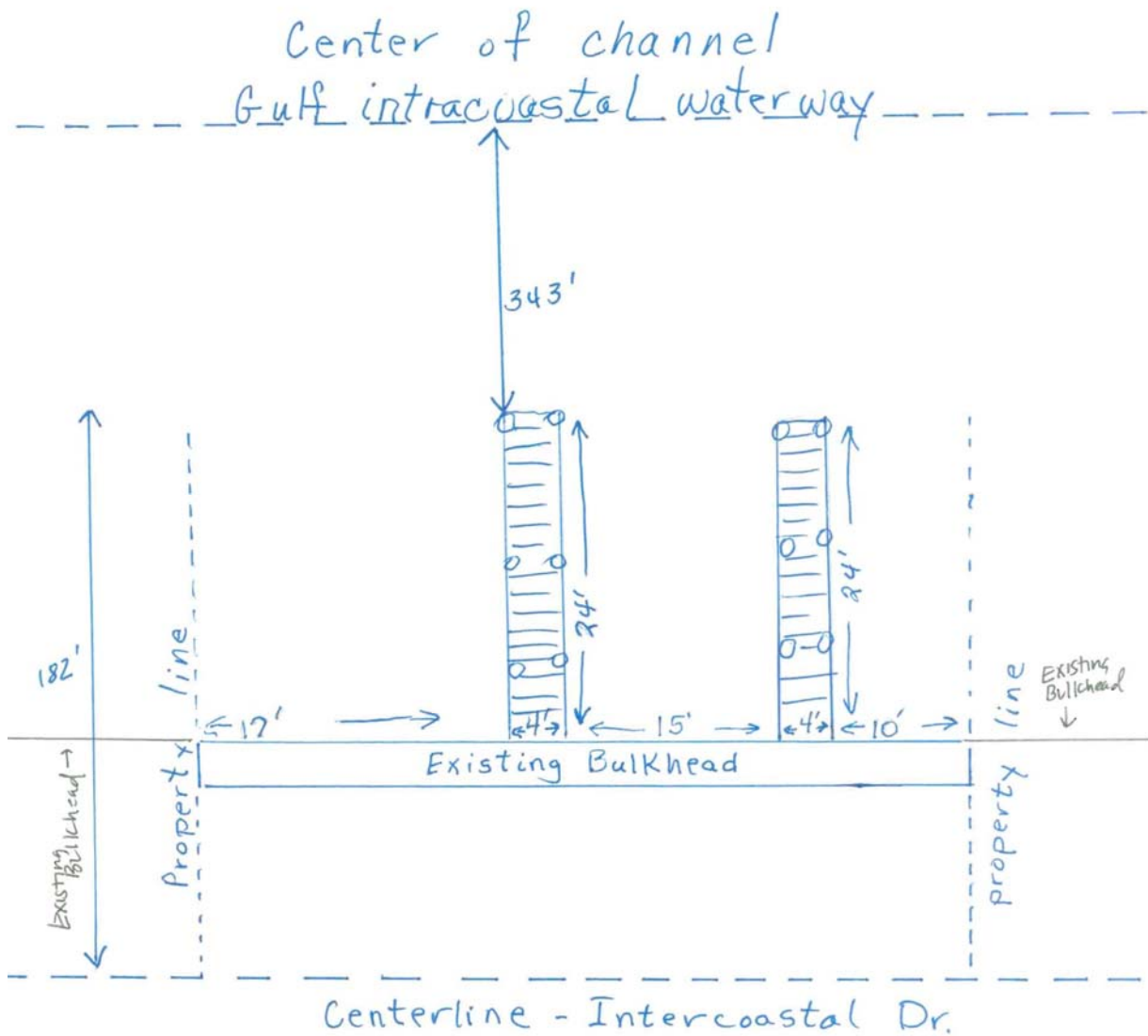
16.  
17.

Sargent, Texas, United States



SW6-2009-00034  
 Marilyn King  
 Matagorda County  
 Tx. 1-09  
 3 of 5

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Adjacent property

Marilyn King

1783

1782

Adjacent prop.

Thomas

Mele

1781

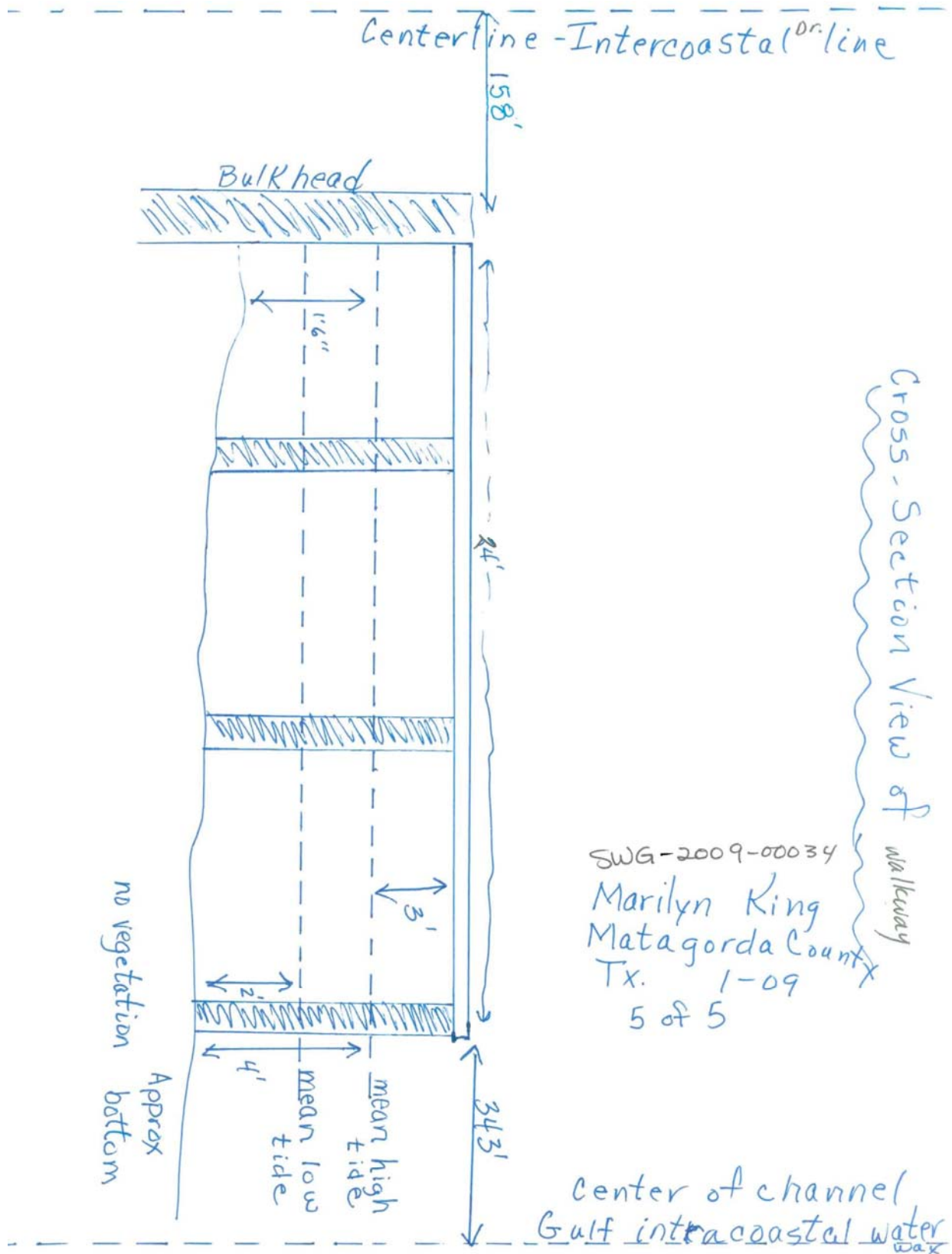
SWG-2009-00034

Marilyn King  
Matagorda County

4 of 5 Tx 1-09

Plan View (top)







**Appendix 5:**  
**Template of Criteria**



## Template of Criteria

Level of Government	Government Agencies	Form or Permit Documentation	Broad Criteria/Standards in Evaluating Permit	Specific Criteria in Evaluating Permit
Federal	U.S. Army Corps of Engineers (Corps)	Form 4345 - A Joint Permit Application Form designed to minimize duplicated paperwork needed by Corps and Texas State Agencies	<ol style="list-style-type: none"> <li>1. Public interest</li> <li>2. Historic, cultural, scenic, recreational</li> <li>3. Private property</li> <li>4. Coastal Management</li> <li>5. Navigation</li> </ol>	Prevent obstruction in waterway; evaluation of interaction with known hazards; 50 ft. from top cut; lights downward; no loose riprap; no wake in neighborhoods
State	Texas General Land Office (GLO)	Texas Coastal Management Plan Consistency Statement, GLO Residential Application, GLO Commercial Application, GLO Attachments A-E*	Limited to minimum necessary to serve and not significantly interfere with commercial navigation	<ol style="list-style-type: none"> <li>1. Dredge</li> <li>2. Fill material</li> <li>3. Riprap</li> <li>4. Marinas</li> <li>5. Commercial piers</li> </ol>
State	Texas Commission on Environmental Quality (TCEQ)	TCEQ Tier I (Small Projects) Checklist, TCEQ Tier II 401 Certification Questionnaire	Water quality impact of project	<ol style="list-style-type: none"> <li>1. Best management practices</li> <li>2. State quality compliance</li> <li>3. Wetlands protection</li> <li>4. Specific material construction req. for large projects</li> </ol>
State	Railroad Commission of Texas	401 Water Quality Certification	Water quality impact of oil and gas projects	No discharge into water
State	Texas Parks and Wildlife (TPW)	TPW Sand and Gravel Permit Application		

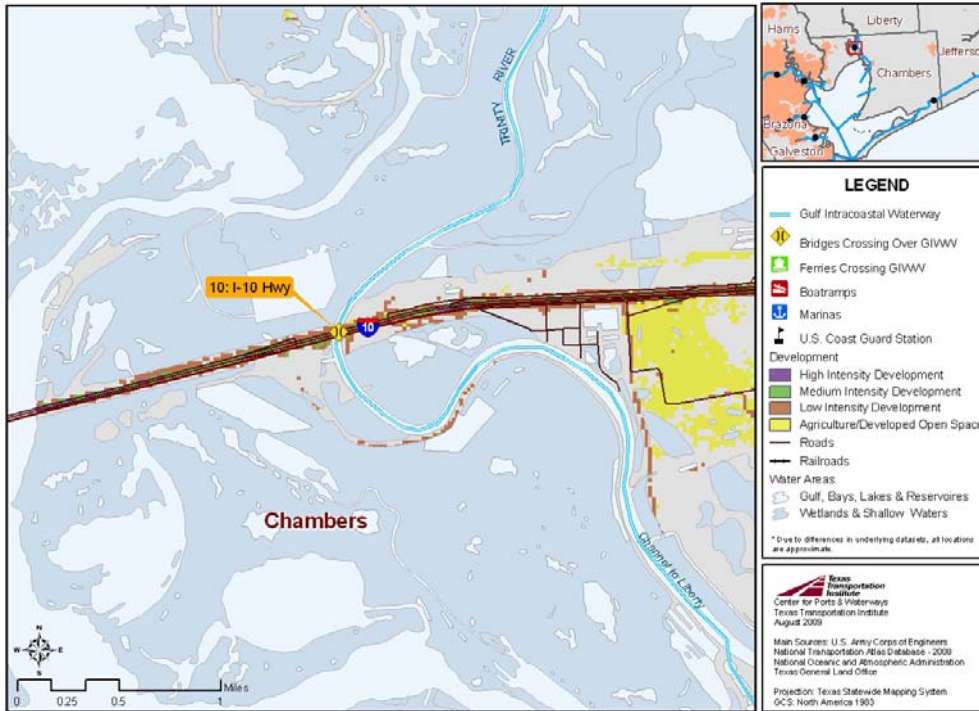
Level of Government	Government Agencies	Form or Permit Documentation	Broad Criteria/Standards in Evaluating Permit	Specific Criteria in Evaluating Permit
County	Aransas	Relies on Army Corps and GLO Permits; Easements must be applied for either from GLO or Navigation District (Vyoral, 2009)		
County	Galveston	Require development permit to comply with flood plain elevation requirements for shore facilities near the water; no requirements for structure on the water (Fitzgerald, 2009)		
County	Jefferson	Rely on Army Corps and GLO permits (Wayne, 2009)		
County	Matagorda	The City of Palacios uses zoning authority to approve Beachside development's site designs. Neither city nor county have standards or criteria for evaluation of the impacts of development on the ICWW (Bludau, 2009)		
County	Nueces	No county requirements; Port of Corpus Christi Authority reviews plans in jurisdiction and makes recommendations (Michael Melina, Nueces County Public Works phone Conversation 4/21)		
* A - Projects Involving Dredging, and/or Discharge of Dredged Material in and/or Affecting State-Owned Land				
B - Projects Involving Fill Material to be Placed on State-Owned Land				
C - Additional Information Required for Projects Involving Bulkheads, Breakwaters, Jetties, Groins, or Riprap				
D - Additional Information for Marinas				
E - Additional Information Required for Commercial Piers				

**Appendix 6:**  
**Bridge Crossing and Development**

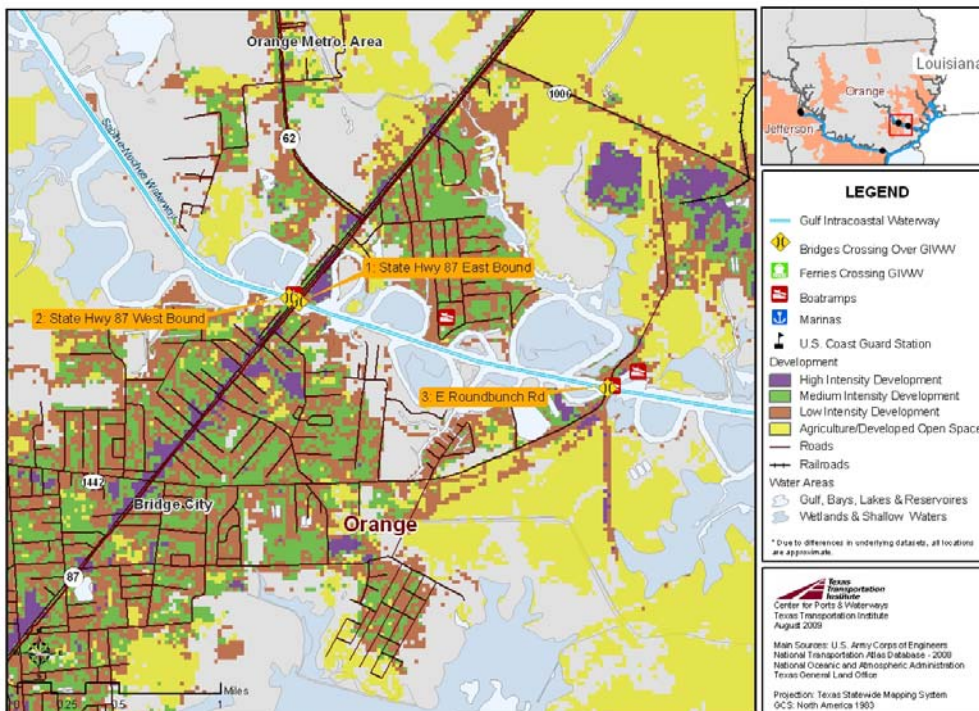




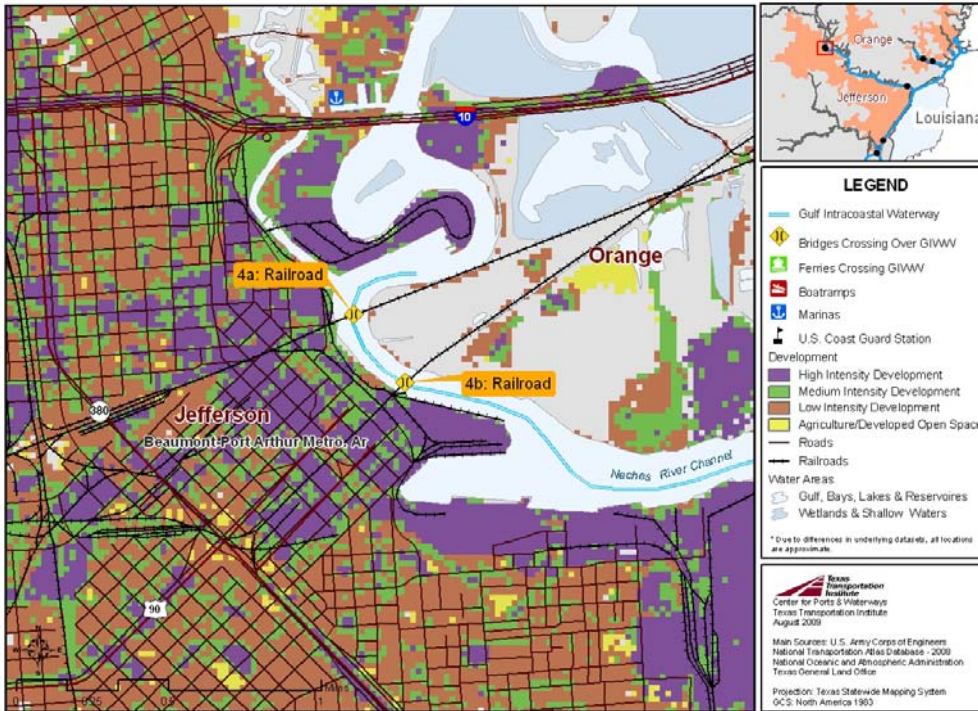
## Bridges and Development in Chambers County \*Map 1 of 1



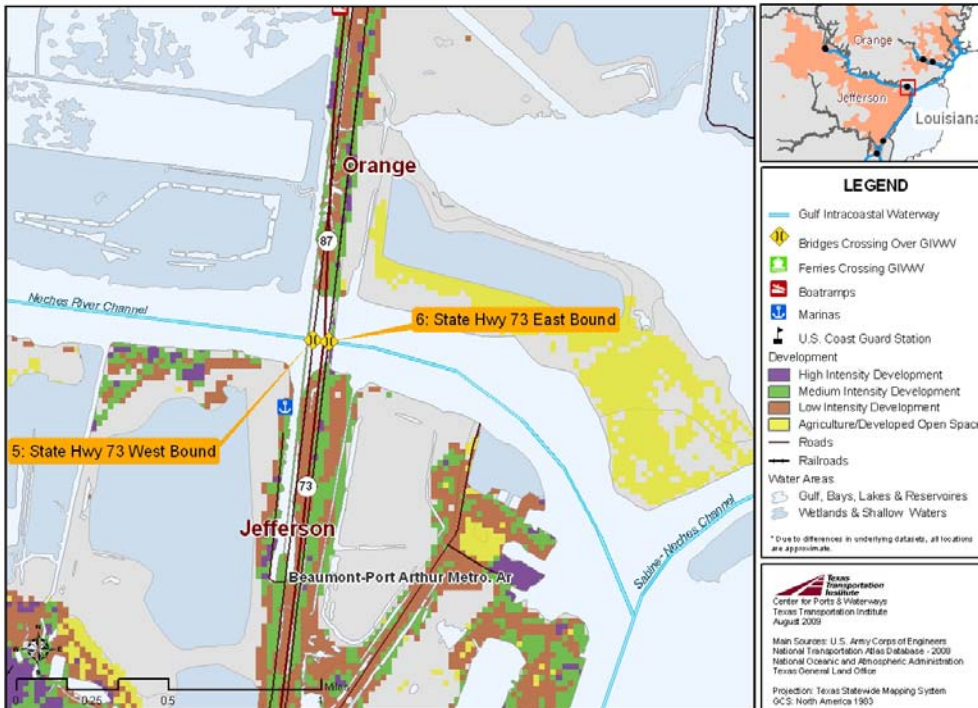
## Bridges and Development in Orange County \*Map 1 of 1



## Bridges and Development in Orange-Jefferson County\* Map 1 of 2

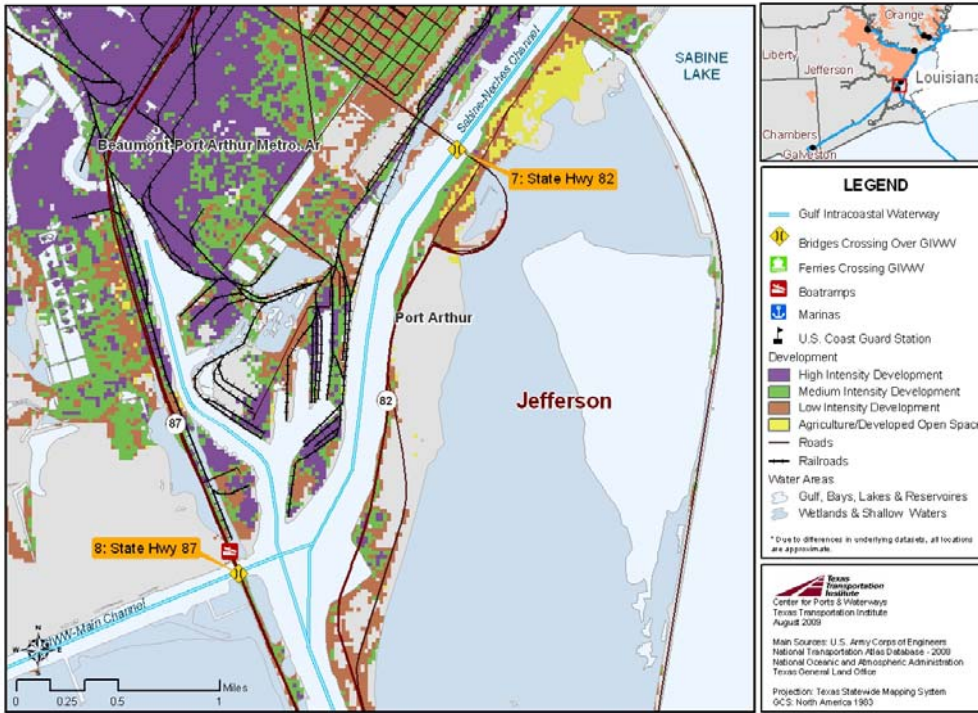


## Bridges and Development in Orange-Jefferson County\* Map 2 of 2

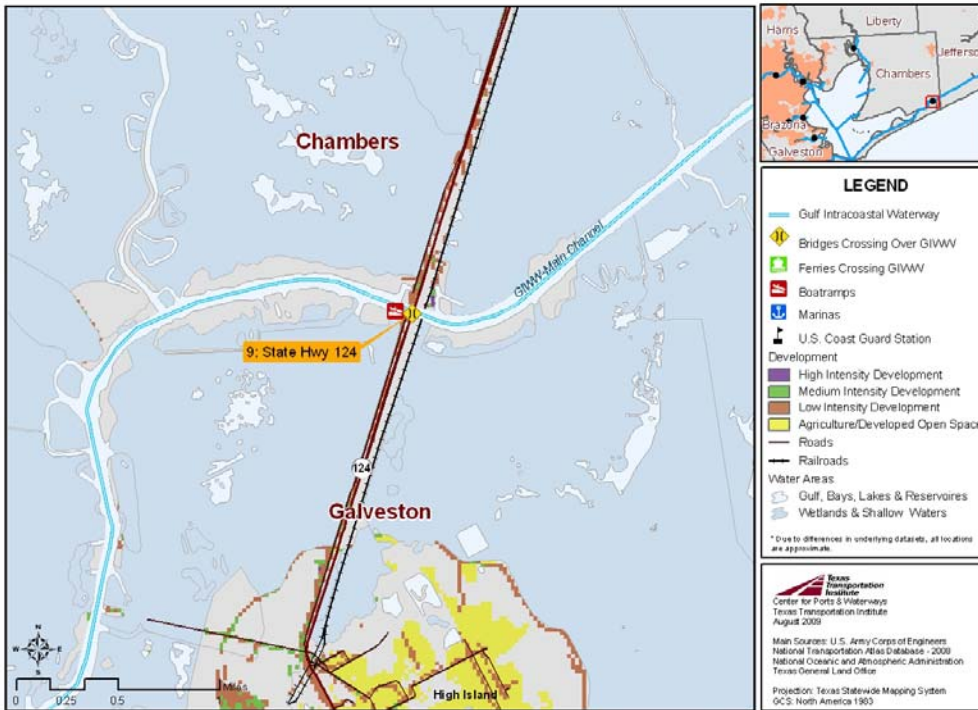




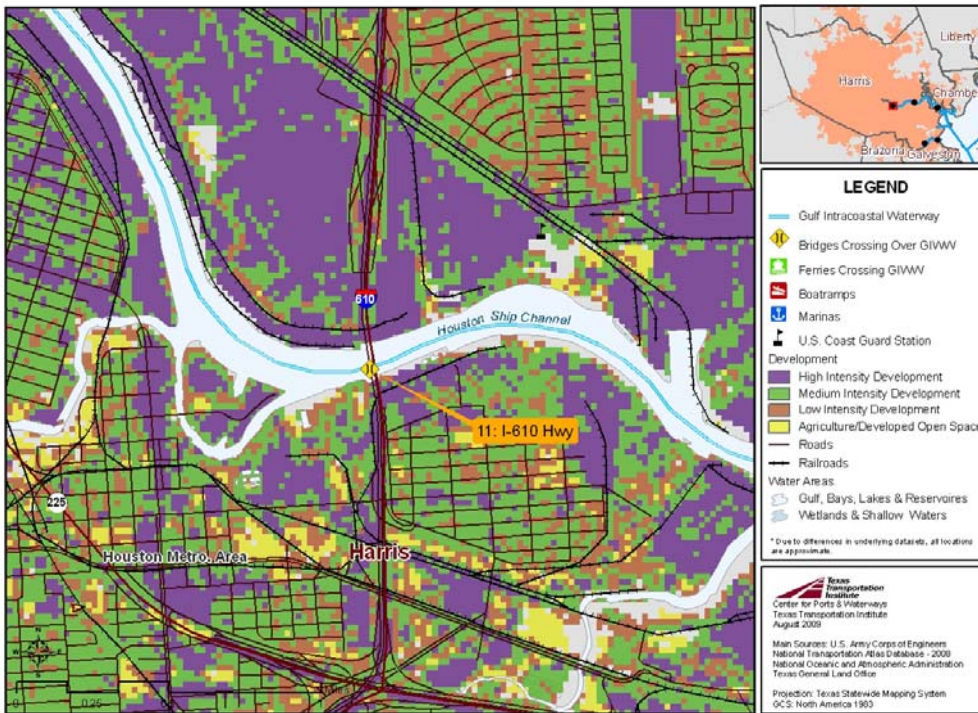
### Bridges and Development in Jefferson County\* Map 1 of 1



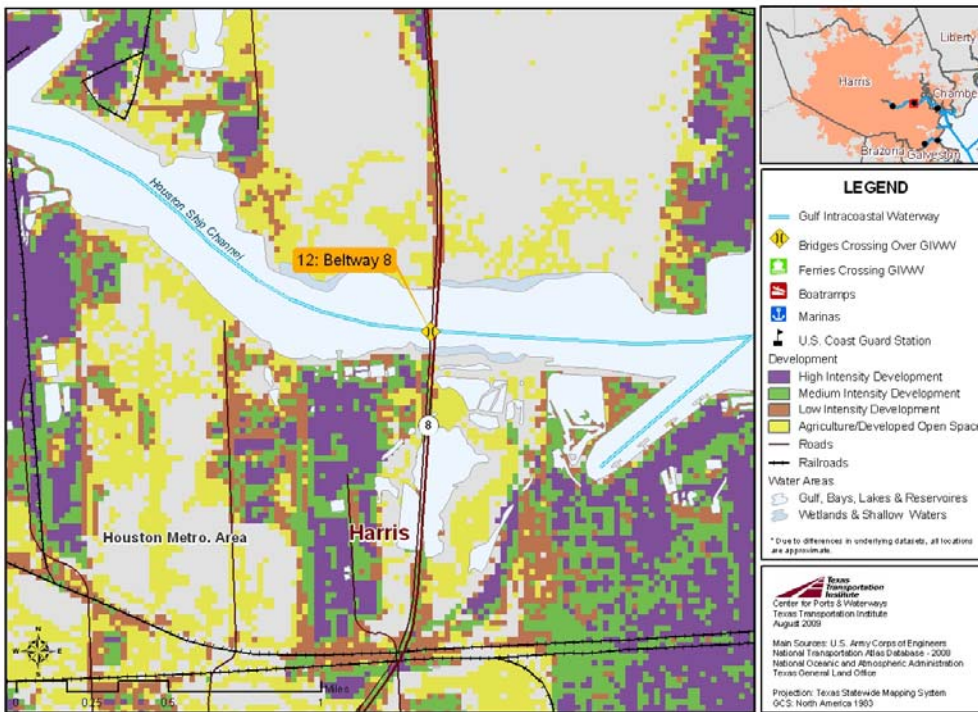
### Bridges and Development in Chambers-Galveston County\* Map 1 of 1



### Bridges and Development in Harris County\* Map 1 of 3

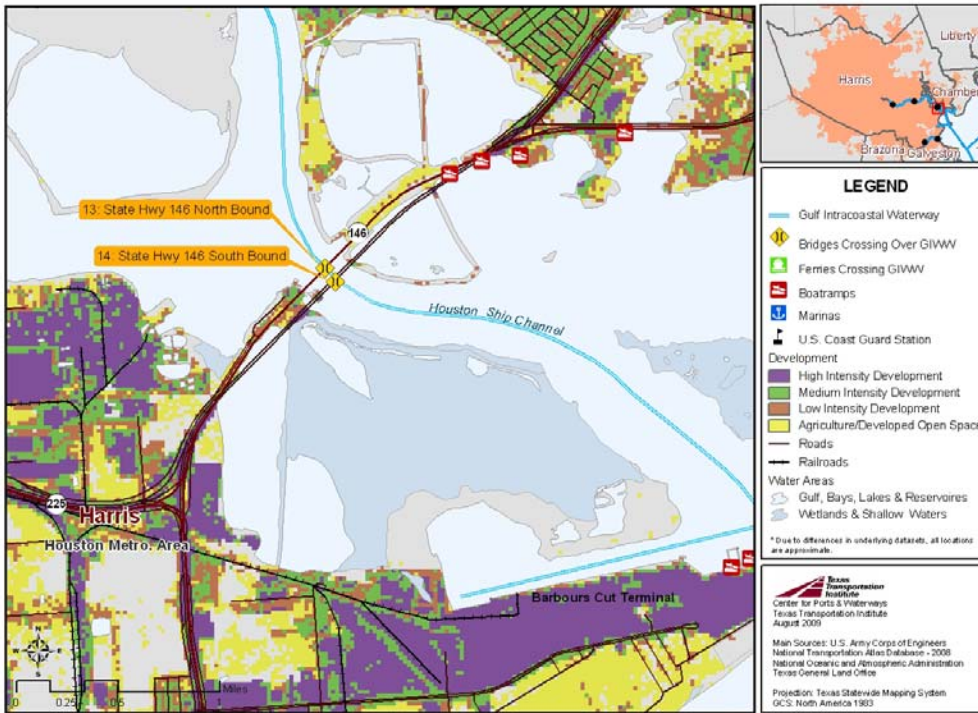


### Bridges and Development in Harris County\* Map 2 of 3

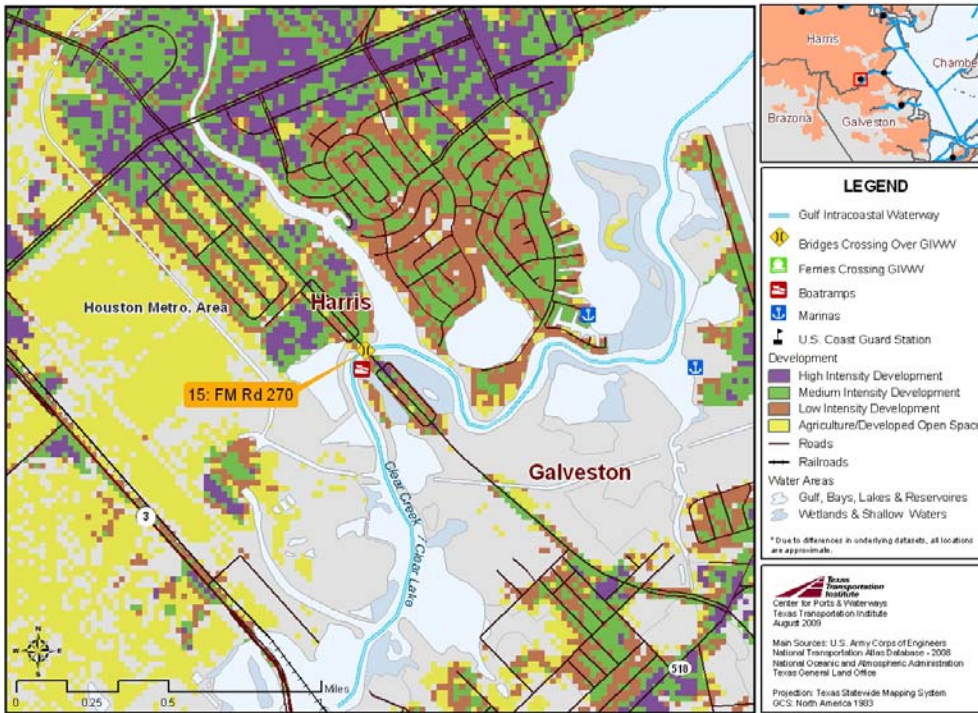




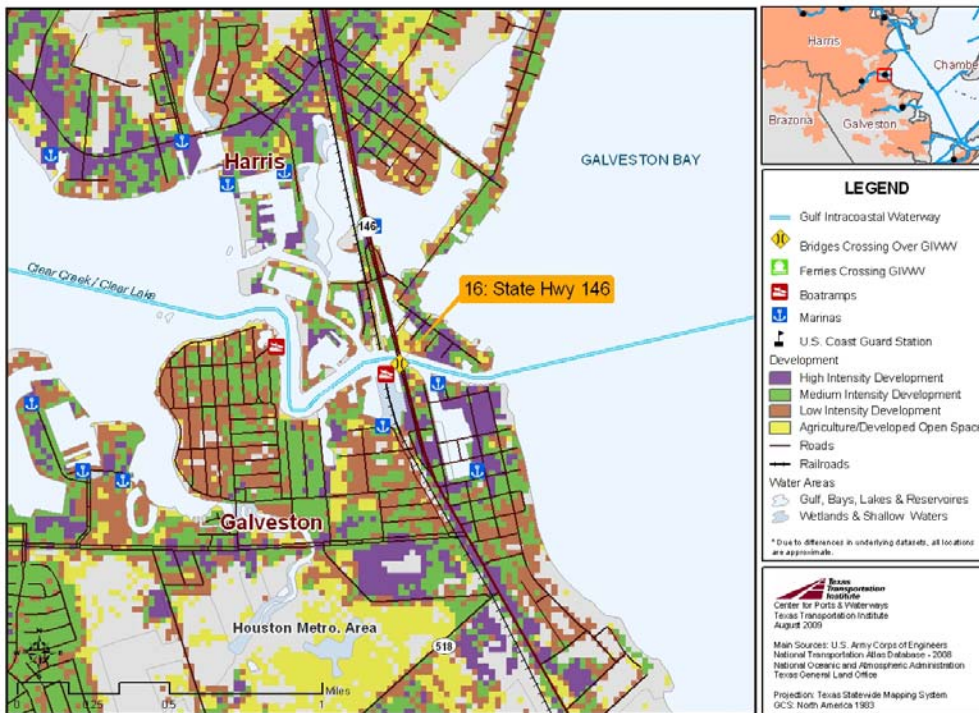
### Bridges and Development in Harris County\* Map 3 of 3



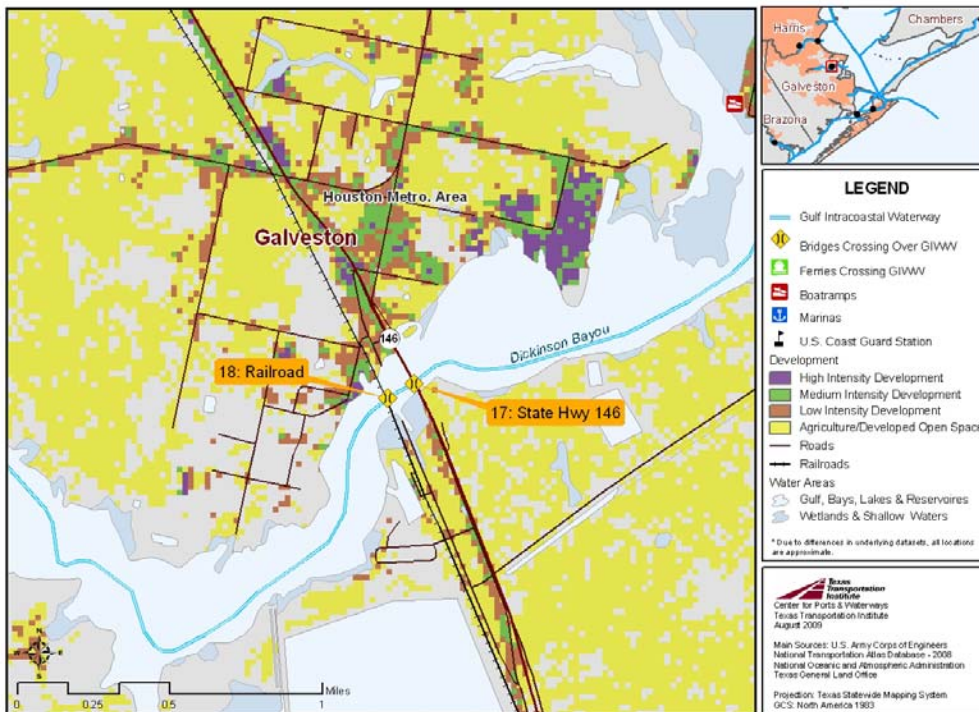
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## Bridges and Development in Harris-Galveston County\* Map 2 of 2

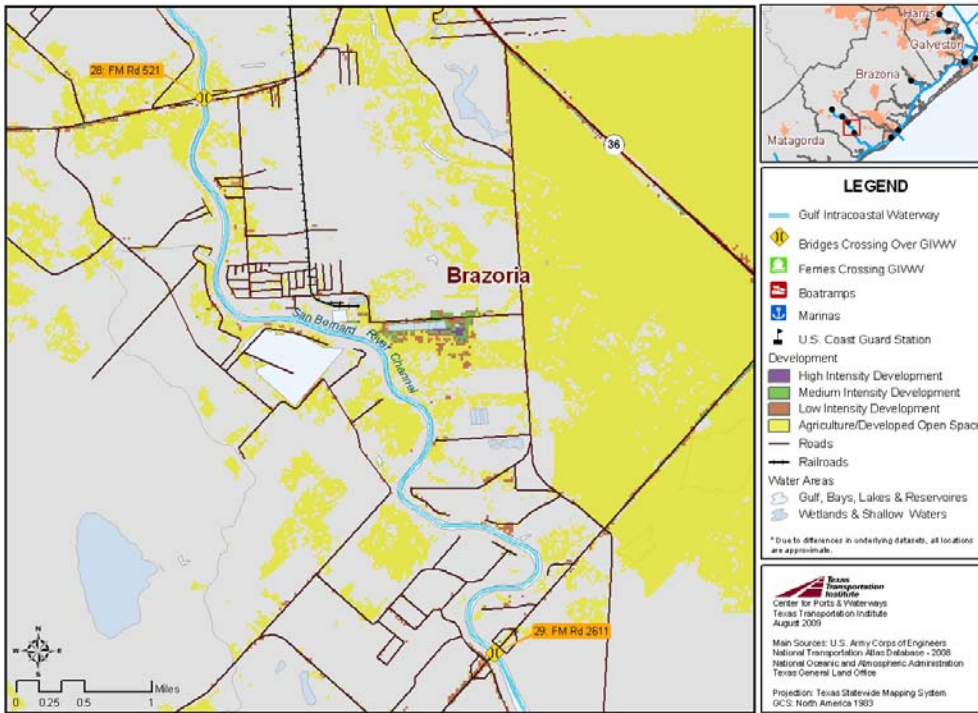


## Bridges and Development in Galveston County\* Map 1 of 3

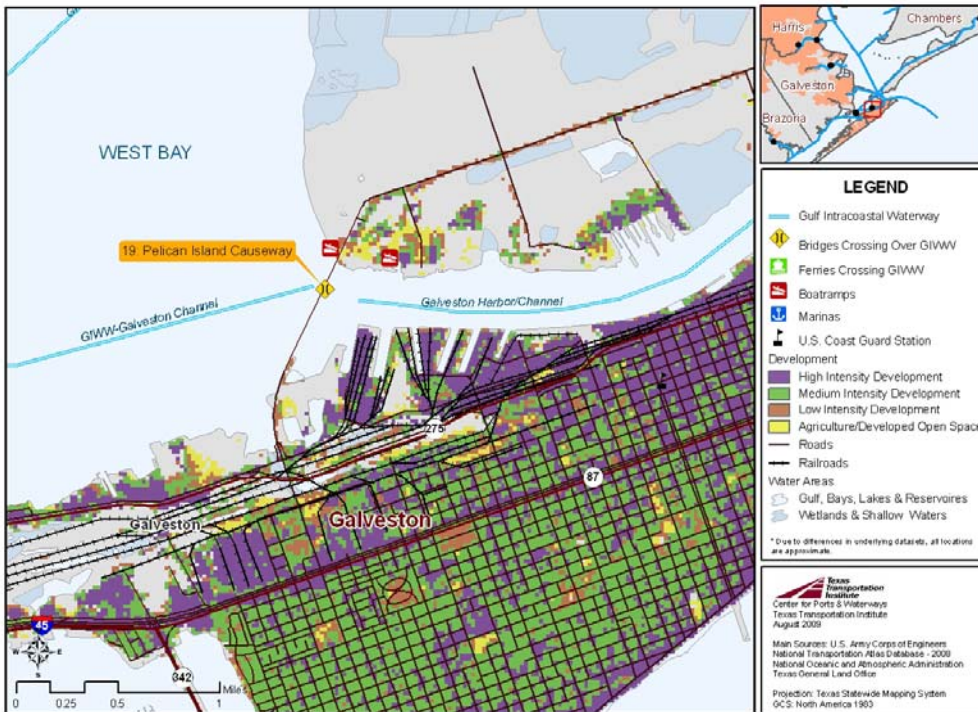




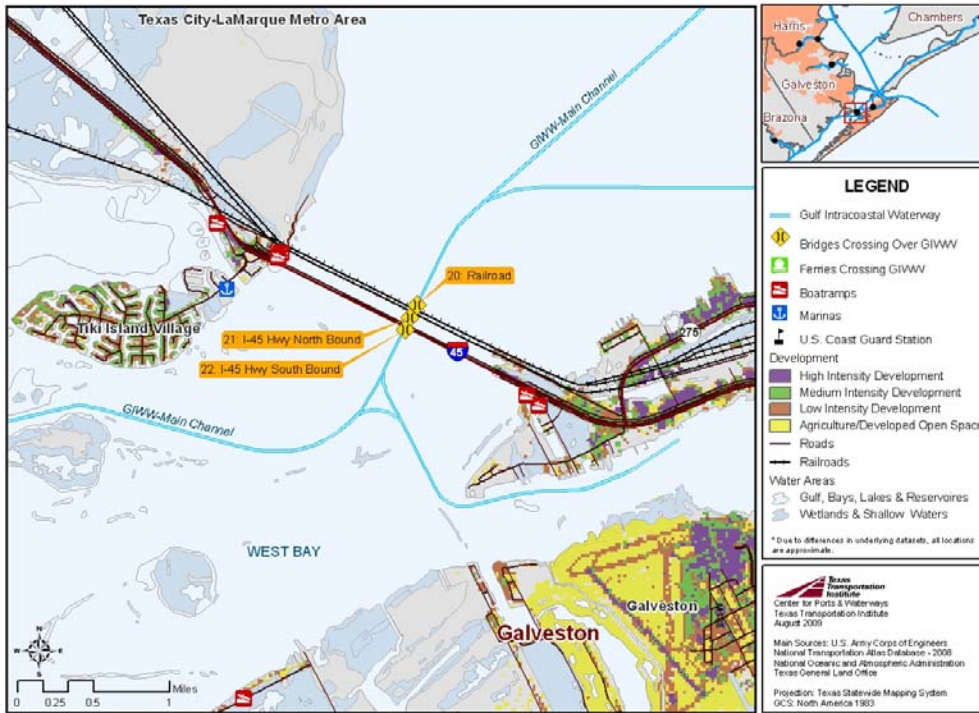
### Bridges and Development in Brazoria County \* Map 4 of 4



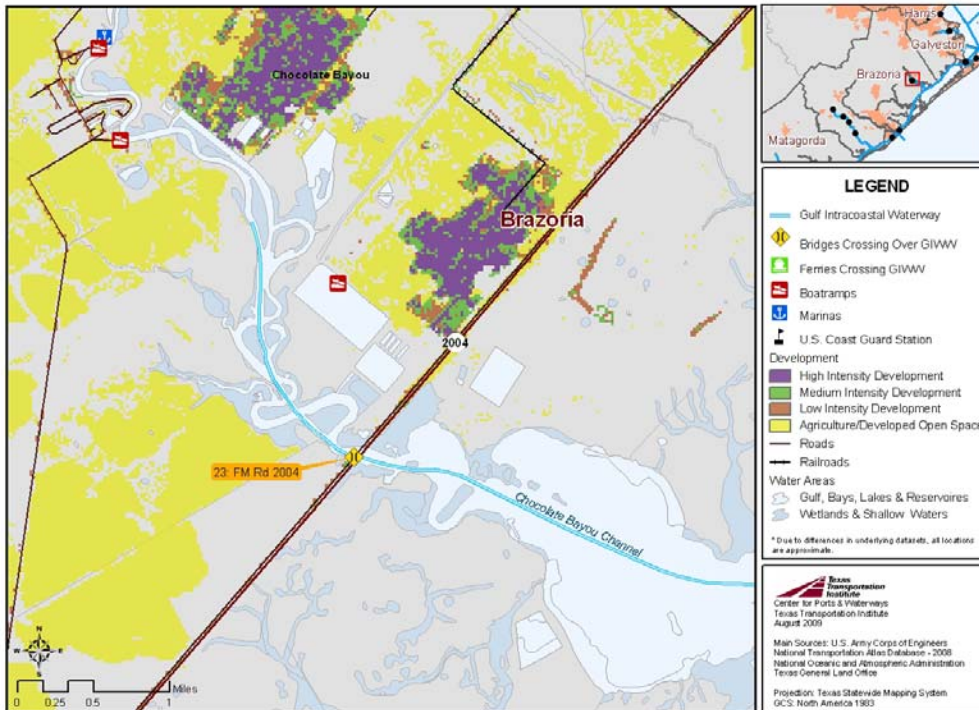
### Bridges and Development in Galveston County \* Map 2 of 3



## Bridges and Development in Galveston County \* Map 3 of 3

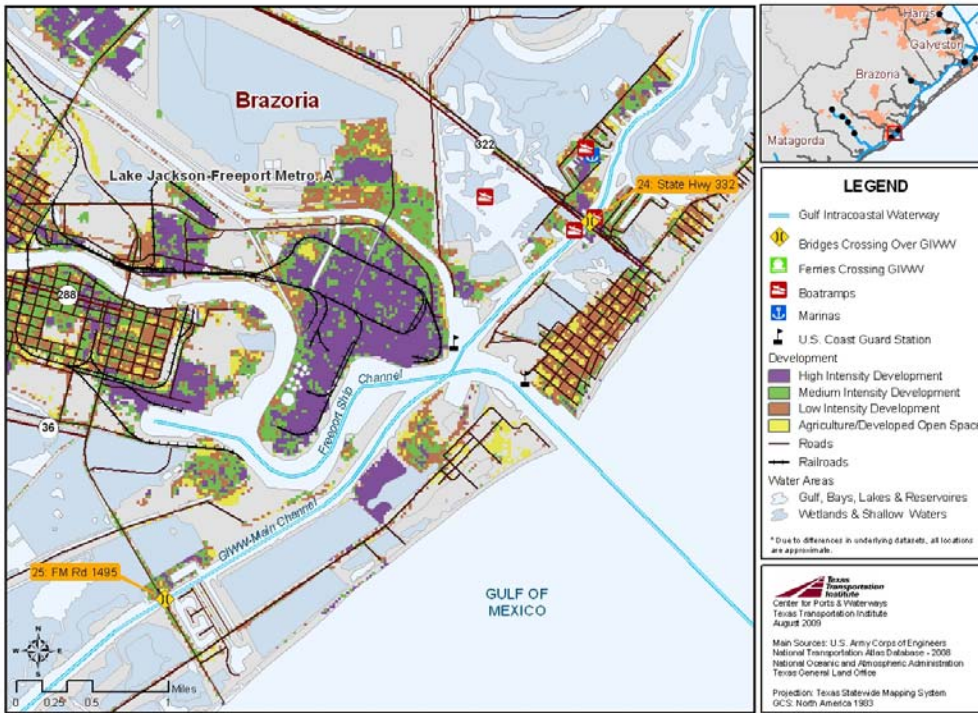


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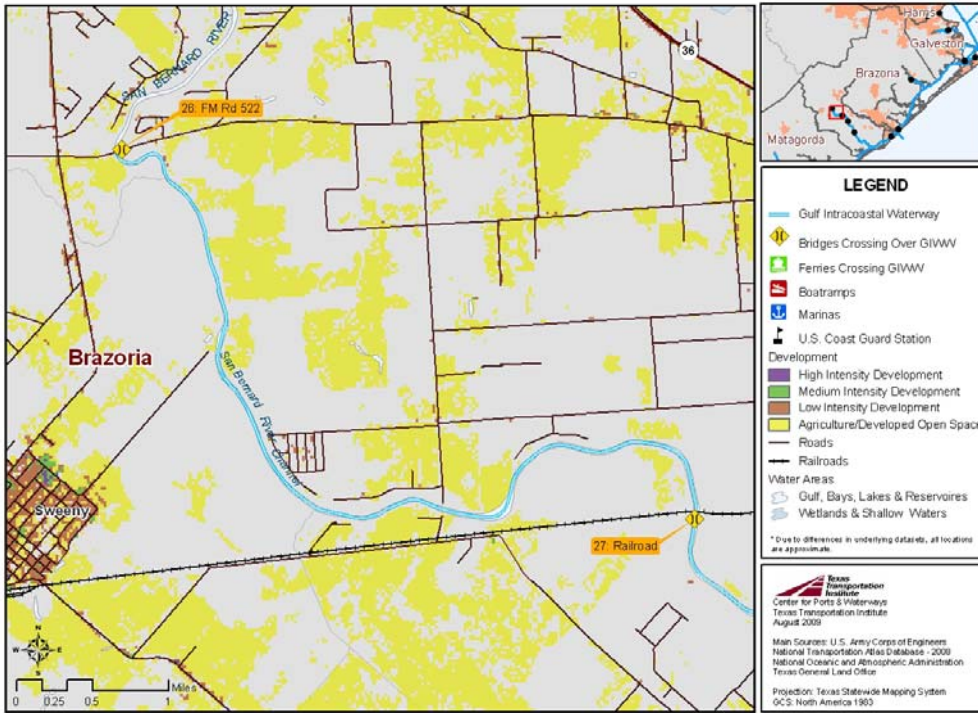




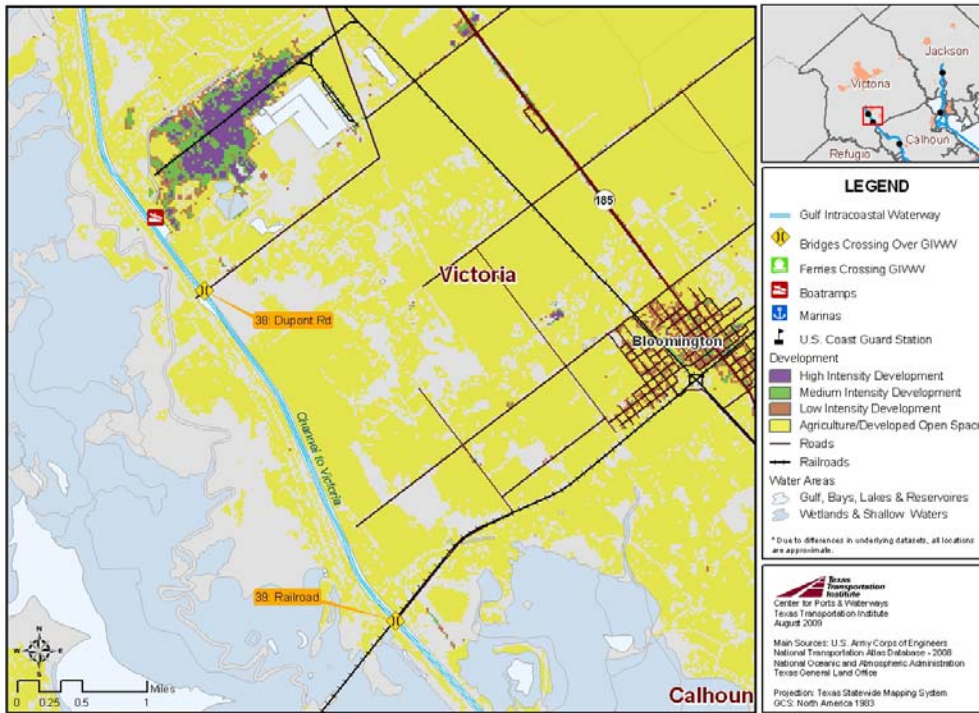
### Bridges and Development in Brazoria County\* Map 2 of 4



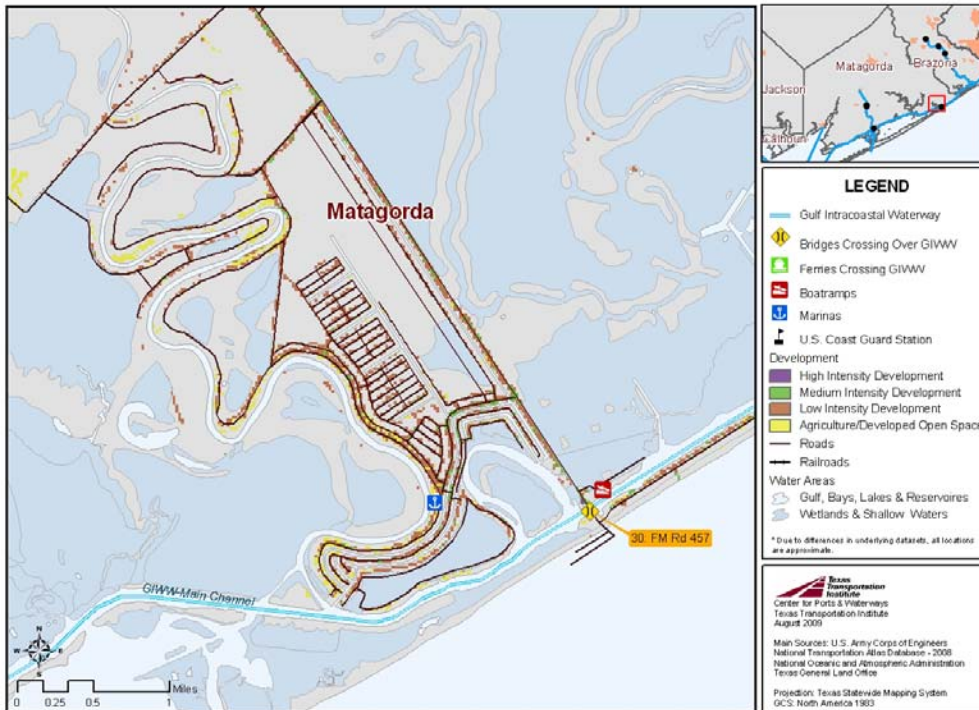
### Bridges and Development in Brazoria County\* Map 3 of 4



## Bridges and Development in Victoria County \* Map 1 of 1

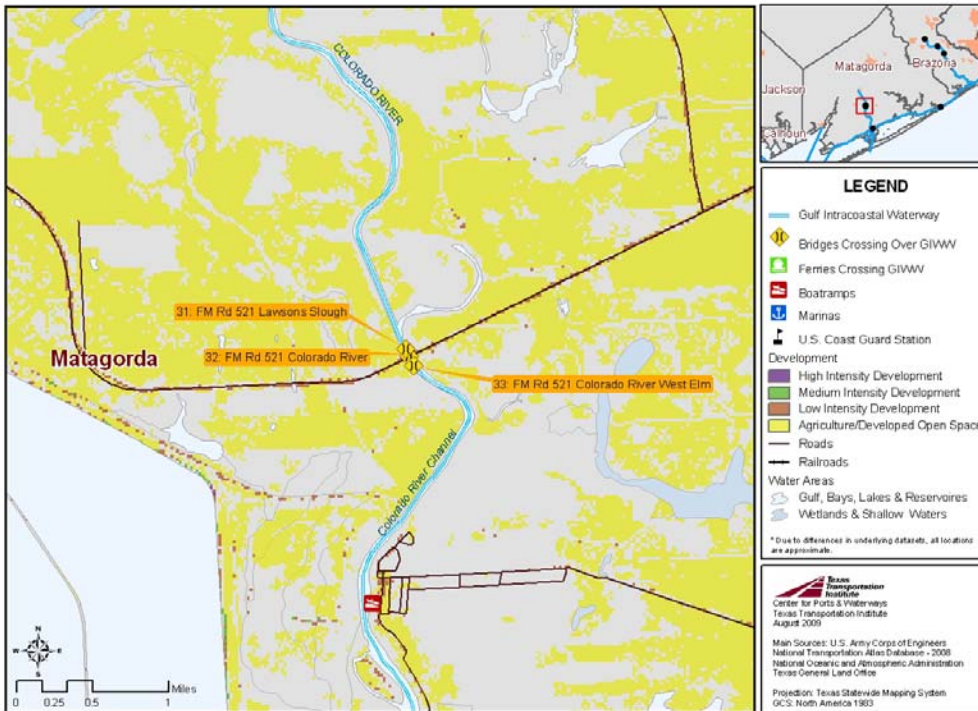


## Bridges and Development in Matagorda County \* Map 1 of 3

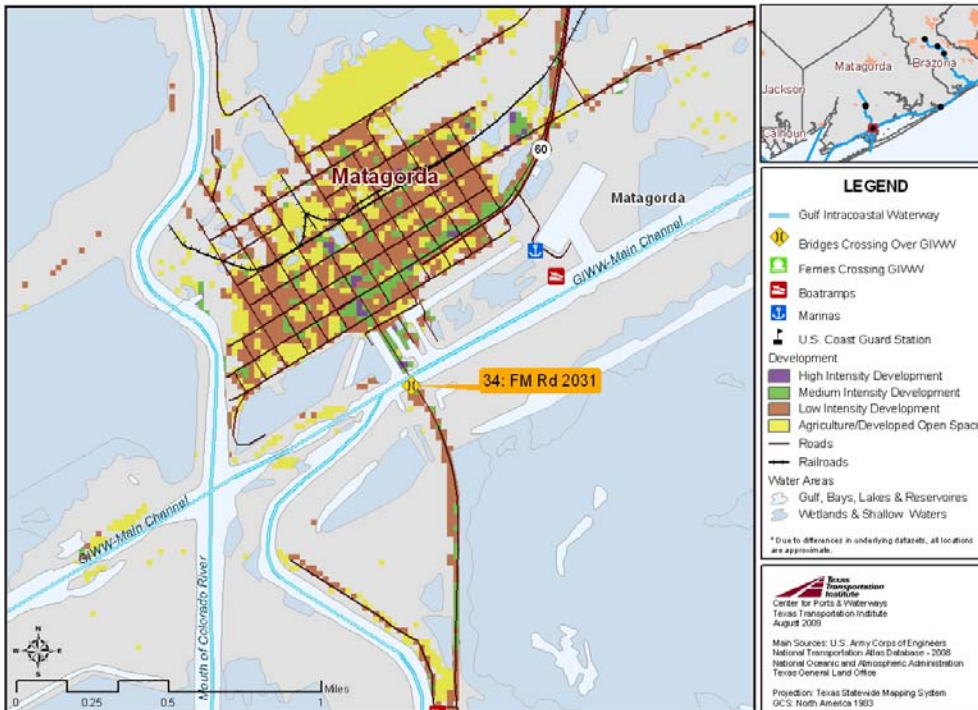




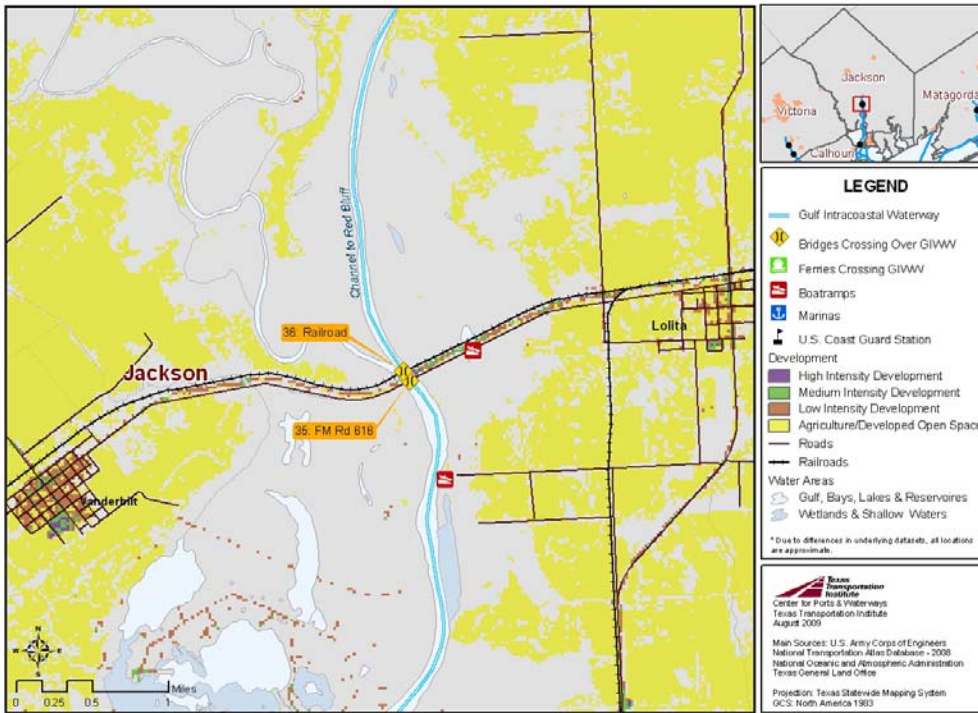
## Bridges and Development in Matagorda County \* Map 2 of 3



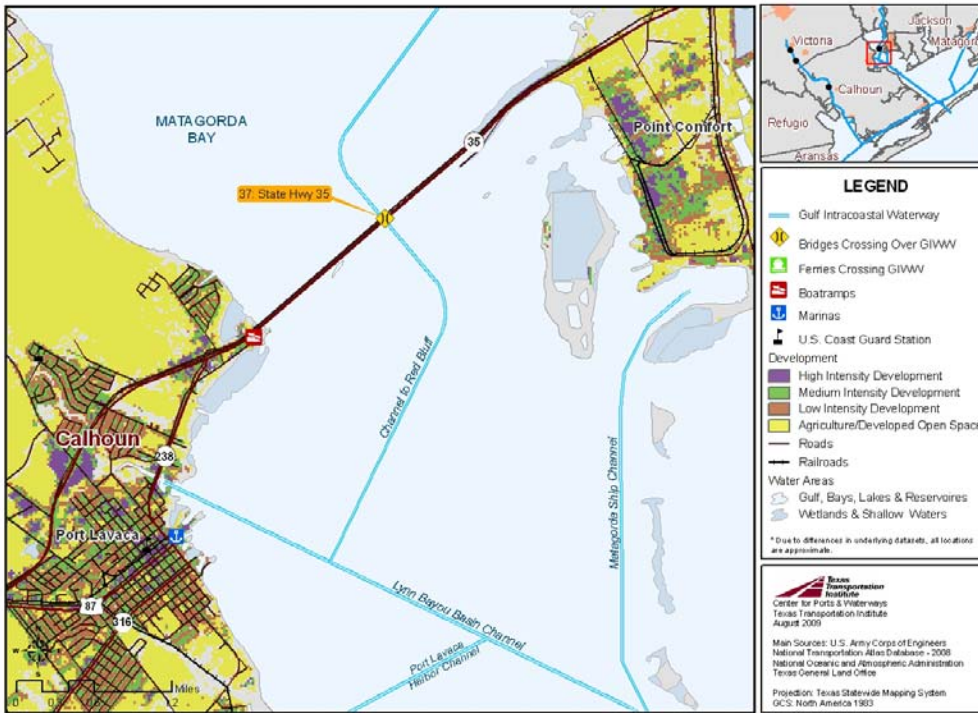
## Bridges and Development in Matagorda County \* Map 3 of 3



## Bridges and Development in Jackson County \* Map 1 of 1

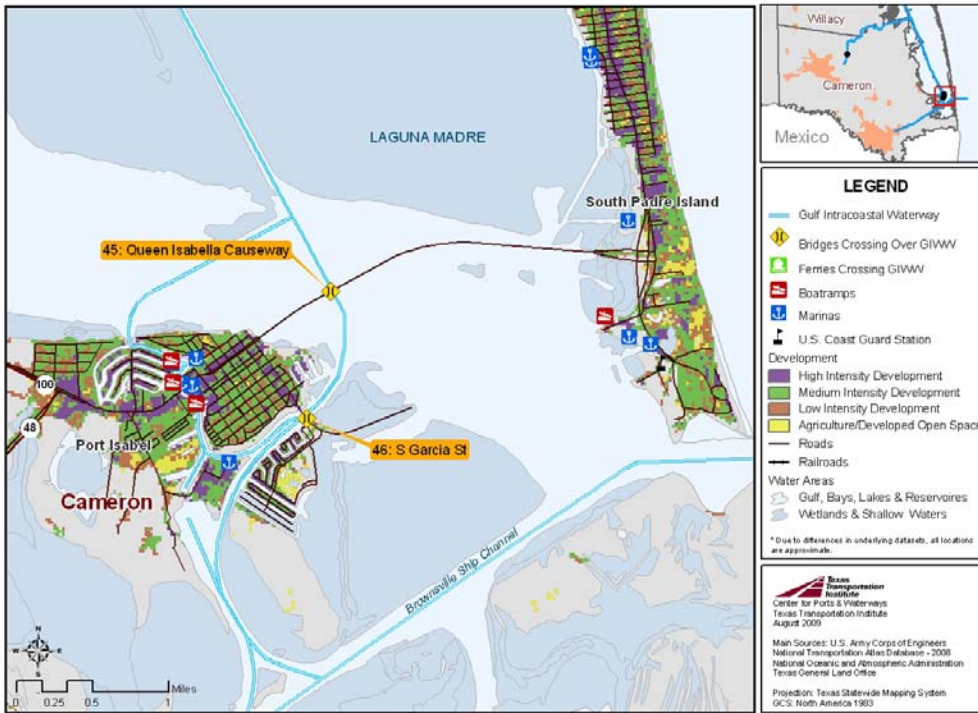


## Bridges and Development in Calhoun County \* Map 1 of 2

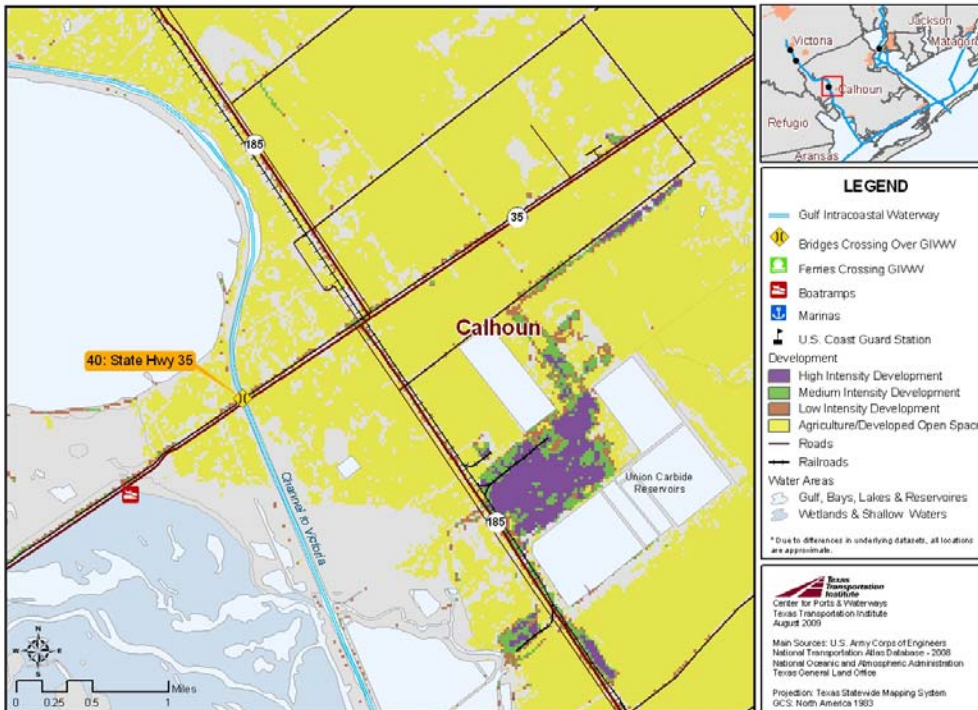




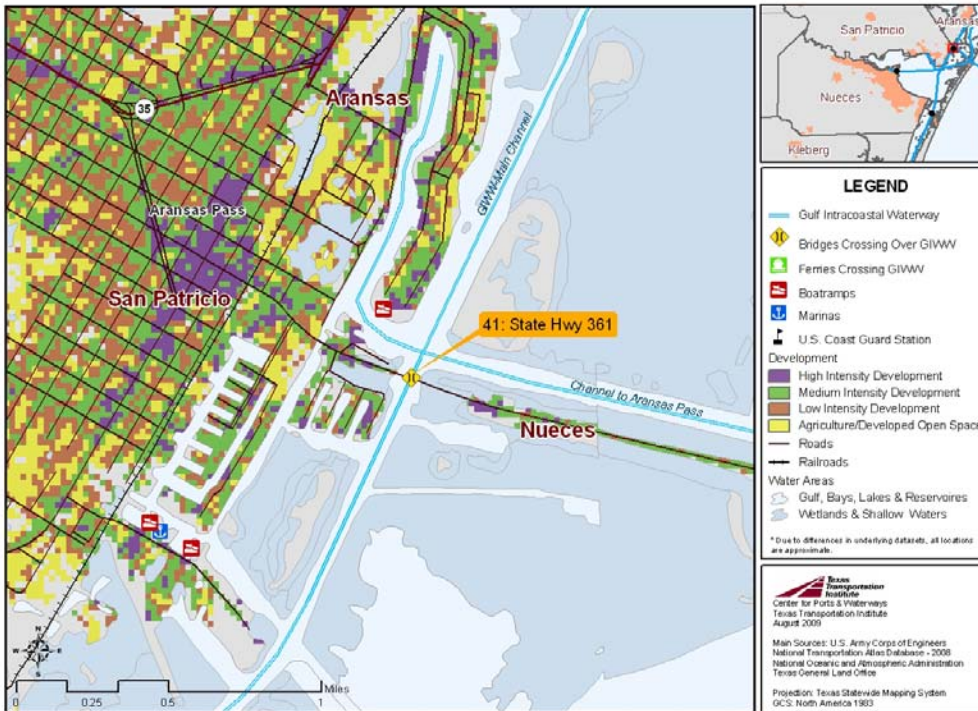
## Bridges and Development in Cameron County <sup>Map 2 of 2</sup>



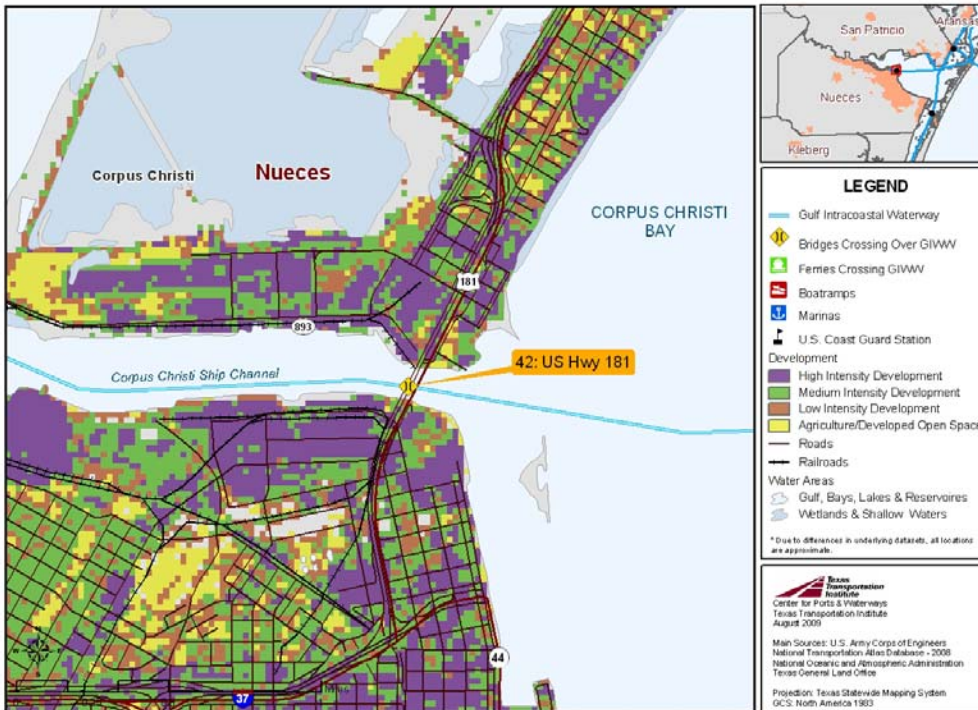
## Bridges and Development in Calhoun County <sup>Map 2 of 2</sup>



## Bridges and Development in Nueces County<sup>\*</sup> Map 1 of 3

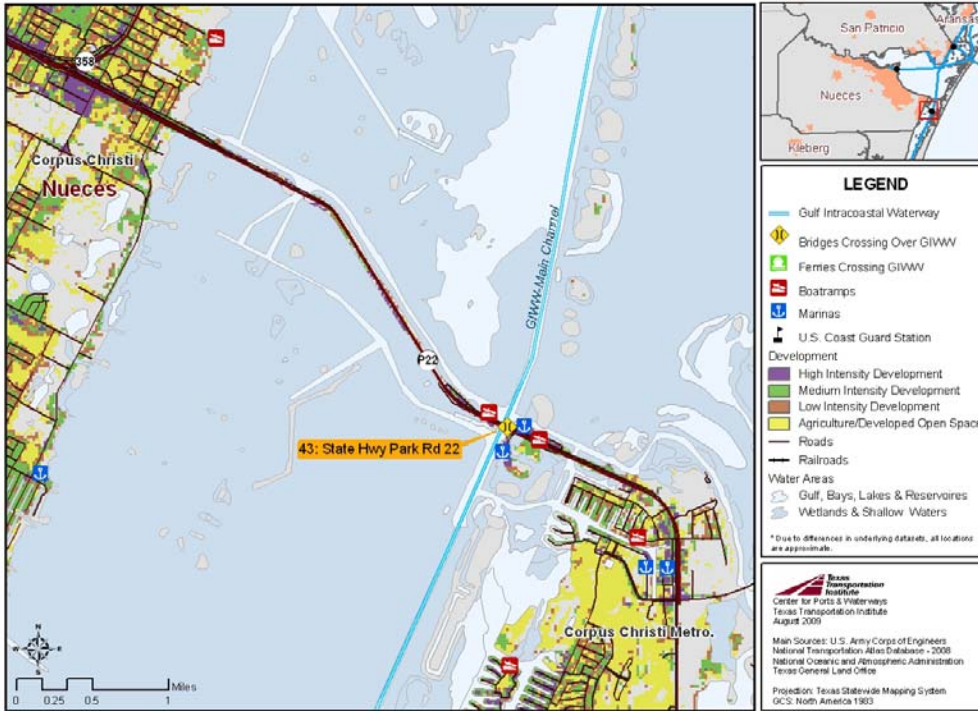


## Bridges and Development in Nueces County<sup>\*</sup> Map 2 of 3

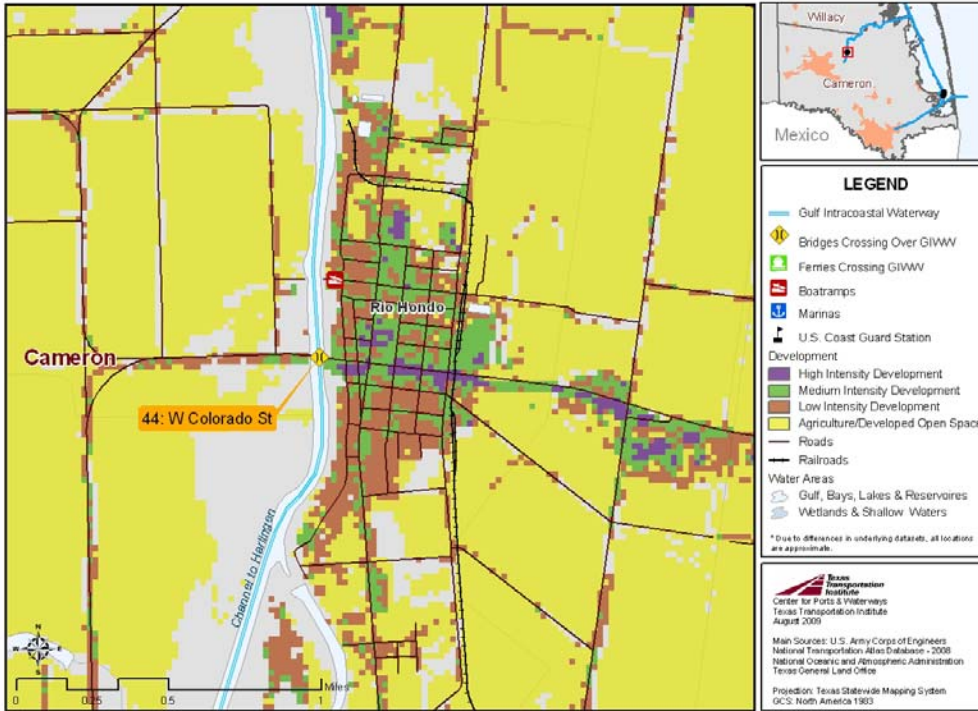




## Bridges and Development in Nueces County <sup>Map 3 of 3</sup>



## Bridges and Development in Cameron County <sup>Map 1 of 2</sup>



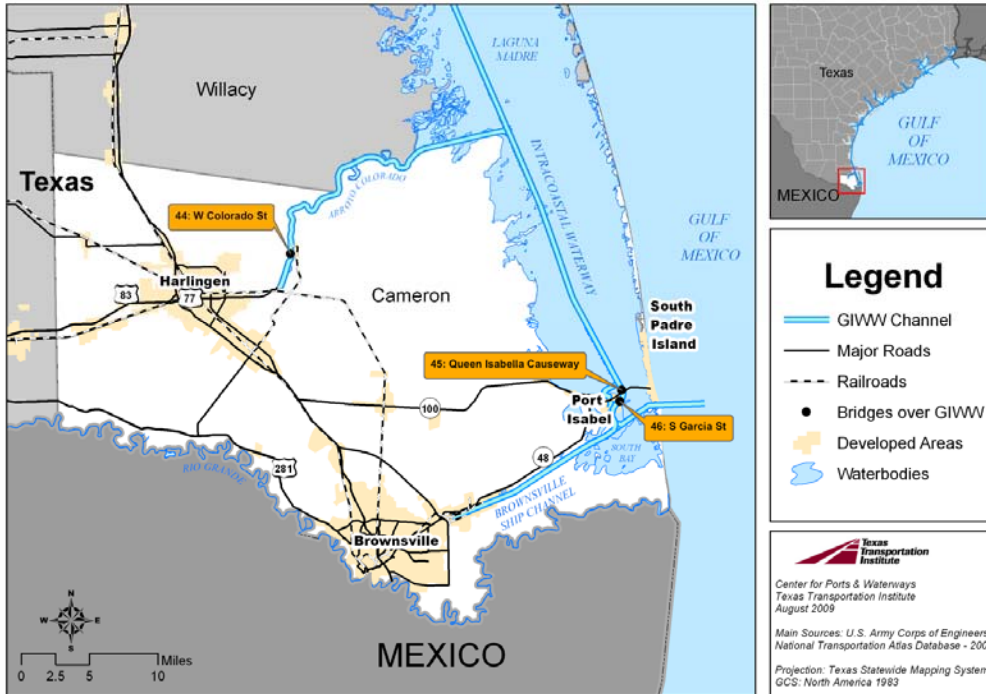


**Appendix 7:**  
**Maps of the GIWW and Tributaries**

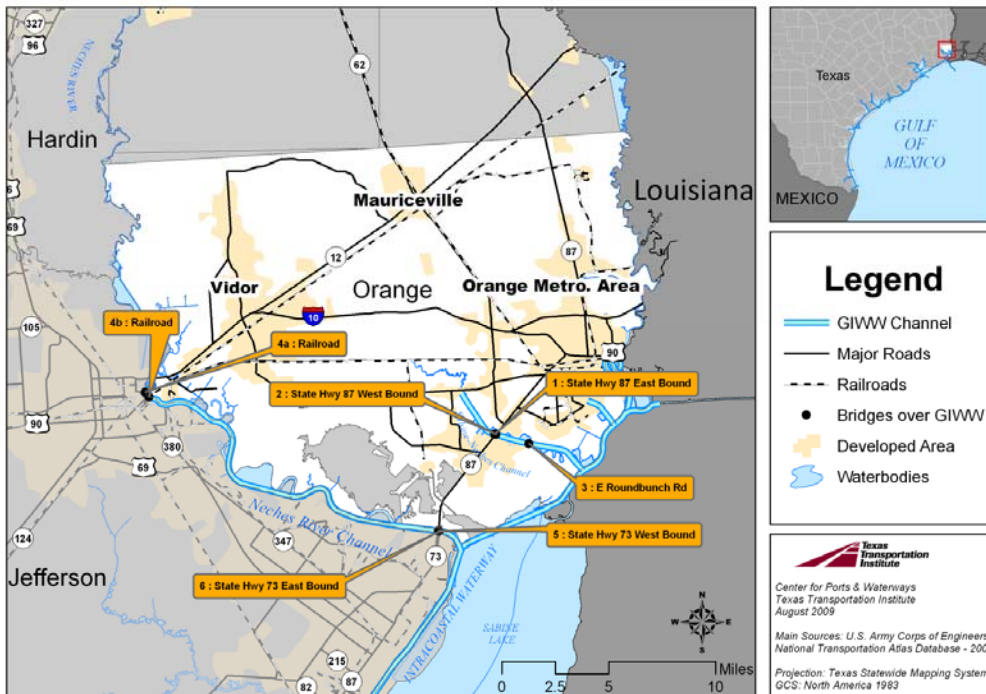




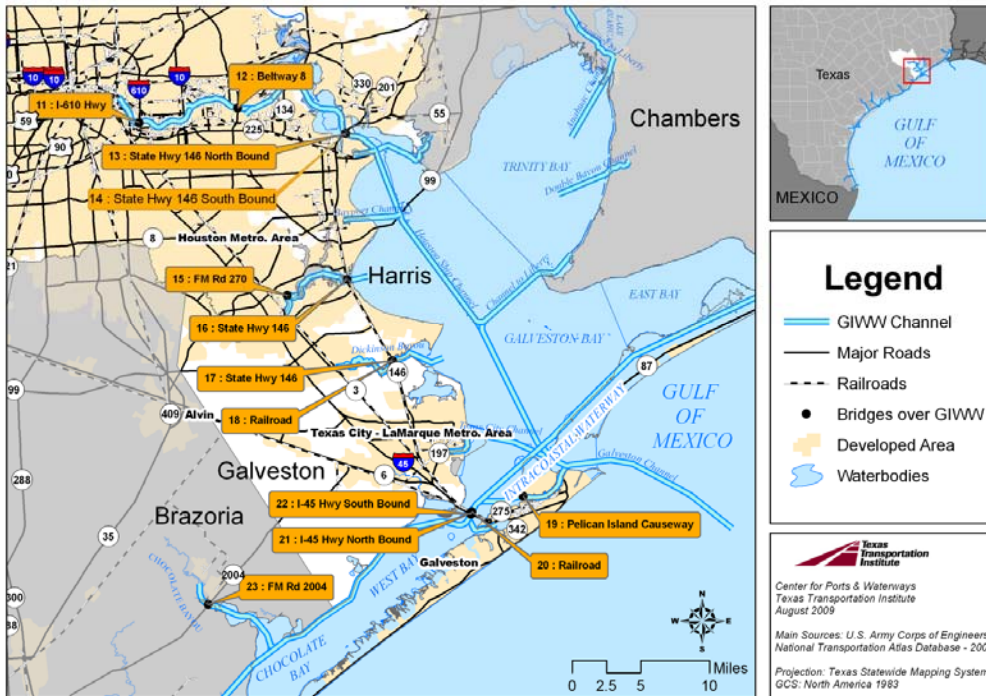
## The Gulf Intracoastal Waterway and Tributaries Cameron County



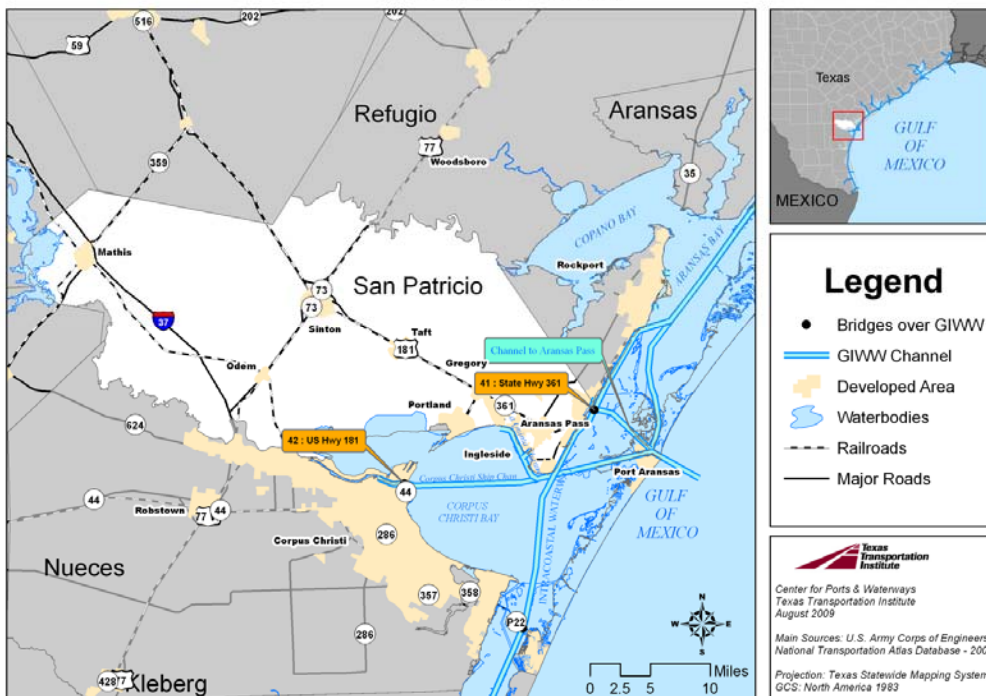
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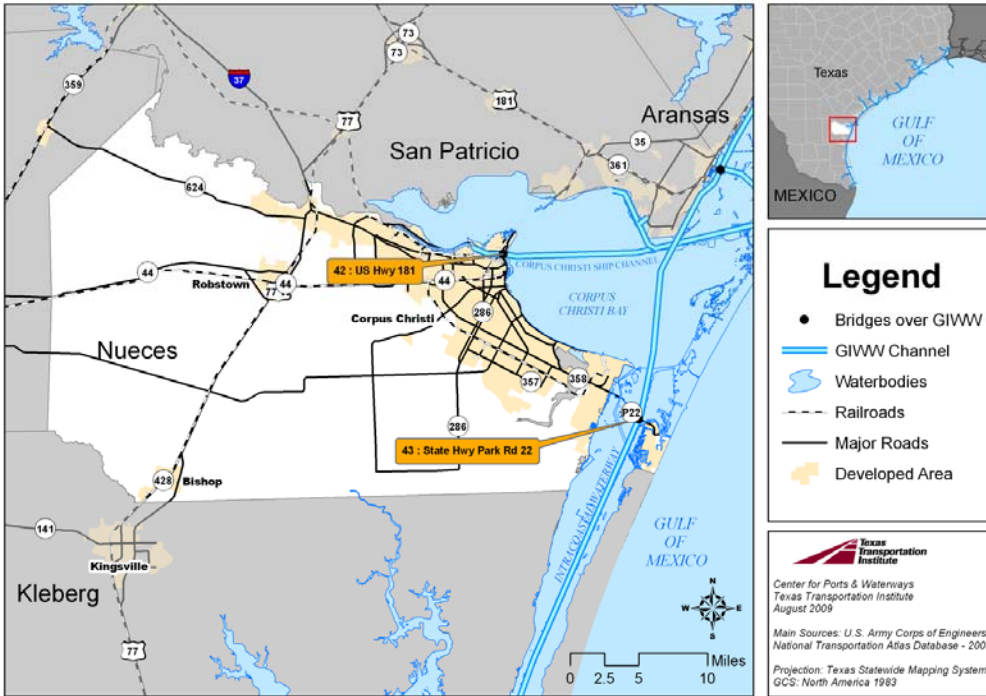
## The Gulf Intracoastal Waterway and Tributaries Harris and Galveston Counties



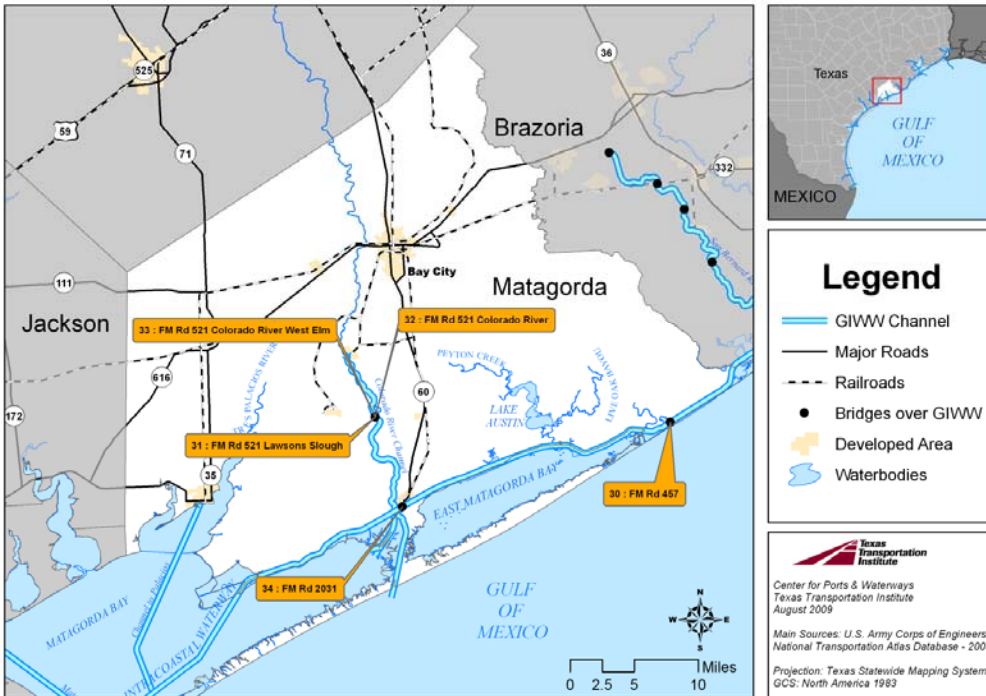
## The Gulf Intracoastal Waterway and Tributaries San Patricio County



## The Gulf Intracoastal Waterway and Tributaries Nueces County

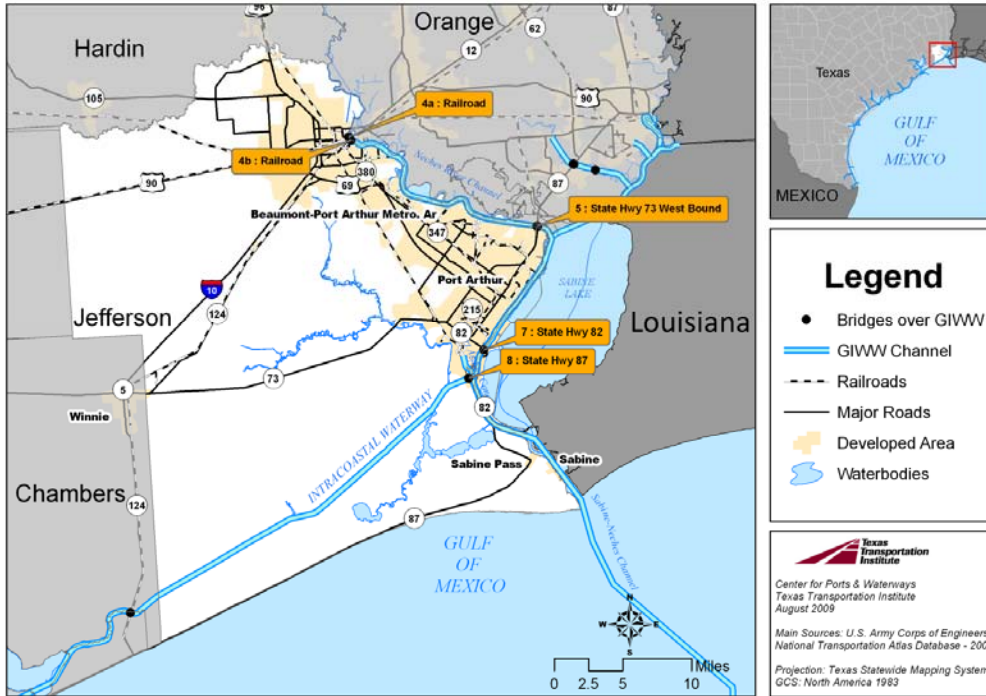


## The Gulf Intracoastal Waterway and Tributaries Matagorda County

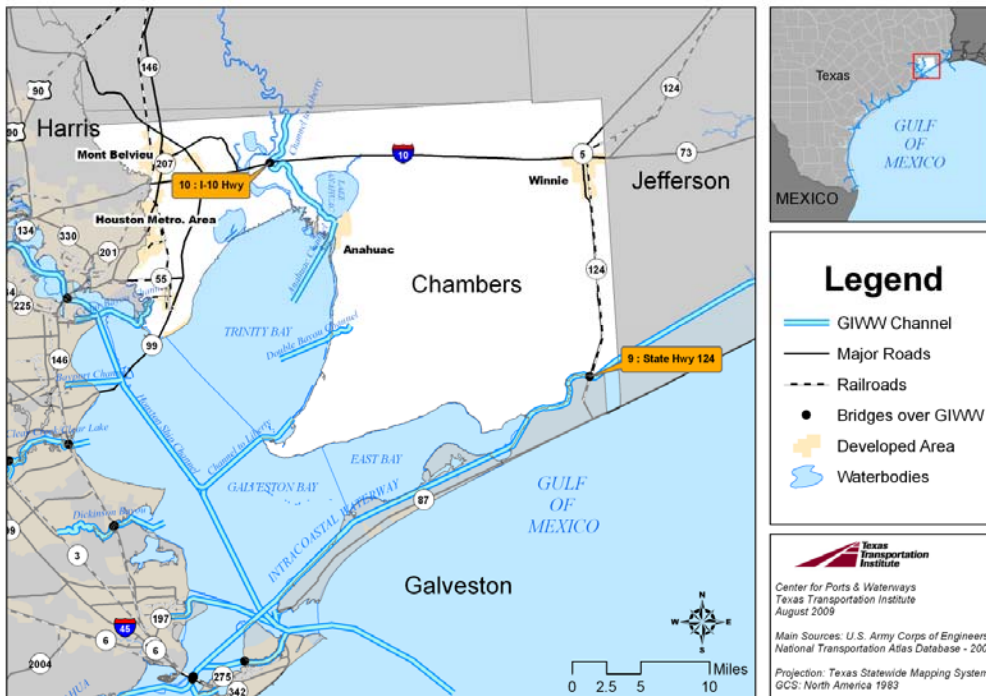




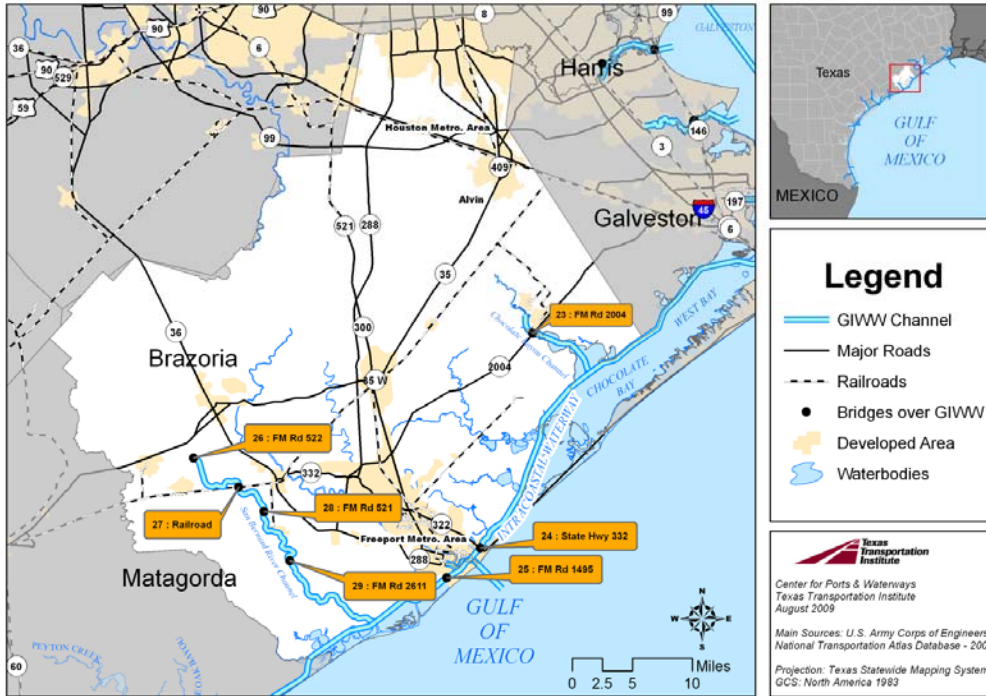
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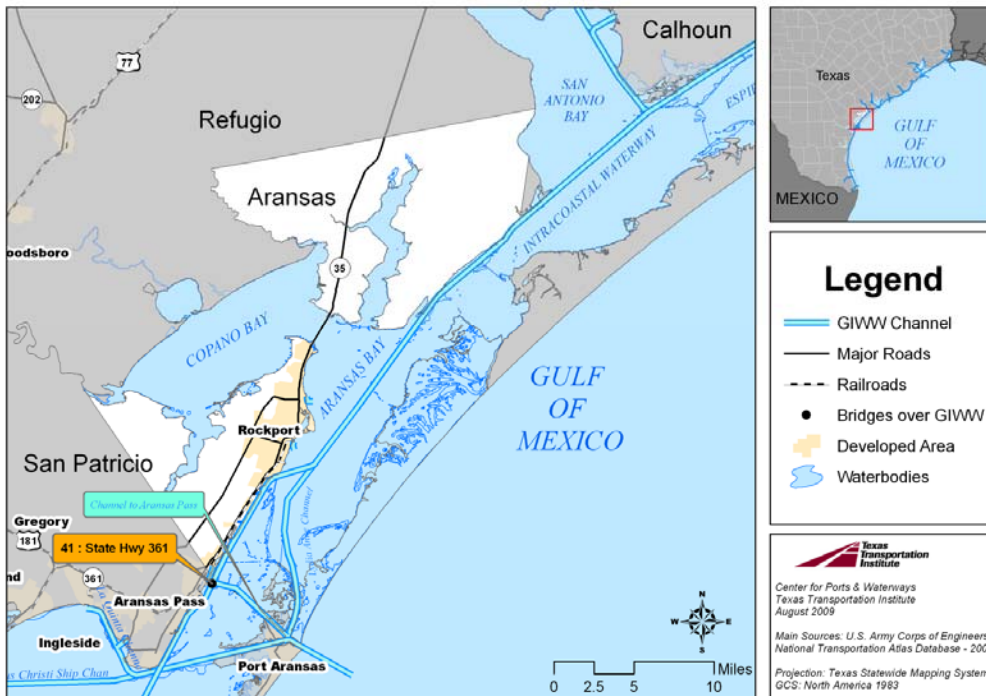
## The Gulf Intracoastal Waterway and Tributaries Chambers County



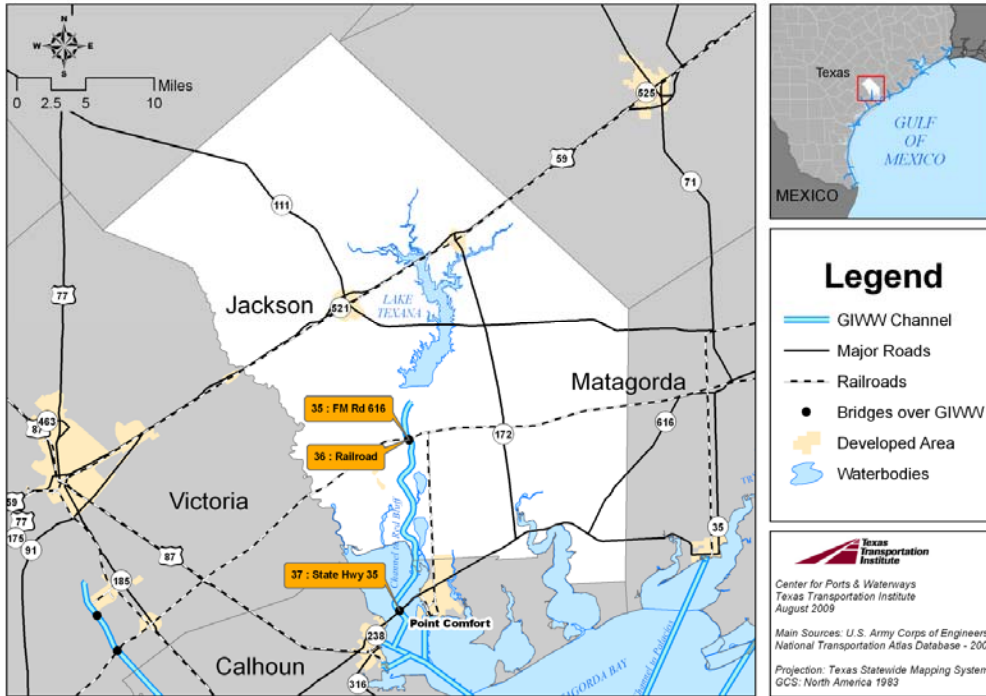
## The Gulf Intracoastal Waterway and Tributaries Brazoria County



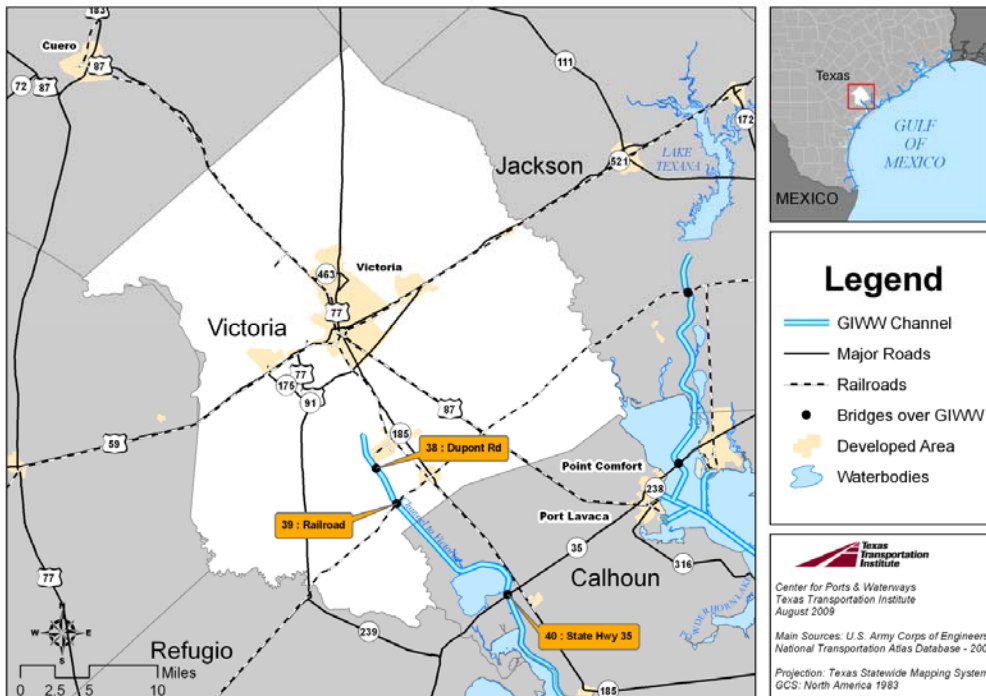
## The Gulf Intracoastal Waterway and Tributaries Aransas County



## The Gulf Intracoastal Waterway and Tributaries Jackson County

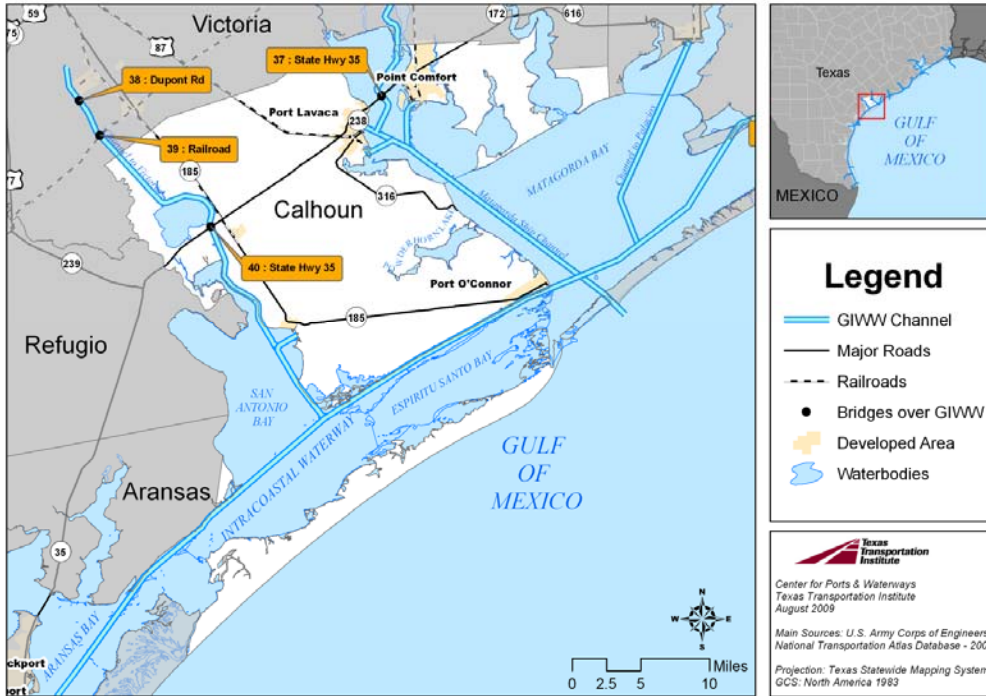


## The Gulf Intracoastal Waterway and Tributaries Victoria County

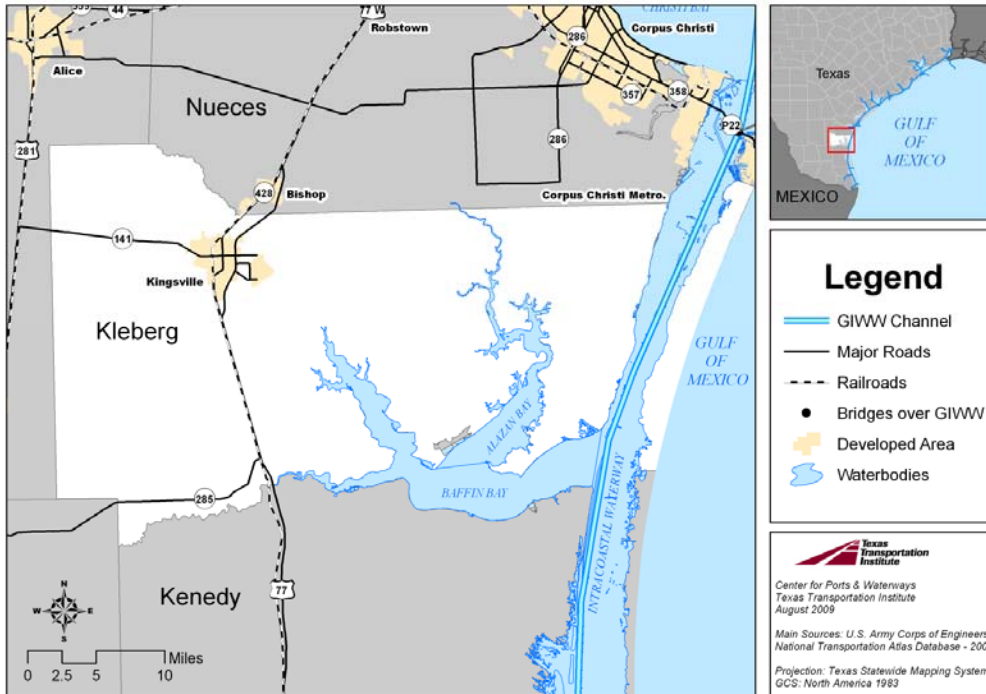




## The Gulf Intracoastal Waterway and Tributaries Calhoun County



## The Gulf Intracoastal Waterway and Tributaries Kleberg County



# The Gulf Intracoastal Waterway and Tributaries

## Kenedy County

