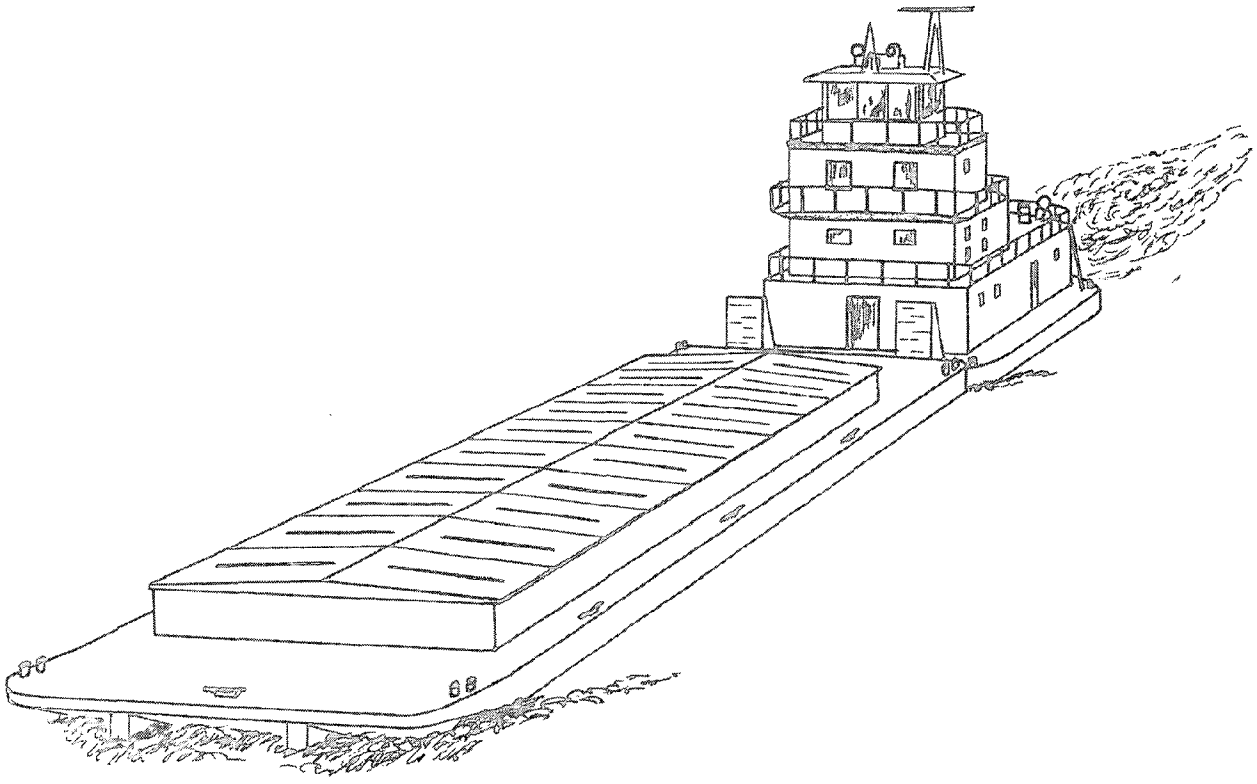
THE GULF INTRACOASTAL WATERWAY IN TEXAS

1982



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Prepared By

THE STATE DEPARTMENT
OF
HIGHWAYS AND PUBLIC TRANSPORTATION

THE GULF INTRACOASTAL WATERWAY

IN TEXAS

PRESENTED IN RESPONSE TO

THE TEXAS COASTAL WATERWAY ACT OF 1975

AND

SUBMITTED TO

THE SIXTY-EIGHTH SESSION

OF THE TEXAS LEGISLATURE

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
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PREPARED BY

THE STATE DEPARTMENT OF HIGHWAYS
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TRANSPORTATION PLANNING DIVISION

1982

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Governor William P. Clements

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Members of the Sixty-Eighth Legislature

Prior to 1975, the need existed for a single, local non-federal sponsor of the Gulf Intracoastal Waterway in Texas. The Texas Coastal Waterway Act of 1975 filled that need by appointing the State Highway and Public Transportation Commission to act as agent for the State of Texas as the non-federal sponsor of the Gulf Intracoastal Waterway in Texas.

The Act also instructed the Commission to evaluate the Gulf Intracoastal Waterway as it relates to Texas, including an assessment of the importance of the Waterway, an identification of principal problems and significant modifications to the Waterway, and specific recommendations for legislative action, if any.

The evaluation mandated by the Act has been conducted and a report prepared; it represents information based upon available data and reflects the current status of Waterway-related matters as well as the possible future of these matters. It also reiterates the desire of the Commission to foster the growth of shallow-draft navigation in Texas while simultaneously fostering the protection and enhancement of the coastal environment.

The report is hereby submitted to the Sixty-Eighth Legislature in accordance with the Texas Coastal Waterway Act of 1975.

Sincerely yours,

M. G. Goode

M. G. Goode
Engineer-Director

FOREWORD

FOREWORD

World history teaches that each culture, every society and every nation in the history of man has had to face and solve complex problems. America has faced and surmounted her share of these difficult problems; she is now facing another crucial issue, an issue to which there is no single clear-cut solution but one which is fraught with emotion and electrified by far-reaching consequences. The issue of how to preserve or maintain the natural environment without damaging the nation's economy must be settled in such a way that neither the environmental nor the economic quality of life of future generations is unnecessarily restricted.

The presence of the Gulf Intracoastal Waterway in Texas has altered the coastal configuration as well as the coastal environment. This alteration occurred almost forty years ago. Maintenance of the waterway has been performed periodically, but not without increasing opposition due to the impact on the environment. Decisions about future management practices for the waterway must be based on the best and most current information available. It is the purpose of this study to provide a broad base of factual information about the waterway and the controversies which accompany it in order to aid the decision-making process. To maintain the present vitality of the waterway commerce, decision-makers must consider the essential economic benefits in light of equally important environmental issues. Continued prosperity along the coast of Texas is dependent on maintaining this delicate balance between the economy and the environment.

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PREFACE

P R E F A C E

Prior to 1975, the Gulf Intracoastal Waterway in Texas had no single local nonfederal sponsor. Various navigation districts, river authorities and port authorities located along the reaches of the Gulf Intracoastal Waterway (hereinafter cited as the GIWW) attempted to coordinate local management efforts with those of the federal sponsor, the United States Army Corps of Engineers.

In 1975, the state legislature passed the Texas Coastal Waterway Act. This Act authorized the State of Texas to act as local nonfederal sponsor of the GIWW in Texas and designated the State Highway and Public Transportation Commission to act as agency for the State in fulfilling the responsibilities of the nonfederal sponsor.

The nonfederal sponsor works closely with the United States Army Corps of Engineers to provide local cooperation and input into federal projects. Local sponsorship requirements may vary as different projects are authorized by the United States Congress. It is usually the responsibility of the nonfederal sponsor to provide all land needed for construction and maintenance of the project at no cost to the federal government. Many projects also require that the local sponsor make any necessary alterations to pipelines, cables and other utilities which may be located in the project area. The local sponsor may also be required to construct and/or maintain containment facilities for disposal material. Whatever the particular requirements of the local nonfederal sponsor may be, it is a general requirement that the federal government be held free from any damage that might result from construction and maintenance of the project. In

the case of state sponsorship, this requirement can be fulfilled only to the extent permitted by state law. Presently, there exists a conflict on this point between state and federal law which has delayed the implementation of full state sponsorship.

In addition to serving as the nonfederal sponsor of the GIWW, the State Highway and Public Transportation Commission received a legislative mandate to carry out the coastal policy of the State of Texas. The State has declared its support of the shallow-draft navigation of the state's coastal waters in an environmentally sound fashion and its desire to prevent the waste of both publicly and privately owned natural resources while at the same time preventing or minimizing adverse impacts on the environment. The State has also pledged itself to maintaining, preserving and enhancing wildlife and fisheries. Much of the state's coastal policy emphasizes the importance of protecting the environment while supporting navigation functions at the same time.

To carry out the legislative mandate and to further discharge the duties of the nonfederal sponsor, the Commission was instructed to continually evaluate the GIWW as it relates to Texas. Such an evaluation involves the consideration of both tangible and intangible values. If the state is to prevent the waste of its coastal resources and minimize adverse environmental impacts while simultaneously fostering an efficient system of navigation, it is first necessary to identify existing conditions and needs. This report, the fourth in the series required by the Act, is submitted to the Sixty-Eighth Legislature to assist in achieving usage of the GIWW to its full potential while protecting coastal resources.

SUMMARY

THE GULF INTRACOASTAL WATERWAY IN TEXAS, 1982

THE GULF INTRACOASTAL WATERWAY

IN TEXAS

INTRODUCTION

The GIWW has well established its reputation as an efficient means of transporting goods to and from Texas, providing a chain of benefits directly and indirectly to the people and to the economy of our state. Like any other valuable piece of working equipment though, it needs regular maintenance and improvements to preserve its usefulness and advance its capabilities according to the demands on the system. The viability of the GIWW depends largely on its' ability to be competitive with other modes of transportation.

Having surpassed early traffic expectations long ago, and now fast approaching its limiting physical capability, serious consideration must now be given to the issue of enlarging and improving the waterway system. Since 1968, the volume of tonnage moved on the GIWW in Texas has been between 60 and 70 million tons annually, and until the last few recession years, the volume of commerce has been edging upward toward the 1972 high of 69 million tons. Predictions for continued growth of commerce on all national waterways is high through the year 2000 and the Texas GIWW must be able to meet the challange.

COMMERCE PATTERNS OF MOVEMENT

The directional flow of commodity movements of imports and exports reveals important characteristics of the Texas waterborne commerce trade patterns, and provides an important insight into the commercial livelihood of the GIWW. For ease in classification these trade patterns

have been separated into three major flow patterns: inland traffic flow (rivers and channels), coastal traffic flow (shallow water and coastal shipping), and foreign traffic flow (deep water overseas shipping).

Of the 20.9 million tons of export goods shipped to the inland waterway system of the U.S. during 1979, the highest volume of freight originated in the "Galveston Bay Complex" of Galveston, Texas City, and Houston. Twelve million tons flowed out of this complex and for almost all export situations, refined petroleum products, chemical and allied products, crude oil and natural gas were the bulk of the materials shipped. Five million tons of goods left the Beaumont, Orange, Port Arthur "Golden Triangle" area with 1.5 million tons being shipped out of Corpus Christi for transportation up the inland waterway system.

Of the 16.2 million tons of imports that flowed from the inland waterway system during 1979, 5.4 million tons were unloaded in the "Golden Triangle" area, and 8.2 million tons in the "Galveston Bay" Complex. It is interesting that the primary imports on the inland system (crude oil and gas, refined petroleum products, and chemical and allied products) were also those that formed the bulk of Texas' export items.

A strong intrastate trade between ports is evident and accounts for 11.5 million tons of goods being transported on the GIWW. Commercial interaction between world trade markets and our ports system would not be nearly as successful without the use of the GIWW that connects our ports together. The protected waterway assures a safe passage between ports for goods that must arrive on time for loading on the ships waiting at dockside. Only the most inclement weather prevents the use of the channel.

The accumulated total of goods leaving Texas ports and destined for foreign markets exceeded 43 million tons in 1979. The Galveston Bay Complex shipped 66% of the total foreign goods, the Sabine Pass Complex shipped 16% of the total, Corpus Christi shipped 13% and collectively 5% of the total foreign exports were shipped out of Freeport, Brownsville and Port Lavaca. Agricultural products accounted for two-thirds of the 43 million foreign exported tons of goods. Foreign imports totaled 153.1 million tons in 1979, of which 89% was crude oil. Crude oil has been the major import item to the Texas port system since the early 70's.

Ports serviced by the GIWW system are important not only to the foreign trade market, but also are the demarkation points for cargos moving along the national coastline. Coastal shipment of goods are moved up the eastern states through relatively shallow Gulf and coastline waters, and to the western states including Hawaii via the Panama Canal or around the Cape of Good Hope. More tons of goods are shipped from Texas to eastern states than the total tonnage shipped overseas. Coastal imports to Texas, however, show low volume movements. Domestic crude oil imports tally only 6.5 million tons, but account for 41% of the total coastal import movements. Refined petroleum products follow at 38% and chemical and allied products account for another 10% of the movements.

COMPETITION FOR WATERWAY SPACE

Aside from the voluminous commercial activities in and around the GIWW, another lively aspect of the Texas coastal scene whose impact shows increasing potential is that of recreational boating. This industry has favorable effects on the economy of the Texas coastal

region, but present a very real threat to the delicate marine ecology of the coastline. Hundreds of thousands of recreational boat trips along the coast each year place a heavy load on the limited public and private facilities and their numbers also greatly increase the risk of marine accidents. Thus, in the interest of perpetuating a profitable industry, the State of Texas must review the recreational boating usage with prudent forethought to prevent the loss of irreplaceable natural resources as well as for promoting its economical aspect.

A study of recreational boating in Texas coastal waters was conducted by this Department to furnish base data for attempting to understand the problems soon to be faced by the overcrowding of our coastal facilities. The study utilized a survey of recreational boat owners in the coastal areas and as expected it was learned that those boats registered closest to the coastline generally make more trips to coastal waters. Therefore, the majority of the 2.4 million recreational trips to Texas coastal waters during the year 1979 originate in counties that touch the coastal waters.

Congestion is one side effect caused by the high numbers of recreational boats using the coastal waters. Peak periods of activity during the warmer months of May through October (averaging 274,200 trips per month) promote congestion since this is the most popular time for pleasure boating. The extensive use of restricted width jettied channels, and the GIWW, for passage from one body of water to another also adds to the crowding factor. In the pursuit of business, many recreational facilities have tended to concentrate along these channels, or at junction points of the channels, adding even more to the crowding of such areas.

The majority of boat trips originating 100 miles or less of the coast, generally are trailered to water and, therefore, do not require coastal storage. However, nearly one-third of the boats that travel 100 to 200 miles to the coast do require some type of storage at the coast. Development of additional storage facilities should not only be encouraged but supervised by local authorities so that congestion and safety hazards are eliminated.

Pleasure craft of different types and sizes enjoy many different forms of recreation at the coast, but by far the most popular type of recreation is fishing. About 81% of the 2.4 million recreational boat trips in 1979 went fishing. Water sports and cruising averaged about 178,000 trips each or nearly 15% of the total. Hunting was least popular activity with only 92,000 trips or 4% of the total reported.

Additional questions determined the frequency of use of the various regions, bodies of waters, and navigation channels for recreational purposes. Those most frequently used are as follows: the Galveston Bay complex initiated the most trips (almost 968,000); Harris County alone had 441,000 trips originating from it and was the highest of any other county; and excluding the GIWW, the Galveston Ship Channel was the most used navigation channel with 388,000 trips. The GIWW trips totaled 1.9 million or about 80% of all recreational trips in 1979. The individual trip length usage of the GIWW was from one mile or less up to the entire 426 miles of the Texas GIWW. It was learned from the survey that less than 1% of all trips are using the unsafe practice of mooring overnight on a navigation channel, and less than 20% of the total trips moor overnight on any type of coastal water body.

TAXATION FOR USE AND SERVICES

The issue of cost recovery measures to pay for the operation and maintenance of America's navigable waterway projects has been debated since the 1930's. Although relevant arguments have been spoken both for and against the issue, only as of late have the legal processes been firmly set into the goals of Congressional legislation. In 1978, Congress enacted the Inland Waterway Revenue Act of 1978 which established a fuel tax on commercial users of inland waterways. The tax, capable of only a modest 20-25% recovery of navigations costs per year when fully implemented, began at 4 cents a gallon and will increase regularly to ten cents a gallon by 1985. These monies are to be accumulated in a Water Trust Fund to function much as the Highway Trust Fund has been used. But, in an effort to recover 100% of the costs of the waterway system to the federal government, even more taxes are being proposed.

FEDERAL USER TAX STUDY

In an effort to protect the sensitive balance between the competition of water carriers and other transportation carriers, Congress instructed the Secretaries of Transportation and Commerce through Section 205 of Public Law 95-502, "Inland Waterway User Taxes and Charges", to evaluate the impacts of waterway user taxes and fees. A most difficult aspect of the study was to decide exactly who should be required to pay the proposed user charges and in what proportions, as many beneficiaries of the use of the waterway system are unidentifiable and therefore untaxable. To whatever extent that cost recovery taxes are levied, it is necessary that the taxes should encourage economic efficiency and should not incur cross-subsidization of

waterway segments. Pros and cons exist for the many possible tax vehicles; therefore, it is most difficult to recommend one method that is equal for all individual situations and still be efficient. Realizing the many possibilities of cost recovery taxes and their potential effects, the study first established a base forecast of barge transportation progress through the year 2000 assuming no taxes being assessed. All tax scenarios are then compared to this base forecast. In particular, system-wide taxes and segment-specific taxes with incremental percentages of cost recovery for each were studied. Although lockage fees, license fees, and congestion fees were evaluated and determined to be somewhat applicable to either system of taxing, the tax forms generally associated with system-wide and segment-specific taxing systems are fuel taxes and ton-mile taxes, respectively. Segment-specific taxes were found to yield the smallest overall detriment to barge transportation; but, system-wide fuel taxes would be the easiest to administer and collect.

A user-fee implementation scenario, utilizing a segment-specific ton-mile tax set at a 100% recovery level with zero percent railroad rate response, illustrated that widely varied fees would be required for separate waterway segment taxing. According to the scenario, the initial impacts of segment tolls would cause traffic diversions to alternate modes of transportation of 59.6 million tons (13%) at 1977 levels. However, the traffic diversions are expected to reduce to 6% of the total waterway tonnage (48.1 million tons) by the year 2000 because of increased traffic movements, particularly in less rate-sensitive commodities like coal.

In comparison, a scenario utilizing a system-wide fuel tax for

full cost recovery forecasts an increase of taxes, (37.9¢ per gallon in 1979 dollars would have been required at 1977 levels, 38.1¢ per gallon by 1990, and a slight drop to 35¢ per gallon by 2000). Under a system-wide fuel tax, waterborne traffic pays tolls for the amount of fuel consumed in carrying out the movement, with the amount of the toll bearing no direct relationship to the public expenditures made on the segments actually used. Traffic diversions under the system-wide fuel tax amounts to 10% less barge traffic in 1990, and 9% less barge traffic by 2000. Diversion of waterway transportation to some other mode is a major drawback caused by waterway taxes. If rate changes in other modes are not increased the same amount that the waterways' rates changed, the competitive edge of water transportation is reduced. In the case of the small carrier, it means that he could be put out of business entirely.

The study evaluated the degree of diversion for commodities that are the largest portions of the commerce moved on inland waterways and will continue to be so in the future. It was found that petroleum product traffic on the inland waterway is one of the most sensitive products to increased user fees, and that a system-wide fuel tax would be more detrimental than a segment-specific fee. Traffic with chemical products may have some diversion of modal and source reallocation, but there is little evidence that the levels of user fees identified in the study would bring about any measurable change in chemical industry production levels or regional patterns. Like petroleum products, chemicals are more likely to pay higher fees per ton-mile under a system-wide fuel tax. Fertilizer is a less fuel intensive product to move and since it is often associated with back-hauling, the diversion

rate is about the same for either method of taxing. When back-hauling is in use, there is less penalty under a system-wide fuel tax. A growth in the shipments of coal is projected to double its present volume of 12 million tons by 2000. It is very possible that Texas could undergo full scale mining of a resource that is ideally suited for barge transportation. The battle between rail and barge carriers for coal transportation contracts will be constant. Barge transportation rates will have to overcome the additional costs of bringing the coal to the barges for shipment up the inland water system. Steel products appear to be the most sensitive commodity to the imposition of user fees. The largest end market, the GIWW West, may experience 20% diversion of transportation mode, especially in end-markets which involve hauls on high-cost segments. System-wide fuel tax tolls are less than segment-specific ton-mile tolls for steel traffic, but the rates will be influenced quite a bit by the cost of the waterway operation and maintenance.

Another scenario sought to obtain a 100% recovery by the combination of a segment tax and fuel tax. The diversion result was 8% of the waterway traffic in 1990 (compared to 8% under segment tax and 10% under fuel tax), and a 7% diversion in 2000 (compared to 6% for segment and 9% for fuel tax).

Scenarios using 50% or 75% recovery by segment tolls showed a smaller diversion effect on the industry than did the 100% recovery with a railroad response of 100%. If other-mode rate responses are factored in, the reductions in traffic diversions are less, but are only so when traffic in the commodities are directly affected by the other-mode response. For example, grain traffic, which is subject to

strong rail competition, loses 6% in 1990 under a segment-specific ton-mile toll with 50% rail response (compared to 0% under a 100% rail response scenario). Under a system-wide fuel tax similar effects are seen in 1990 and 2000, but under a 50% rail response the segment-specific ton-mile toll shows a considerably lower diversion.

The impacts of waterway user charges on the United States balance of payments can be expected to be negligible. For the most part, taxes will likely be passed on to the sales price of the commodity unless there is strong foreign competition, and in that case, the carriers may attempt to absorb some of the tax until readjustment to pre-user charge levels is reached in traffic levels. Some overall national effects will be seen in the delay of construction of new facilities. But these new facilities may not be needed soon because of the expected diversion of traffic on the waterway.

TEXAS USER-FEE STUDY

In an effort to acquire a better understanding of the effects of user charges on Texas coastal waterways, the Texas State Department of Highways and Public Transportation (SDHPT) in cooperation with the Texas Transportation Institute (TTI) conducted a study of the impact of navigation user-fees on the economy of Texas. The objectives of the study included identifying primary commodity flows along the Texas Gulf Intracoastal Waterway, forecasting any modal diversion or market abandonment caused by user charges, and projecting the effects of increased shipping rates on regional economies of Texas.

The current federal waterway tax, the first of its kind in United States history, was set at four cents per gallon beginning October 1, 1980, with two cent increments rising to a maximum of ten cents in

1985. Many other user charge proposals have crossed the floor in the U.S. Congress ranging from the President's 30 cent per gallon fuel tax for 100% recovery of federal expenditures for operations and maintenance in 1983, to other variations of cost recovery percentages. Proponents of waterway user charges argue that the fees are needed for maintaining modal competition while opponents claim that all other major modes of transportation are federally subsidized and as a rule are privately owned, whereas the benefits of waterways subsidies are to the public as a whole and not to any special interest groups. Irregardless of the outcome of these debates, it is certain that cost recovery will be a reality in the near future, and the effects of whatever measures adopted will cause definite effects on the economy of Texas. Although the GIWW in Texas has been a viable support to the economy of Texas, it has been almost totally maintained and constructed at the expense of the federal government. It is possible that the State, as non-federal sponsor of the GIWW, will soon be entertaining a much more active role in the operation and maintenance of the waterway.

There are three alternatives of user charges applicable to Texas: fuel taxes, segment tolls, and license fees. The use of the lockage fee is not possible because there are no locks except the flooding locks of the Colorado and Brazos Rivers. The fuel tax has the capability of generating high revenues because of the high ton-mileage which is characteristic of the GIWW West (Texas GIWW plus New Orleans) and therefore promotes higher fuel consumption. Since the operations and maintenance costs of this portion of the navigable waterways is low to medium, it is probably subsidizing the higher operation and maintenance costs of the Mississippi River System. A second

alternative of user charges and also a method of avoiding cross-sectional subsidization, is to structure the fee schedule on the amount of federal expenditures for each segment and to levy a ton-mile tax. The initial impacts of a segment toll would be the loss of low value bulk shipments. The tolls on each segment would vary accordingly with the costs of each segment, and depending on the demand and cost structures of the firms and industries located on each segment would determine whether or not they would survive the increased rise in their overhead. The third possible user charge alternative for Texas would be license fees applied to a fixed operating charge on towboats and barges based on horsepower, registered tonnage or cargo capacity. It would represent a fixed cost to the firm which could be distributed over the shipping season so that slack periods are not so severely taxed.

The primary commodities moved in 1977 on the Texas GIWW were identified as fuels, chemicals, and crude petroleum, followed by general mining shipments, and primary iron and steel, all of which are high-value commodities. The greatest effects expected of user charges on high volume-high value shipments of fuels, chemicals and crude petroleum could be higher energy costs for the general consumer, and a loss of traffic from increased shipping rates, followed by a slowing of new industry moving into the Texas coastal area. The effects on high volume-low value shipments could be ruinous for certain waterway segments, and the effects on low-volume low-value commodity movements might completely eliminate certain firms from competition.

Due to the low-ton mileage and high maintenance and construction costs characteristic to the Corpus Christi to Brownsville segment, it

is the most sensitive of the five Texas GIWW segments to user charges, particularly a segment toll at any cost recovery level. Generally the distribution by type of commodity moved is fairly uniform so that no single segment carries entirely low-volume or low-value tonnages. As long as segment tolls are avoided as cost recovery measures, the segments should be able to adjust to the effects of user charge effects.

Questionnaires to the various types of commercial users of the GIWW asked for their response to different recovery schemes and what effect in their opinion to volume and rate change would result from each. Collation of the answers furnished the following information with respect to a fuel tax.

Fuel Tax Rate (per gal.)	Percent Recovery		Volume Change (%)	Rate Change (%)
	Operation	Maintenance		
$0.04	--	--	-0.3%	+4%
$0.10	25%	25%	-2%	+7%
$0.50	50%	100%	-10%	+30%
$0.75	100%	100%	-20%	+40%

Responses to the effect of a segment-specific tax varied and could not be readily tabulated. It was apparent from the responses that there were wide gaps in existing information on the waterway user charge issue and a general lack of accessible data.

The least detrimental tax is believed to be a low-level across the board fuel tax. License fees were thought to be less detrimental than segment tolls. The general response from the participants in this

report was that the waterway industry should bear some portion of the operating, maintenance, and construction costs of the waterways but that the waterway system was a federal responsibility and should be in the large part financed by federal funds.

Further research on the inland waterway user charge issue is urged. The SDHPT/TTI study is an attempt to synthesize the existing information regarding the potential effects of varying levels and types of user charges on the Texas GIWW and their impact on Texas' economy. But the surface has only been scratched and it is necessary that full ramification of such a tax should be thoroughly researched in order to ward off "quick action" on taxes that later will prove detrimental to a vital part of our nation's transportation system.

INCREASING ROLE OF THE NON-FEDERAL SPONSOR

The State's current role as the non-federal sponsor of the Texas GIWW is certain to undergo changes due to federal budget cutbacks and up-coming legislation of federal cost recovery measures. Both federal actions will steer the State toward a more active responsibility for the management of the GIWW. A $150 million cutback in the Corps of Engineers' 1983 operations and maintenance budget could inflict a shortfall of funds for the maintenance of the GIWW, particulary the Corpus Christi to Brownsville segment. Although of great economic value, this segment has been listed as one of the nation's inland waterway segments that has a low waterbourne commerce level and may therefore cause its maintenance to be stopped. In addition to budget cuts that will curtail services previously assumed by the Federal government, federal cost recovery taxes will be assessed on the remaining services that provide uninterrupted assistance. Accordingly,

the non-federal sponsor should be prepared to continue servicing the waterway so that the coastal economy is not impaired. Therefore, during the Sixty-Eighth Legislative Session of Texas, funds should be allocated to maintain at least the "status quo" of the GIWW through the fiscal years 1984 and 1985, when it is then expected that Congress will have finalized their cost recovery program. In the meantime, it will be necessary that the Corps of Engineers maintain the GIWW for safe navigation through 1983. Soon, it must be determined if tributary channels are to be maintained by the State river authorities or port authorities. According to the Galveston District Engineer of the Corps of Engineers, the Arroyo Colorado channel and the Port Mansfield channel may not be maintained in 1983 and maintenance of the channel to Victoria for that period is also doubtful.

NEEDED LEGISLATION

Prior to construction of any future water projects, a longstanding stalemate between the Texas Constitution and Section 221 of Public Law 91-611, the Federal Flood Control Act of 1970, must be resolved at the federal level. The current provisions of Section 221 contain rigid restrictions that require the Corps of Engineers to draw construction contracts in which the non-federal sponsor must legally hold and save the United States free from any damages incurred in the construction and maintenance of waterway projects. The State Highway and Public Transportation Commission cannot sign a contract with that indemnity clause, because it is in violation of the Texas Constitution by pledging the credit of the State. To break this stalemate between the federal statutes and the State Constitution, a waiver or limitation of these indemnity requirements must be inserted in some federal

legislation.

To further ease the State's transition into a more active management of the GIWW, legislation is also necessary at the state level. The State Department of Highways and Public Transportation needs the legislative authority to issue contracts for dredging and making improvements should the Corps' responsibility for the channel be limited or removed.

MAINTENANCE REQUIREMENTS

Regular maintenance of the GIWW and its tributary channels is determined by the shoaling rates of the individual channels to the point that navigation is unsafe or impossible. Average shoaling or silting-up rates for the main channel and its tributary channels are farily predictable except for the problems caused by floods and hurricanes. Constant shoaling of the channels requires a never ending maintenance program to keep the channels open and safe for movements of commerce.

Albeit regular maintenance of the GIWW is vital, the real success of the GIWW lies in future improvements to the system to insure its competition among other modes of transportation. In 1962, Congress had authorized deepening and widening the GIWW to 16 feet by 150 feet, based on a study's findings that the movement of tonnages on the waterways had exceeded the original expectations and thus merited channel improvements. Unfortunately, the project was placed on inactive status because no local sponsors could or would support the project. Now, some twenty years later, the commerce values have almost doubled that of the early 1960 era placing the status of efficiency drastically below standards. A thorough feasibility study to determine

the current condition of the system is urged, and the findings should be acted upon as soon as possible to deepen, widen, and straighten the channel. Deepening the channel will allow the waterway a greater capacity for handling dead-weight tons, thus making commodity movements more economically efficient. Widening and straightening will increase the limited tow capacity which is currently five large barges lashed in a single file. Improvements to the waterway in respect to the manners discussed above will certainly enrich the cost-efficiency of waterway movements, increase the ability to compete for business, and decrease costs to shippers.

The responsibilities and steps in modernizing the GIWW are quite extensive and may soon be solely up to the state or at least in part. The non-federal sponsor must supply levees, weirs and drainage ditches, and if needed, relocate utilities or pipelines or possibily reconstruct restricting bridges. Property acquisitions for rights-of-way, disposal sites, dredging requirements, and open-water disposals, will all be criteria for construction of water-related projects and maintenance. The required acreage and cubic yards for dredge removal and disposal necessary for construction and maintenance for six proposed channel dimensions has been documented, as well as the costs incurred by their construction.

In addition to deepening, widening and straightening improvements, the two locking structures on the waterway need to be updated. The Brazos River floodgate, although not a true locking facility, can complicate or eliminate traffic flow in the following ways: poor alignment with the GIWW at the crossing of the river, a river current that exceeds two miles per hour with a differential head of .8 feet

that limits tows to one loaded or two empty barges, and if the differential head reaches 1.8 feet or more, navigation is impossible.

The second locking facility is the Colorado River Crossing. This facility can lock traffic across the river as long as the differential head does not exceed 10 feet. This facility seems adequate at this time but tow operators would like to see the lock moved further away from the river so that more speed could be obtained before crossing the swift river current to reach the other side.

CONCLUSION

Cost recovery Federal legislation will likely include some type of user fees, and will probably be enacted by the 1983 Congressional Legislature. The assessment of user fees to recover the percent of federal participation for water projects will cause a small recession in the waterway shipping industry that may extend until the year 2000. Federal budget cutbacks will have more immediate effects, in that operations and maintenance of the GIWW which have been furnished by the Corps of Engineers may be reduced or eliminated completely. In order to better meet the new responsibiities as the non-federal sponsor of the GIWW, the State should evaluate some means of funding their own portion of waterway costs.

RECOMMENDATIONS

The sponsorship of the GIWW has passed from the county, port authority, navigation district, and other local parties, to a single agent with the ability to act in the interests of all previous sponsors as well as for the interest of the state. With increasing responsibility being thrust on it by the federal government, the State

Highway and Public Transportation Commission has formulated actions and suggestions for management and for improvements concerning the GIWW.

These recommendations are believed to be the most appropriate solutions to the mounting problems facing the people of Texas and of one of their most valuable assets, the Texas Gulf Intracoastal Waterway and the coastal recreational playground. Consequently, the Commission recommends the following legislative actions be taken:

1. State and Federal resolution of the conflict existing between the Texas Constitution and Section 221 of Public Law 91-611.

2. State legislative authorization for the SDHPT to enter into contracts for dredging and improvement of the GIWW and, in general, assume the responsibilities of the Corps of Engineers should their participation in operation and maintenance of the GIWW be reduced or withdrawn.

3. Provide State funding in an amount sufficient to cover operational and maintenance costs of the GIWW should the Corps of Engineers withdraw or limit their services.

The Commission also recommends that the following improvements to the GIWW be undertaken:

1. The GIWW from the Sabine River to Corpus Christi should be widened to a minimum of 250' in order to facilitate larger and more cost-efficient tows.

2. The depth of the GIWW from the Sabine River to Corpus Christi should be increased to a minimum of 16' to reduce frictional loss to tows and help in maintaining bottom clearance.

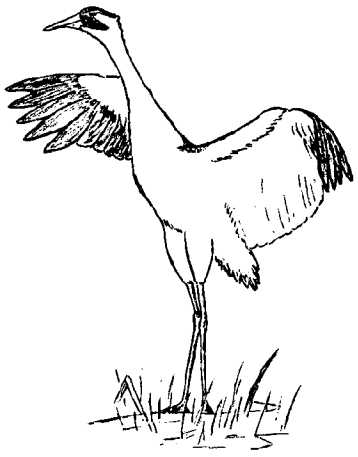
3. Where possible, the GIWW should be straightened and all bends or curves restricted to a 1 degree curvature or less.

4. The Brazos River flood gates should be replaced with true locking facilities so that small rises in the river do not shut down traffic.

5. Additional public launching and recreation areas should be constructed at appropriate locations so that the anticipated increase in recreational use of the GIWW can be accommodated in a safe and orderly manner.

CHAPTER ONE

A SUMMARY OF THE PREVIOUS REPORT



A SUMMARY OF THE PREVIOUS REPORT

The Gulf Intracoastal Waterway (GIWW) is a shallow-draft channel that stretches along the entire coastline of the Gulf States, from the southernmost tip of Florida to the edge of the Texas border of Mexico. This waterway is like a life-line to the economy that connects trading partners in other states and nations. It is also an important thoroughfare for the armed forces during times of war, and has become increasingly useful to the boating public. Many industries have settled in regions along the 426 miles of the Texas GIWW. The efficiency which barge transportation lends to the movement of their commodities has provided an economical advantage that furthered their enterprises. Through the GIWW, whether directly or indirectly, the prosperity of Texas and that of the people who live within have been advanced and the setting for a thriving economy has been implanted.

RECREATIONAL BOAT STUDY

The evaluations of the Gulf Intracoastal Waterway in Texas have shown the need for a study to determine the extent of recreational boating in Texas coastal waters. A significant impact to the coastal regions of Texas has resulted from the recreational activities of pleasure craft, therefore, an accurate knowledge of the nature and magnitude of boating related activities will assist the planning of public facilities that would best accommodate the recreationists.

It was determined that a survey of the boating public would portray the most accurate picture of their activities. Due to the colossal number

of registered boats in Texas, a random sampling of the recreational boat owners was conducted. To further reduce the size of the survey and to concentrate the effectiveness of the investigations, only those boats registered within 200 miles of the coastline were surveyed. It was assumed that the boats registered farther than 200 miles from the coastline would account for very little, if any, activity.

A preliminary analysis of the information received from the survey indicated that in 1979 an estimated 430,000 of the total 2 million trips were initiated in Galveston Bay. There were over 800,000 trips that started in the Galveston Bay complex which included East Bay, Galveston Bay, and West Bay. Additional information derived from the survey was that peak periods of recreational boating occurred during the months of May through October. It was also learned that 1.6 million pleasure trips utilized the GIWW during 1979.

TEXAS' MARINE COMMERCE

The trade movements of goods through Texas' deep-water ports have been undergoing changing patterns in regards to the volumes of in-coming and out-going freight. Using 1970 and 1977 as comparative years, it can be seen in Figure 1 that for many Texas ports there was a rapid growth in the percentage of receipts as compared to the growth in the percentage of shipments. Three Texas ports that exemplify the higher growth rate of receipts over shipments are as follows:

PORT	PERCENT OF CHANGE FROM 1970-1977 RECEIPTS	PERCENT OF CHANGE FROM 1970-1977 SHIPMENTS
Beaumont	up 310%	down 23%
Houston	up 133%	up 21%
Corpus Christi	up 318%	up 14%

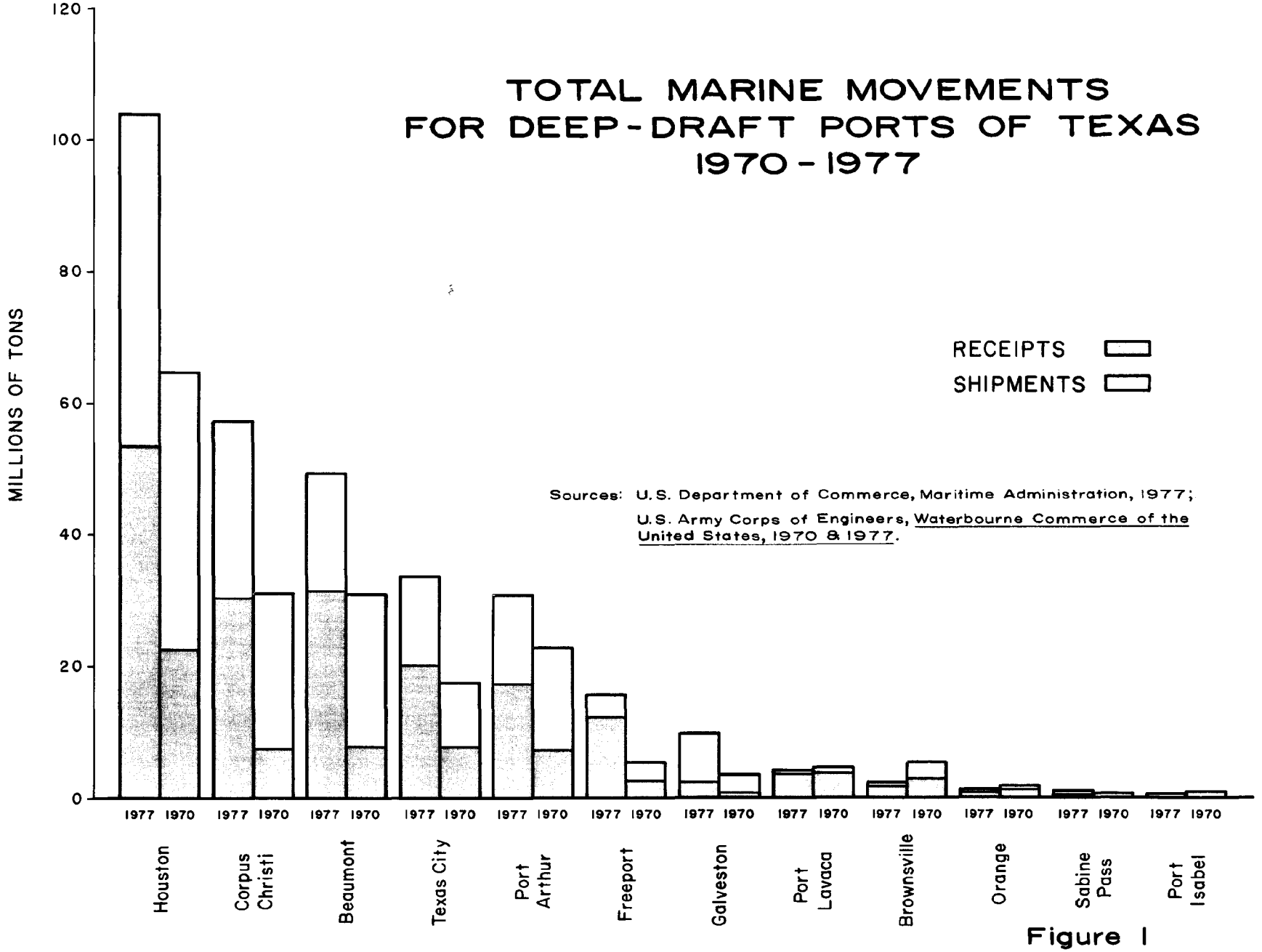

TOTAL MARINE MOVEMENTS
FOR DEEP-DRAFT PORTS OF TEXAS
1970-1977
MILLIONS OF TONS
120
100
80
60
40
20
0
RECEIPTS
SHIPMENTS
Sources: U.S. Department of Commerce, Maritime Administration, 1977;
U.S. Army Corps of Engineers, Waterbourne Commerce of the United States, 1970 & 1977.
1977 1970
Houston
Corpus Christi
Beaumont
Texas City
Port Arthur
Freeport
Galveston
Port Lavaca
Brownsville
Orange
Sabine Pass
Port Isabel

Figure 1

The real significance of the changes in the marine movement of goods can be more easily seen by individually analyzing the three trade routes of freight movement which are: inland waterway movements which include the GIWW and all other waterways serving the inland United States, coastal waterway movements which serve other states via deep-water paths of the coastline, and foreign trade movements.

The total volume of inland marine movements in 1977 was 69 million tons. For this system of movement the number of in-coming goods had always been higher than the number of out-going goods. But, in 1973, this trend reversed and the total of out-going goods is now greater on the inland marine system.

In 1977 the volume of freight that moved on the coastal marine system was about 64 million tons of goods. Volumes of export goods moving along the coastal system have consistently been higher than the volume of import goods.

Through 1973 the majority of goods that moved on the foreign marine system were export goods. However, since 1974, there has been a reversal of that trend and by 1977 a total of 128 million tons or 79% of the total 162 million tons of goods moved on the foreign system have been import goods. The commodity that was predominately responsible for this change and for the rapid increase in the amounts of import goods was foreign crude oil. In 1974 38 million tons of imported crude passed through Texas ports, while only 28 million tons were exported. By the year 1977, the foreign crude imports amounted to 112 million tons as compared to the export of 16 million tons of domestic crude. Movement of other commodities remained at about the same levels.

Collectively, the total tonnages handled for the three individual marine movements in 1977 were above the 300 million tons mark. A plot

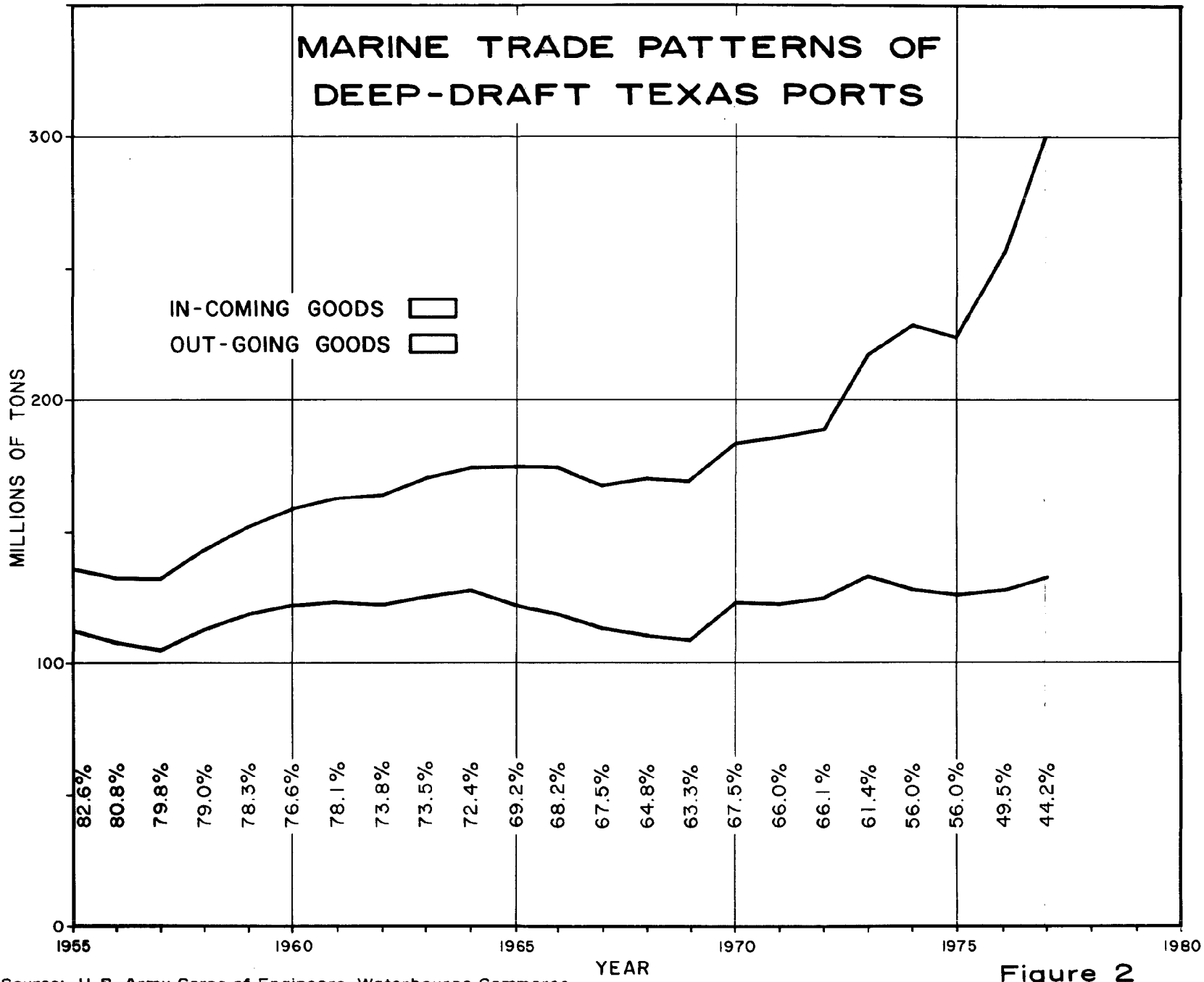
of state-wide yearly totals of marine exports and imports for Texas deep-draft ports is shown in Figure 2. Percentages of exports are noted for each year, thus showing 1975 as the last year for which export volumes exceeded import volumes. It is highly probable that this trend will continue and as this information is available, it will be updated in our subsequent GIWW reports.

GIWW SPONSORSHIP RESPONSIBILITIES CHALLENGED

Section 221(b) of the Flood Control Act of 1970, (Public Law 91-611), requires the non-federal sponsor of navigation projects to hold the Federal Government free from damages incurred as a result of a project. Without this agreement, an official contract with the Corps of Engineers cannot be signed. The Texas Coastal Waterway Act of 1975, declared the State of Texas to be the non-federal sponsor for the main channel of the GIWW in Texas, thus assigning the State of Texas to be responsible for future damages incurred by any GIWW projects. This legislation caused a conflict between federal statutes and the Texas Constitution because the constitution declares that the credit of the State cannot be pledged. Recognizing that without necessary maintenance dredging of the channel it would soon become hazardous or even impossible to navigate, the Corps of Engineers decided to maintain the channel until ordered by a higher authority to cease.

FEDERAL FUNDING CUTS

The rising costs of construction and maintenance projects, in addition to other inflationary pressures, led to a shortfall in funding available to the Corps of Engineers for the fiscal year 1980. The loss of funding was reported to be $170 million for the fiscal year 1980 with



Source: U. S. Army Corps of Engineers, Waterbourne Commerce of the United States, 1955—1977.

Figure 2

proposed funding cuts of $100-$165 million from the fiscal 1981 budget of $414 million. Meanwhile, the Corps of Engineers had scheduled a record-setting $37 million for maintenance dredging and structural repairs to navigation channels in Texas. It was uncertain how much of this needed work would be postponed due to the funding shortfall.

LENGTHLY PERMITTING PROCESSES

Strict environmental regulations regarding the selection of dredge materials disposal sites have resulted in lengthly permitting processes, both State and Federal, which endangers the viability of navigation projects. Results from in-depth bioassay testing of dredge material effects on the ecology of a disposal area must be completed prior to issuance of a federal permit. Meanwhile, needed dredging operations are postponed which then allows siltation, leading to hazardous shoaling conditions, groundings of craft, and the necessity of light-loading vessels.

FEDERAL NAVIGATION STUDIES

A federal study was required by legislation to determine the effects of the first federal tax on commercial navigation in U.S. history. The legislation required the Secretaries of Transportation and Commerce to conduct a study of inland waterway user charges and make findings and policy recommendations to the U.S. Congress by September 30, 1981. There have been stern warnings by waterway interests that this study is oriented strictly from the national level. It has been suggested that states should conduct studies of the impact of navigation user-fees at their own local level because their input is essential if their interests are to be protected. In response, this Department, in cooperation with the Texas Transportation Institute, began a study in 1980 of the impact of

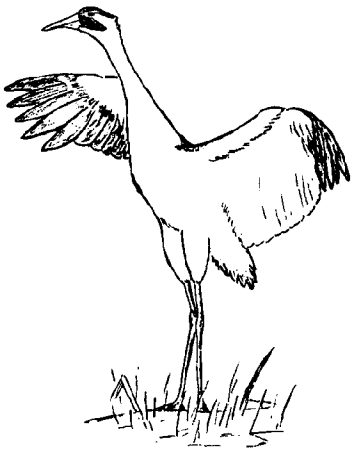
navigation user-fees upon the economy of Texas. The findings of this study are presented within the 1982 GIWW report.

Another study that could have strong impact on navigation in Texas is the National Waterways Study. This study has painted a bleak picture of the future marine shipping in Texas. It forecasted an increase in demand in the next 25 years for certain domestic marine shipments: coal up 126%-197%, farm products up 115%-146%, and metallic ores up 76%-112%. Most of the commodities projected for these increased demands will not move through the domestic marine commerce in Texas. The study also classified the Texas portion of the GIWW from Corpus Christi to Brownsville in a low-class funding category. Under various funding strategies in this study, the low-class categories could be relegated to receive minimum funds for operation and maintenance, or could even be deauthorized as federal projects.

The challenge of GIWW sponsorship responsibilities, lengthly project permitting processes, the federal funding crunch for marine transportation, and the apparent narrow orientation of the two major federal navigation studies all seem to indicate that the State will have to be active and alert to protect their local interests in maintaining a viable domestic navigation system, upon which much of their economy depends.

CHAPTER TWO

TEXAS MARINE COMMERCE UPDATE



TEXAS MARINE COMMERCE UPDATE

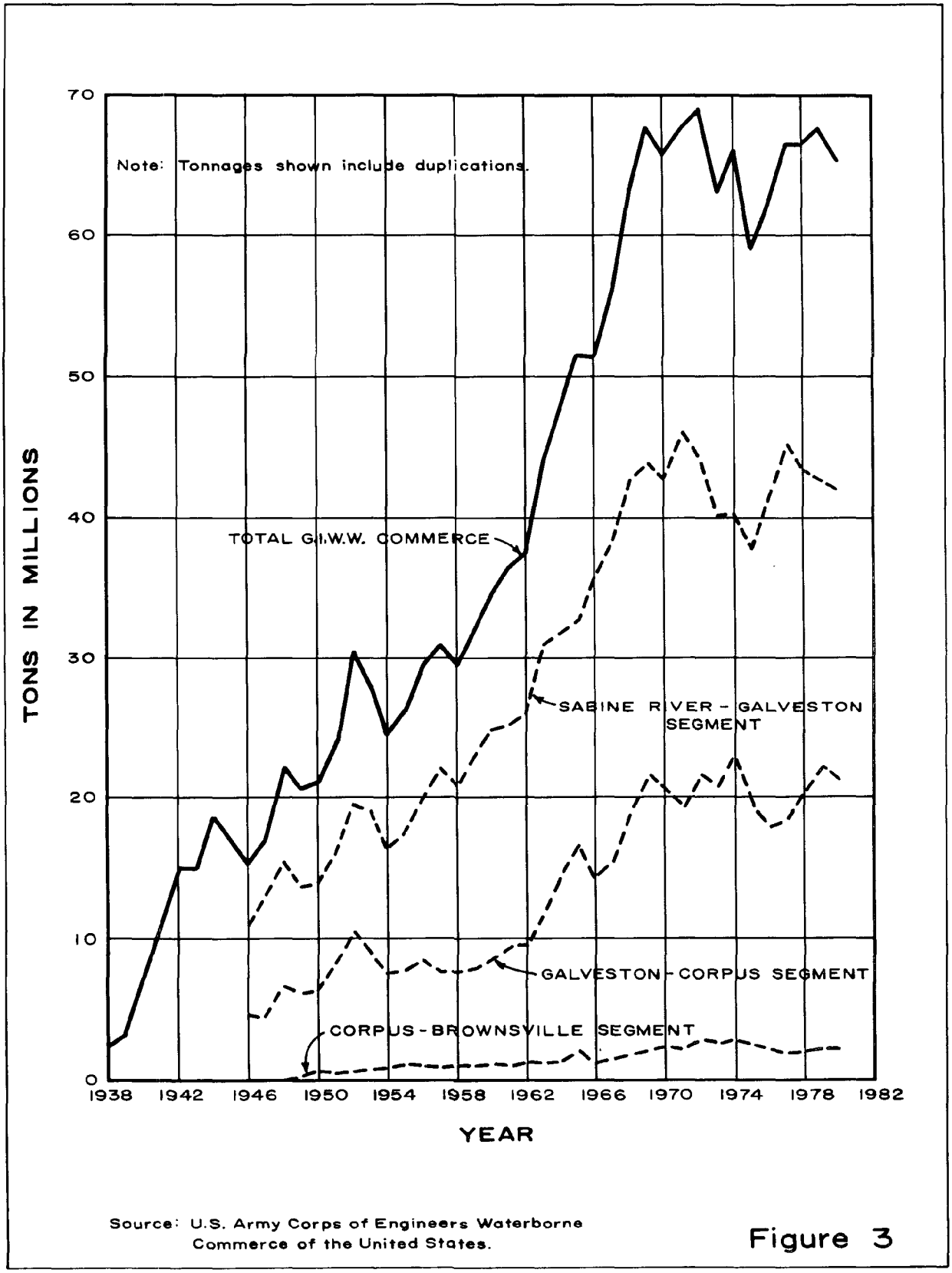
The total importance of the GIWW is sometimes not fully recognized. Obvious contributions to the economy such as employment, income and revenues, often overshadow other benefits just as important as those mentioned. Add the benefits of water circulation to otherwise closed bays, paths of travel for finfish, and for the fishermen who pursue them, escape routes for shallow draft boats threatened by impending hurricanes, an avenue for just plain lazy cruising in a boat, and it is easy to see that this list could almost be endless. The development of industrial parks along the canal are attracting new industries to take advantage of an economical form of transportation for getting their products to market. These industries, in turn, attract employees who need the services of other businesses, cause growth in a community, furnish the tax dollar to run the community, and help provide a better level of living for all the people.

With such an asset then to be used by the people and the economy of the State it is necessary that the "pulse" of the GIWW, or its commerce, be continuously monitored and analyzed to establish the "health" of the system.

YEARLY COMMERCE VOLUMES

To aid in understanding the growth of the GIWW, a line graph tracing the total commerce volumes for 1938 through 1980 is shown in Figure 3. As a further aid to understanding the movement of commerce, the total

MARINE COMMERCE ON THE G.I.W.W.



Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States.

Figure 3

volume for each year is broken down into three separate segments along the GIWW and the volume of commerce moved on each plotted.

In 1925 when Congress authorized the original 9 foot by 100 foot canal, it was estimated that it would have to handle two million tons of traffic annually.[1] In 1940, two years before authorization to enlarge the canal to 12 feet deep by 125 feet wide, the tonnage had climbed to 7.3 million tons annually. Since that last improvement, the annual tonnage had rocketed to an amount that since 1968 has fluctuated between 60 to 70 million tons annually. This pattern, with its relative stable pattern for the last ten years perhaps is an indication that the capacity of the canal has been reached. In the near future, the question of enlarging the GIWW should be carefully studied and if warranted the necessary construction should be started. Many problems will be presented if widening is to be accomplished. Ecological studies will be required, land for right-of-way for the canal and for dredged materials storage must be purchased, relocation of utilities, replacement of bridges, and construction of containment dykes for the spoil must be completed before the actual dredging of the canal can begin.

Naturally, not all of the GIWW canal carries the full 60 plus millions of tons each year, so Figures 4 through 10 have been devised to show the various flow volumes of commerce on the canal during the year 1979. 1979 is the last year for which detailed information on goods movement on Texas waterways is available. Again, three major flow patterns are presented as follows: inland traffic flow, coastal traffic flow, and foreign traffic flow. Each major pattern is further broken

[1]Report of Board of Engineers of Rivers and Harbors, War Department, March 6, 1939, p. 4.

into import volumes terminating in Texas and into export volumes originating from Texas.

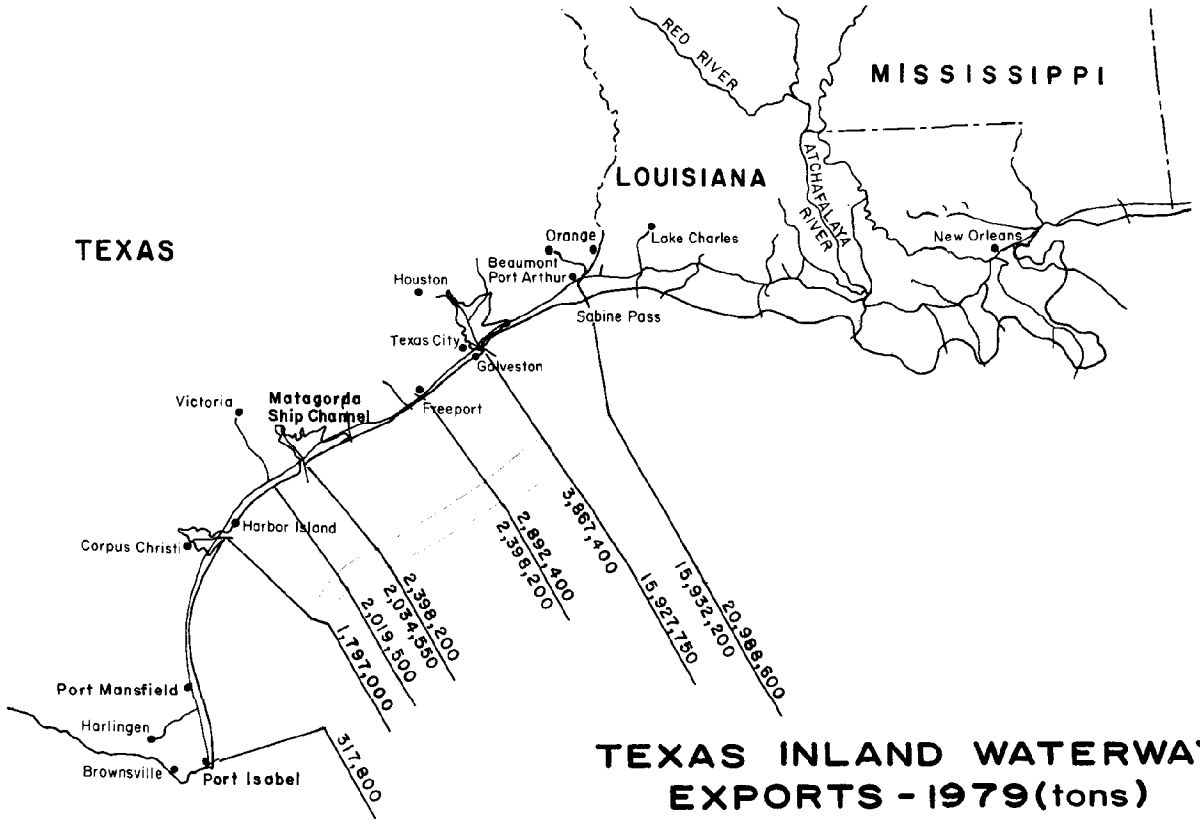
INLAND WATERWAY SYSTEM

Figure 4 illustrates the flow of export goods along the inland waterway system. The accumulation of freight volume starting from Brownsville and Port Isabel is greatly increased by contributions to the volume from the industrial complex areas that have developed around the canal and port systems. As has been the rule, the Galveston, Texas City, Houston complex contributed the larger volume of freight by adding 12 million tons to the flow volume. Export commodities follow a pattern that is maintained for almost all export situations in that crude oil and natural gas, refined petroleum products, chemical and allied products make up the bulk of the goods moved inland, along the coast, and overseas.

Commodities exported up the inland waterway system are refined petroleum products (53%), chemical and allied products (34%), crude oil and natural gas (7%), and others (4%).

The flow of import goods into the state using the inland waterway system is shown in Figure 5. Approximately 5.4 million tons of goods terminate in the "Golden Triangle" area of Beaumont, Port Arthur, and Orange. Another 8.2 million tons are distributed to the Galveston Bay complex that include the cities of Houston, Texas City, and Galveston. Some of the same items imported were those that formed the bulk of export items. Imports include crude oil and gas (33%), refined petroleum products (28%), chemical and allied products (15%), primary metal products (6%), agricultural products (5%), and others (13%).

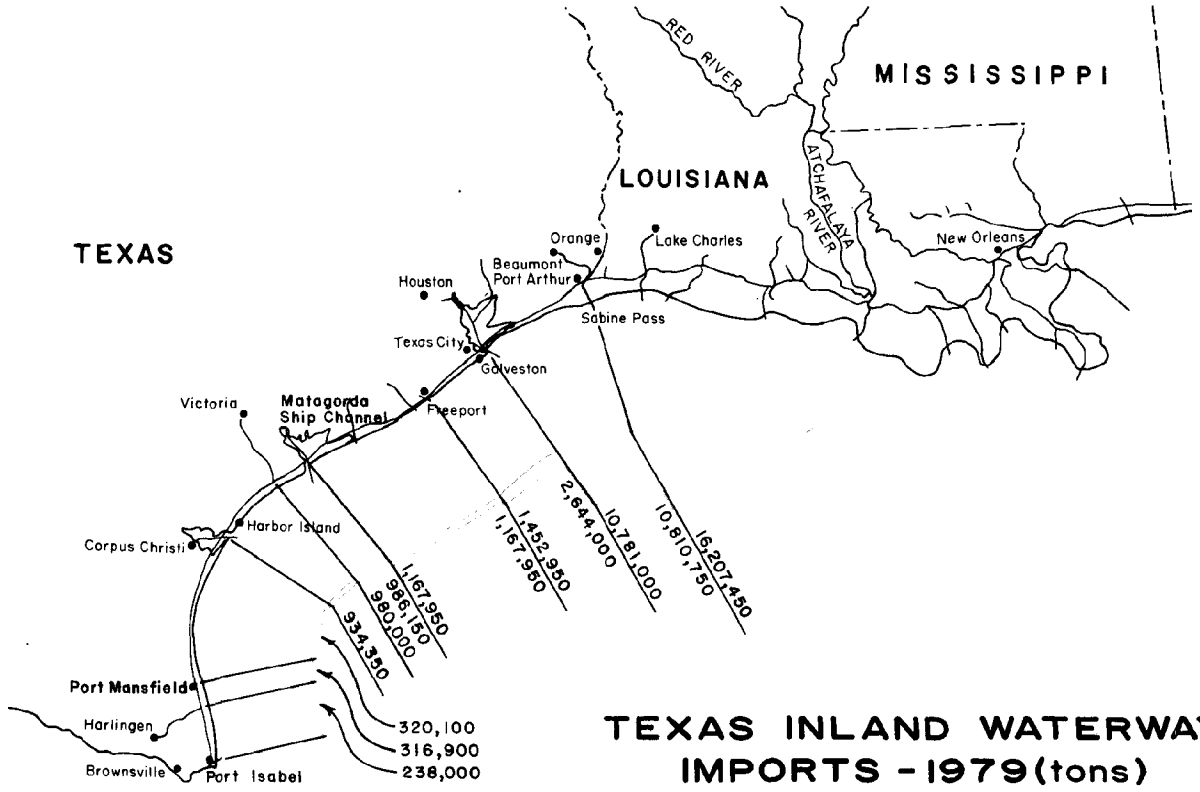
Intrastate movements of goods count for a large part of the commerce



TEXAS INLAND WATERWAY EXPORTS - 1979 (tons)

Source: U.S. Department of Commerce, Maritime Administration, 1978 & 1979; U.S. Army Corps of Engineers.

Figure 4



TEXAS INLAND WATERWAY IMPORTS - 1979 (tons)

Source: U.S. Department of Commerce, Maritime Administration, 1978 & 1979; U.S. Army Corps of Engineers.

Figure 5

on the GIWW. Trade between ports, plants, and industrial complex areas is brisk and again is dominated by refined petroleum products (35%), chemical and allied products (25%), crude oil and gas (17%), mining materials, non metallic (6%). Figure 6 is a flow chart for goods moving on the GIWW within the state borders.

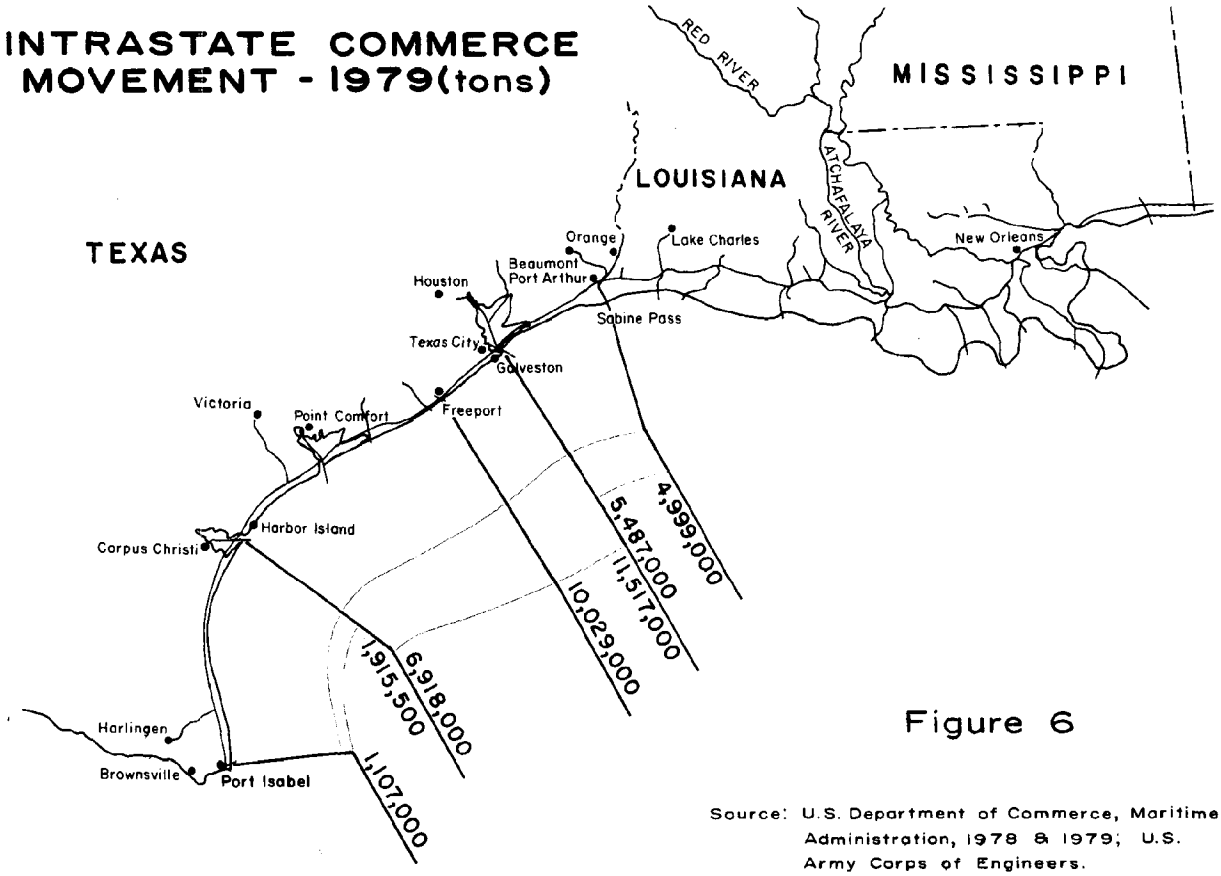


Figure 6

Source: U.S. Department of Commerce, Maritime Administration, 1978 & 1979; U.S. Army Corps of Engineers.

FOREIGN TRADE SYSTEM

A normal visualization of the GIWW is one that includes calm waters, locks and canals, and towboats passing on a summer evening. But that picture hides the fact that the GIWW is a vital, vibrant system that connects the bustling ports of this nation where the commerce to carry on the world trade is accumulated to be shipped to foreign markets. Con-

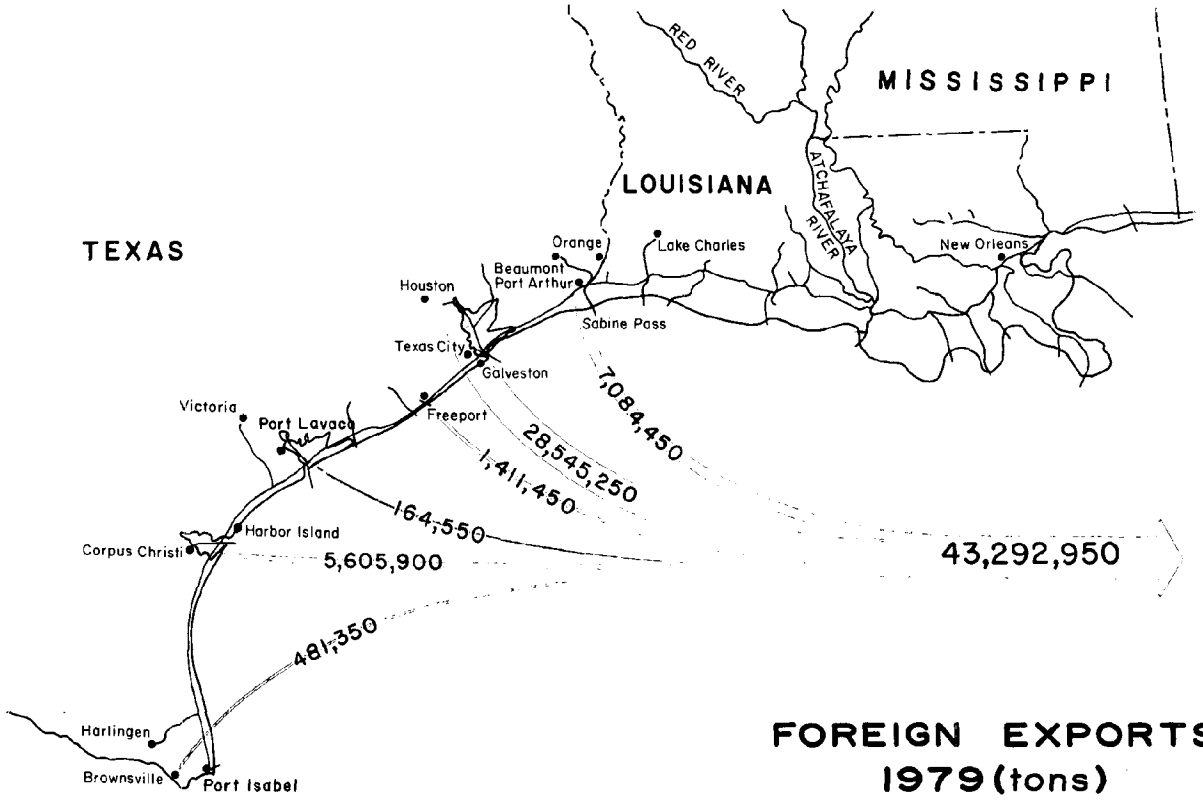
versely, it is a distribution system for the goods that are imported from overseas. No nation can remain isolated and self-sufficient, and no other method of transportation other than deep-water freighting can maintain the capability of moving the vast quantities of goods necessary to keep a nation competitive on the world market. Foreign exports (Figure 7) amount to 43.3 million tons of goods with 66% of that being shipped from the Galveston Bay complex. Approximately 16% leave from the Sabine Pass complex with about 13% coming from Corpus Christi. Freeport, Brownsville, and Port Lavaca account for 5% of the foreign exports.

For this particular instance refined petroleum-products amounted to only 9% of the volume along this major path of water transportation. Dominant cargo for export was agricultural products that accounted for 60% of the total export volume. Chemical and allied products totaled 20%, non-metal minerals 4%, and grain products 4%. However, it will be seen that crude petroleum really set the record when the imports from overseas were analyzed.

When foreign import volumes are mentioned, crude petroleum automatically becomes the main topic of discussion. Of the 153.1 million tons (Figure 8) of goods received from overseas in 1979, 85% of that volume was crude oil. Metal mining ore could only account for 6% of the import volume and was the second highest percentage. The 1980 GIWW report pointed out that since the early 70's crude petroleum has been the major import item to the Texas port system.

COASTAL WATERWAY SYSTEM

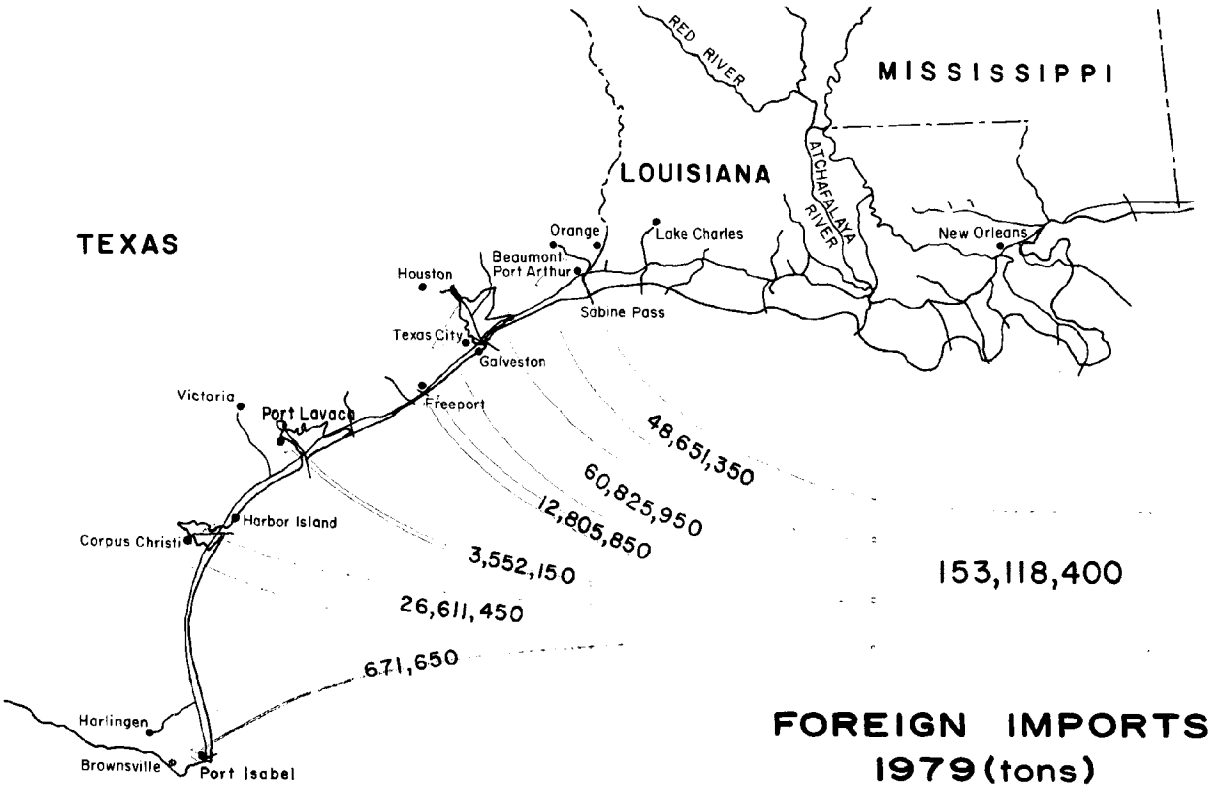
Ports serviced by the GIWW transportation system are important not only to the foreign trade market but also are the debarkation points for cargos moving along the national coastline. Freighters and ocean-going



FOREIGN EXPORTS 1979 (tons)

Source: U.S. Army Corps of Engineers, Waterbourne Commerce of the United States, 1978 & 1979.

Figure 7



FOREIGN IMPORTS 1979 (tons)

Source: U.S. Army Corps of Engineers, Waterbourne Commerce of the United States, 1978 & 1979.

Figure 8

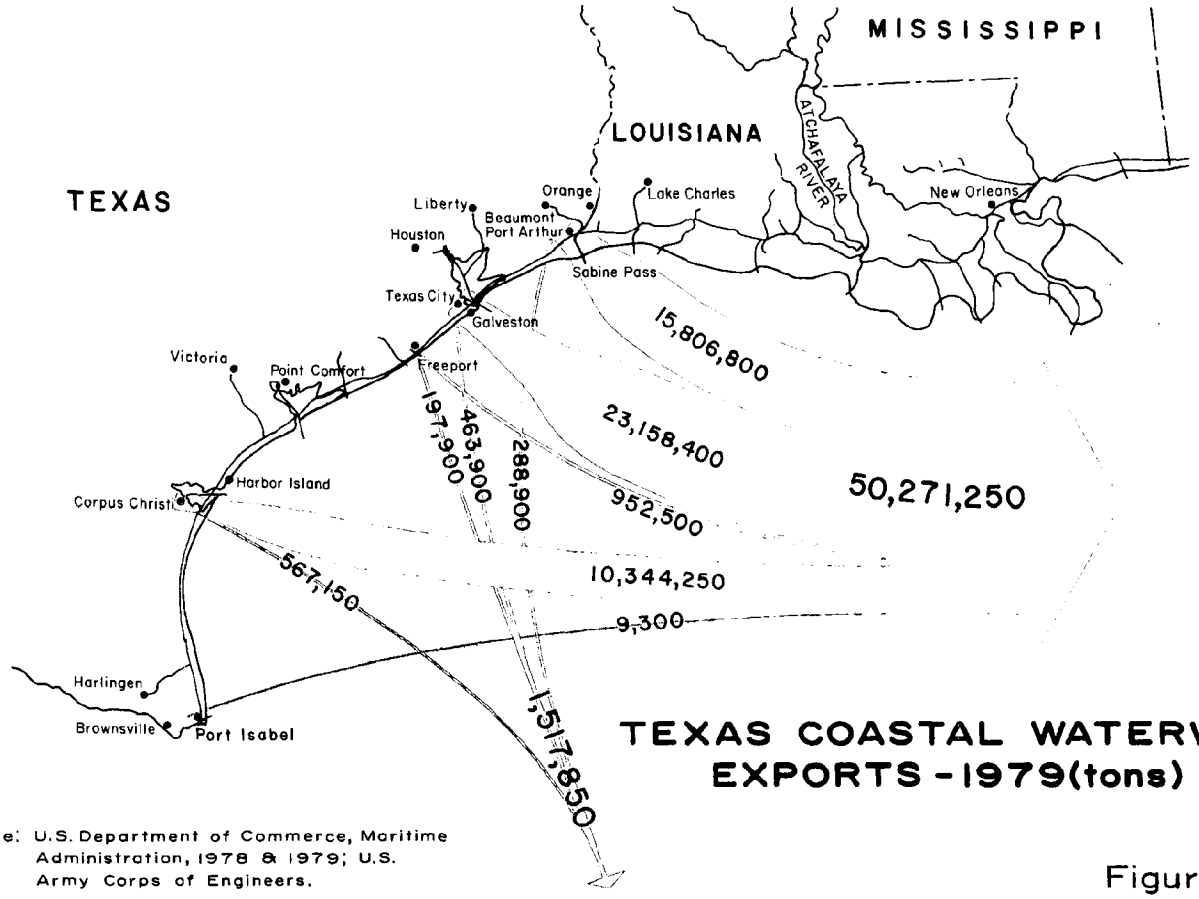
barges ply our coastline carrying the products required by the consumers. Raw materials are moved economically to manufacturers and often the finished goods are returned in the same manner.

Coastal shipment of goods, besides being shipped up the eastern coast, are moved through the Panama Canal or around the Cape of Good Hope to the western states and to the Hawaiian Islands. Figure 9 illustrates that there is a strong export trade to the eastern states that exceeds the total amount of goods that are shipped overseas. Significantly, refined petroleum products again comprise the majority of the recorded volume (83%), and chemical and allied products shipment amount to 8% of the volume shipped by coastal routes.

Coastal waterway imports (Figure 10) show the smallest volume of any of the operations considered. Domestic crude oil imports comprise 41% of this small total of 6.5 million tons, while refined petroleum products (38%) and chemical and allied products account for another 10%.

THREAT OF FEDERAL TAXES

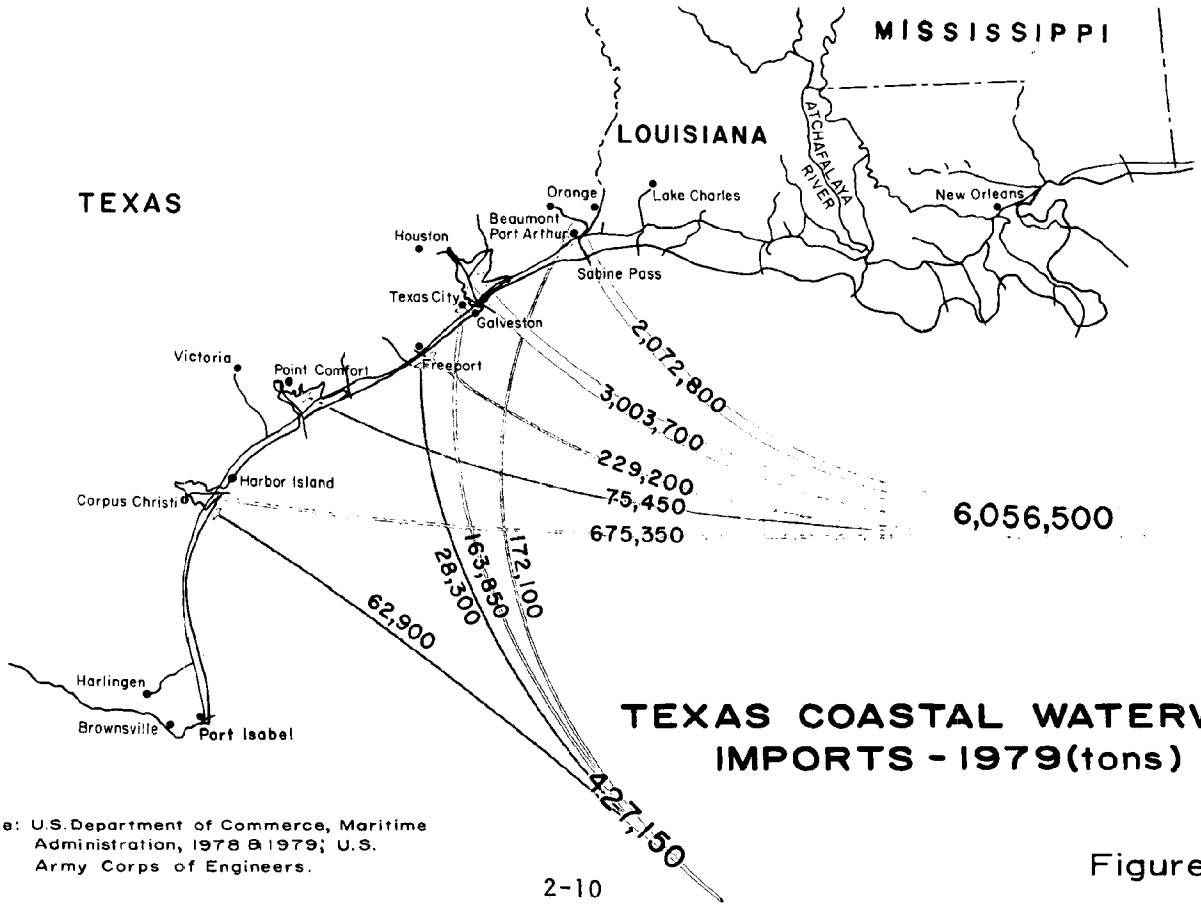
Collectively, it can be seen that the GIWW serves a strong state and national need and provides a safe, economical mode of transportation that is an integral part of the overall transportation picture of the United States. However, this economical method of transportation is being threatened by the imposition of federal taxes. Strong attempts to levy these taxes are in progress at this time and these taxes may prove to be disastrous to some portions of the waterway system. How these taxes can affect the system is discussed in the chapters 4 and 5. At this time it looks as if no taxes will be passed this year; but, are expected to be imposed next year.



TEXAS COASTAL WATERWAY EXPORTS - 1979(tons)

Source: U.S. Department of Commerce, Maritime Administration, 1978 & 1979; U.S. Army Corps of Engineers.

Figure 9



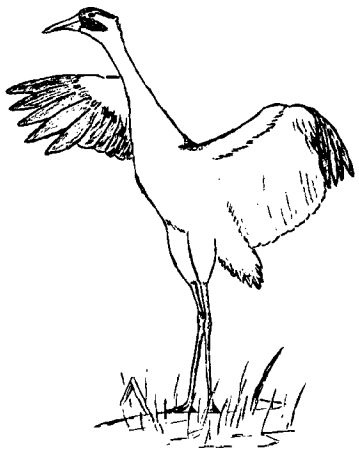
TEXAS COASTAL WATERWAY IMPORTS - 1979(tons)

Source: U.S. Department of Commerce, Maritime Administration, 1978 & 1979; U.S. Army Corps of Engineers.

Figure 10

CHAPTER THREE

AN OVERVIEW OF RECREATIONAL BOATING IN TEXAS COASTAL WATERS



AN OVERVIEW OF RECREATIONAL BOATING IN TEXAS COASTAL WATERS

The Texas bay waters and nearby coastal areas have become this State's largest playground. The coastal zone of Texas provides an ideal area for recreation due to its accessibility, geographic location, and natural and man-made attractions.[2] Continued migration to this inviting region combined with increasing numbers of recreational boat ownership indicate that the impact of recreational boating to the Texas coastal zone is a very strong one. More than $47 million was spent by the public sector for recreation and tourism within the coastal zone of Texas during 1973, thereby generating a $155 million economic impact to the region.[3] Aside from this economic impact to the Texas coastal zone, the impact on the coastal resources could be tremendous and must be recognized. The growing number of recreational boats provides a great potential for marine accidents and also places more stress on the marine ecology system in the Texas coastal zone, thus making saltwater recreation a significant issue of concern to the State. Preparations for the growth of the boating public must begin now, not only to facilitate their recreational needs and insure their marine safety, but to protect the State's coastal resources as well.

[2] Billie I. Ingram, An Economic Impact of Recreation and Tourism Within the Texas Coastal Zone (Texas A&M University: Sea Grant Program, 1974), p. 59.

[3] Ingram, p. 32

In addition to the impact of recreational boating on the coastal zone in general, the Texas portion of the Gulf Intracoastal Waterway (GIWW) is also affected by this traffic. The GIWW was originally designed for commercial purposes, but since has evolved to a multipurpose waterway providing safe passage from one body of water to another for vessels of many categories. In order to best understand the nature, magnitude and extent of recreational boating in Texas coastal waters and on the GIWW, a study of such was conducted by the Texas State Department of Highways and Public Transportation. It was decided that a survey of the actual boating public would yield the best understanding of recreational boating in Texas. The preliminary results of this survey were presented in the 1980 GIWW report, and the conclusive findings of the survey are the basis for this chapter of the 1982 GIWW report.

DESCRIPTION OF SURVEY AND REPORTED COASTAL USAGE

A survey was mailed out to sample 11,000 of the 242,000 recreational boat owners registered within a 200 mile distance of the Texas coastline. The 200 mile boundary was selected on an assumption that most coastal recreationists would have their boats registered within a relatively close proximity to the coastline and that any boats beyond the 200 mile boundary would account for a very small percentage of coastal waters usage. The study area was divided into three particular regions, determined by geographic location and demographic characteristics. The three regions, referred to as Tier I, Tier II and Tier III, consist of thirty-eight Texas counties. Tier I was further reduced to five subregions for survey purposes. A map portraying the study boundary and the regions within are depicted in Figure 11.

BOUNDARIES OF GEOGRAPHIC REGIONS FOR BOAT SURVEY

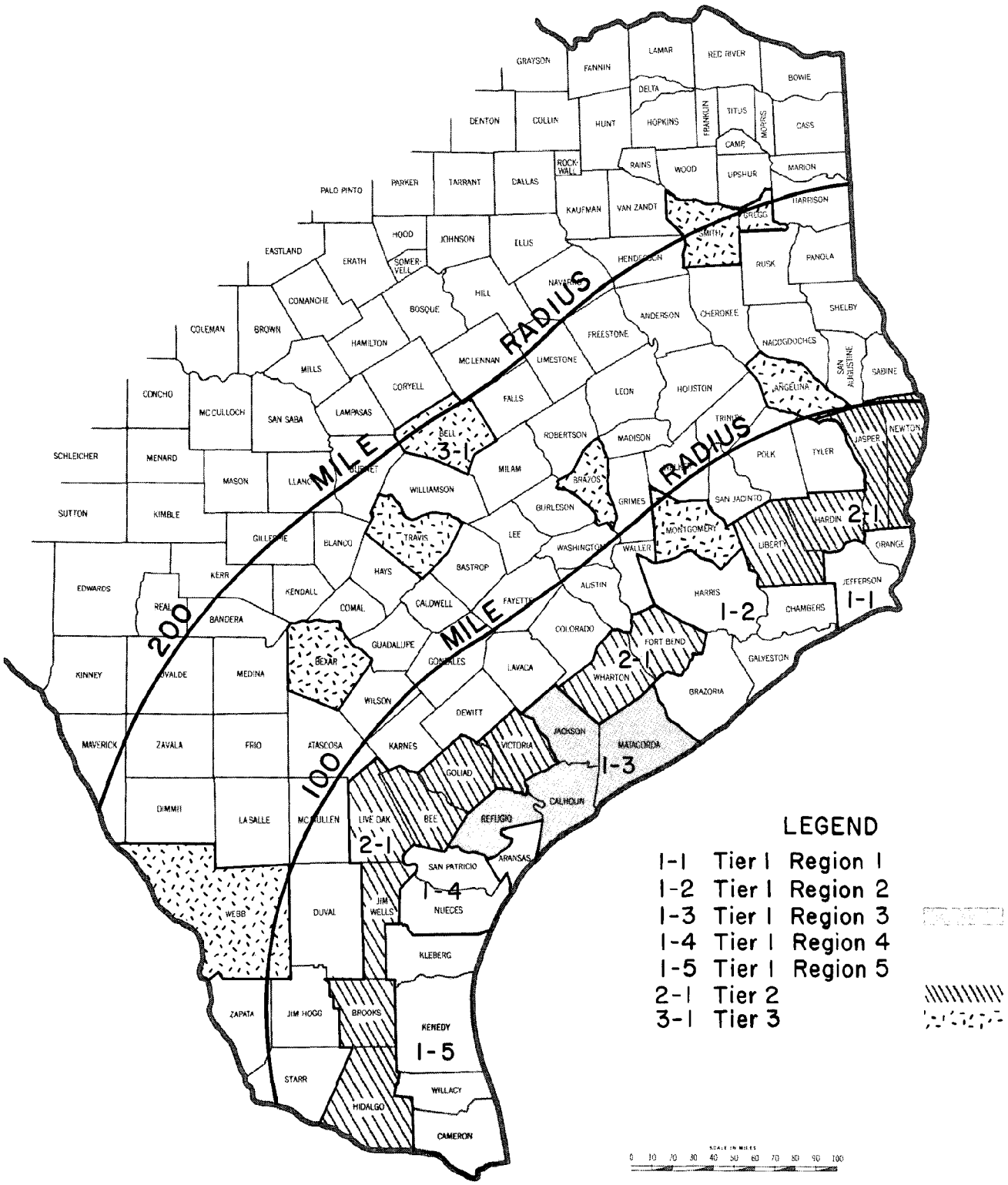


Figure 11

There was a 42% response to the mailed surveys and from these returns it was learned that 49% of the recreational boat owners used the coastal waters each year. The information received from the sampling of boat owners was expanded so that it would be representative of the trends of all recreational boat owners within the 200 mile boundary. A close analysis of the individual study regions has shown that the boats registered in regions closest to the coast have, as would be expected, the highest percentage of saltwater usage. Tier I owners reported that 64% of all their boat trips were made in coastal waters while Tier II's relative close proximity to the coast probably accounted for their 44% usage of the coast as a recreational playground. Tier III's limited use of only 17% reflected the effect of its greater distance from the coastline. The boat owners from Tier III have more obstacles to overcome before enjoying saltwater recreation, i.e. longer distances to trailer a boat, lodging expenses, etc. Table 1 lists the number of registered recreational boats in the individual study regions and their reported amounts of coastal usage.

FREQUENCY OF TRIPS TO COAST

Each recreational boat trip to the coast has some impact on the coastal zone. Therefore, it is most important to calculate the total number of trips generated annually rather than just the number of boats that use the coastal playground. Listed below is the most selected category of trip frequencies for each tier and the average number of trips generated. A complete table for all categories of trip frequencies is shown in Appendix 1. The totals infer that the further removed from the coast that a boat is registered, the least usage of coastal waters

there will be. Collectively, the total for all trip categories summed up to be 2,403,000 trips for 1979.

REGION	MOST SELECTED TRIP FREQUENCY	NUMBER OF BOATS OF THAT FREQUENCY	AVERAGE TRIPS GENERATED
Tier I	5-15 times per year	30,500	305,500
Tier II	5-15 times per year	4,450	44,500
Tier III	1-5 times per year	5,400	13,500

TABLE 1

1979 RECREATIONAL BOAT REGISTRATIONS* AND NUMBER OF COASTAL WATER USERS** FOR STUDY REGIONS AND SUBREGIONS

	NUMBER OF REGISTERED RECREATIONAL BOATS	NUMBER OF BOATS THAT USE COASTAL WATERS	PERCENTAGE OF BOATS THAT USE COASTAL WATERS	NUMBER OF BOATS THAT DO NOT USE COASTAL WATERS	PERCENTAGE OF BOATS THAT DO NOT USE COASTAL WATERS
TIER I, REGION I	24,300	14,600	60.1%	9,700	39.9%
TIER I, REGION II	103,100	65,400	63.4%	37,700	36.6%
TIER I, REGION III	4,800	3,700	77.1%	1,100	22.9%
TIER I, REGION IV	10,500	7,100	67.6%	3,400	32.4%
TIER I, REGION V	3,900	3,000	76.9%	900	23.1%
TIER I SUBTOTAL	146,600	93,800	64.0%	52,800	36.0%
TIER II	22,700	11,100	48.9%	11,600	51.1%
TIER III	71,100	12,200	17.2%	58,900	82.8%
TOTAL	240,400	117,100	48.7%	123,300	51.3%

*Source: State Department of Parks and Wildlife, Current Boat Registrations Records, February, 1979.

**The number of coastal users was derived from a sampling of the total number of registered boats in the study area and factoring the survey responses with expansion numbers.

MONTHLY BREAKDOWN OF TRIP TOTALS

To plot peak periods of activity during 1979, the survey asked in which months of the year were the trips made. During these peak periods,

the impact of the recreational activities is expected to produce greater effects on the economical and environmental status of the coast and may also present a greater chance for marine accidents to occur. Identification of these peak periods of activity may aid State and community groups to prepare for, and perhaps to prevent any ecological damage to the system as well as to prevent any foreseeable hazardous conditions.

As expected, the peak months of recreational boat trips were the warmer months from May through October. As shown in Figure 12 the highest number of trips occurred in June and July when over 289,000 trips were made per month.

COASTAL BOAT STORAGE OR TRAILER TRANSPORT

It was surmised from the survey responses that comparatively limited coastal storage of boats exists in that most of the boats are trailered to the coast. The survey asked the number of miles, if any, were the boats trailered for a coastal trip. If zero mileage was reported, it was assumed to indicate coastal storage in a marina. It is interesting to note that nearly 30% of the boats registered in Tier III are being trailered a distance of 1-25 miles indicating that many of these boats are being stored near the coast, perhaps at a vacation residence. See Table 2 for the number of boats and the distance trailered from each of the three tiers.

The size of a boat often dictates the necessity of a particular kind of storage or handling. Smaller boats which are more easily trailered do not normally require a coastal storage, whereas larger boats may necessitate such storage as a marina to eliminate hauling problems. In Table 3 it may be observed that 94% of all smaller boats (1-20') were

RECREATIONAL BOAT TRIPS TO COASTAL WATERS PER MONTH

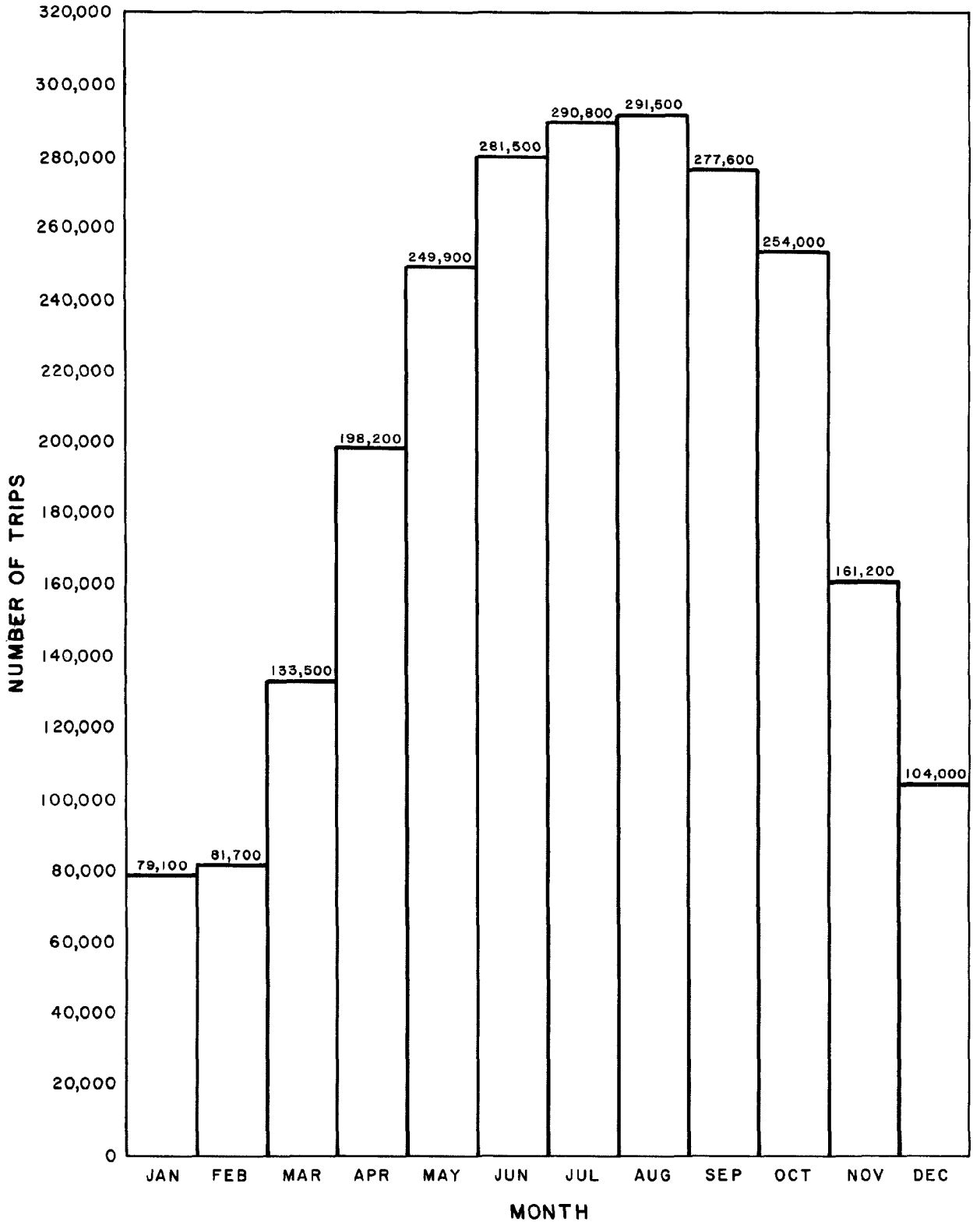


Figure 12

trailered to the coast and 52% of the larger boats (21' and over) were stored in marinas. Table 4 categorizes several kinds of boat storages utilized by recreationists within Tiers I, II, and III.

TABLE 2

NUMBER OF BOATS THAT
ARE TRAILERED TO COASTAL WATERS

	ZERO MILES	1-25 MILES	25-50 MILES	50-75 MILES	75-100 MILES	OVER 100 MILES	TOTAL NUMBER BOATS
TIER 1 BOATS	9,150	35,750	23,000	18,000	5,000	2,900	93,800
TIER 2 BOATS	650	1,300	3,900	3,700	1,250	300	11,100
TIER 3 BOATS	900	3,600	850	400	300	6,150	12,200
TOTAL BOATS	10,700	40,650	27,750	22,100	6,550	9,350	117,100

TABLE 3

CLASSIFICATION OF BOATS
THAT ARE OR ARE NOT TRAILERED
TO COASTAL WATERS

		BOATS TRAILERED ZERO MILES		BOATS TRAILERED ANY MILES
Powerboats 1-20' and Sailboats 1-20'	TIER I	5,140	TIER I	81,480
	TIER II	430	TIER II	10,080
	TIER III	580	TIER III	10,530
	TOTAL	6,150	TOTAL	102,090
Powerboats 21' & Over and Sailboats 21' & Over	TIER I	4,020	TIER I	3,050
	TIER II	220	TIER II	370
	TIER III	410	TIER III	790
	TOTAL	4,650	TOTAL	4,210

TABLE 4

COASTAL BOAT STORAGE
FOR STUDY REGIONS
(IN BOATS)

REGION	BOAT CLASS	VACATION RESIDENCE	MARINA	HOME	OTHER
TIER I	Powerboats 1-20'	12,030	7,360	58,970	7,310
	Powerboats 21' & Over	640	4,060	2,250	570
	Sailboats 1-20'	80	70	380	110
	Sailboats 21' & Over	5*	100	40	7*
TIER II	Powerboats 1-20'	1,670	920	5,560	2,000
	Powerboats 21' & Over	110	260	160	80
	Sailboats 1-20'	12*	14*	40	9*
	Sailboats 21' & Over	0	11*	0	2*
TIER III	Powerboats 1-20'	4,130	1,640	2,330	2,880
	Powerboats 21' & Over	190	570	220	190
	Sailboats 1-20'	30	5*	20	40
	Sailboats 21' & Over	8*	10	3*	9*

*Any number less than 20 was not rounded off.

PURPOSE OF RECREATIONAL BOAT TRIPS

Preparations to meet the increasing impact of boat usage in the coastal regions of Texas must be well planned to achieve optimum results. A knowledge of the more frequent recreational activities can facilitate

plans to better provide for many of the needs and desires of the boating public. Consequently, the boat owners were asked for the purpose of their trips to the coast listing fishing, cruising, hunting or water sports as likely choices. Fishing proved to be the number one purpose of boat trips to the coast when about 80% or 1.9 million of the yearly trips were reported as being for this reason. Excursions for water sports and cruising accounted for about 200,000 trips each or approximately 15%. Hunting was the least sought after activity of those listed. The purposes of recreational boat trips were found to be closely associated with the class of boat involved. Table 5 lists the purposes of trips as used by the different boat classes.

TABLE 5

CLASSIFYING THE RECREATIONAL PURPOSES
OF BOAT TRIPS

BOAT CLASSIFICATION	FISHING TRIPS	CRUISING TRIPS	WATER SPORTS TRIPS	HUNTING TRIPS
Powerboats 1-20'	1,768,160	90,180	144,670	79,950
Powerboats 21' & Over	175,700	95,170	14,480	9,180
Sailboats 1-20'	9,520	4,930	2,560	2,680
Sailboats 21' & Over	1,110	4,220	370	120
TOTALS	1,954,490	194,500	162,080	91,930

BOAT TRAFFIC CONCENTRATIONS

Naturally, the impact of the 2.4 million total trips to the coast made in 1979 will be greater wherever the largest concentrations of boats occurred. Therefore, to accurately plot these concentrations, the survey

asked which county the boat is launched from and also what body of water it entered. These findings were reported on a preliminary basis in the 1980 GIWW report, and now the final tabulation of trips is presented in this 1982 GIWW report. Separate maps depicting the trip totals launched from the counties and the initial body of water are shown in Figures 13 and 14, respectively.

Because particular facilities are necessary for boat launching and recovery, the boat owner must go where those facilities are available. Often there is a lack of marinas and public docks that furnish these facilities except where the larger cities can afford to provide them. This then causes congestion problems and safety hazards to the boaters. It is doubtful that new marinas on the Texas coast are likely to be forthcoming because in the marketplace struggle for shore space many recreational amenities such as marinas are unaffordable.[4] The State of Texas then has the opportunity to provide a service to those desiring to enjoy our natural resources, by supporting the growth of public recreational facilities on State lands for all to enjoy.

DEEP-DRAFT NAVIGATION CHANNEL USAGE - INCLUDING THE GIWW

The heavy congestion of existing commercial traffic on navigation channels has been compounded by the growing usage of these channels by recreational craft. To determine the tangible effect of recreational traffic on the GIWW and the ten deep-draft channels, the survey asked the boat owners to estimate the number of trips they make on any of

[4]John L. Crompton, Dennis D. Beardsley, and Robert V. Ditton, Marinas on the Texas Gulf Coast (Texas A&M University: Sea Grant Program, 1975), p. 3.

NUMBER OF RECREATIONAL TRIPS PER ORIGINATING COUNTY

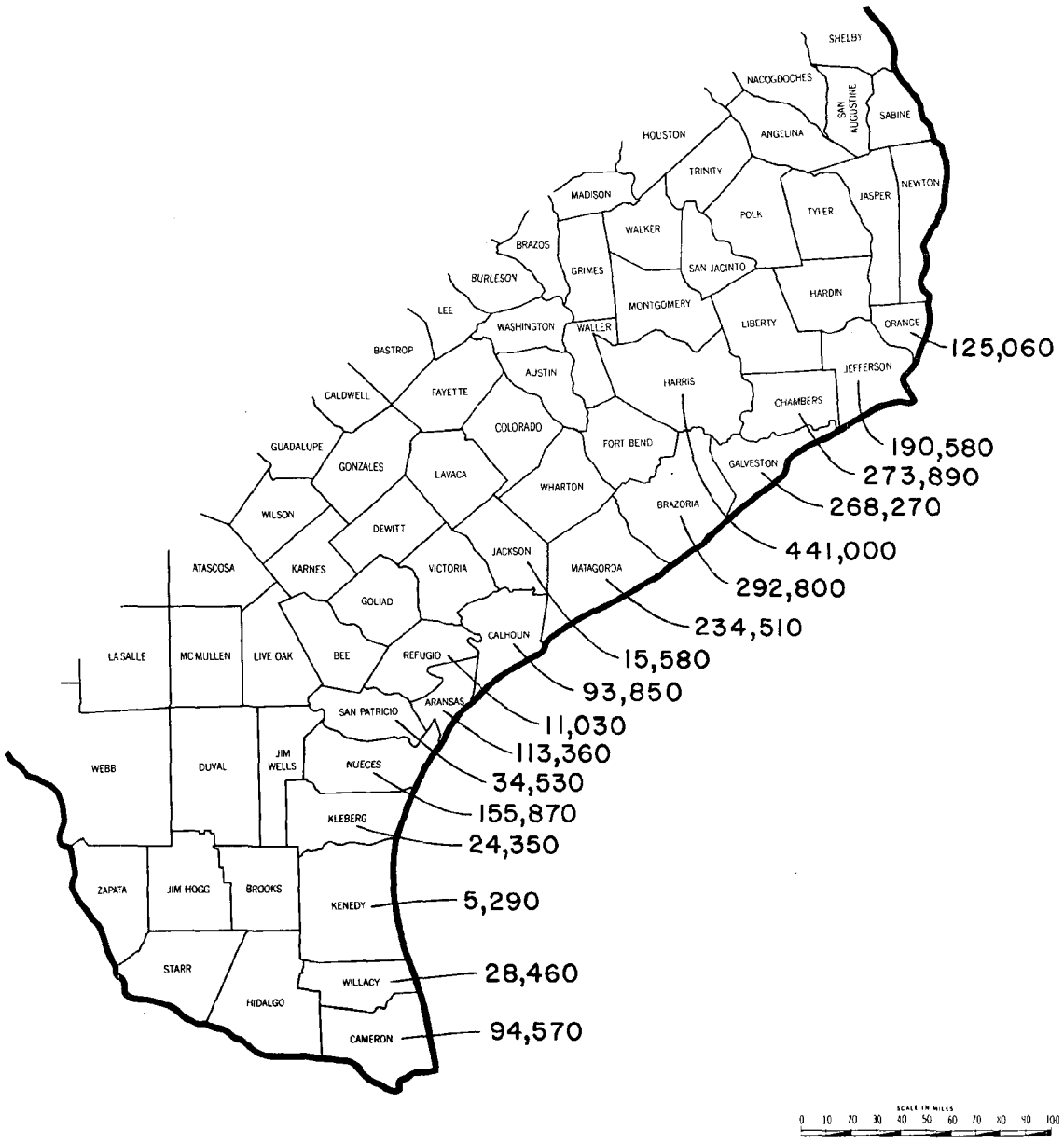


Figure 13

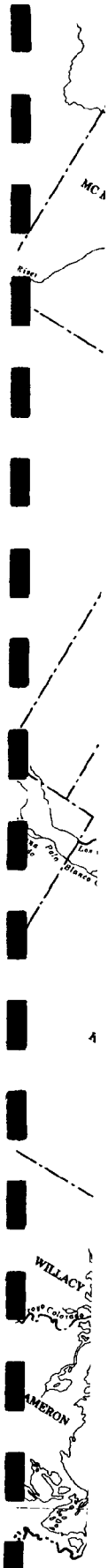


FIGURE 14

Texas' major waterways. Table 6 identifies the collective usage of deep-draft channels and the GIWW by the four boat classes. Percentages of navigation channel activity are figured by comparing channel trips to the total number of trips to the coast.

TABLE 6
NUMBER OF TRIPS USING DEEP-DRAFT NAVIGATION CHANNELS

BOAT CLASS	TOTAL TRIPS TO COASTAL WATERS	TRIPS USING NAVIGATION CHANNELS	PERCENTAGE USING NAVIGATION CHANNELS	TRIPS USING GIWW	PERCENTAGE USING GIWW
Powerboats 1-20'	2,082,960	1,325,000	63.61%	1,746,100	83.83%
Powerboats 21' & Over	294,530	203,000	68.92%	198,000	67.23%
Sailboats 1-20'	19,960	11,100	57.90%	14,400	73.13%
Sailboats 21' & Over	5,820	4,900	84.19%	4,600	79.04%
TOTAL	2,403,000	1,544,300	64.27%	1,963,100	81.69%

*Including the GIWW

The number of trips on each of the ten deep-draft navigation channels and the GIWW are listed by the four boat classes in Table 7.

Although vessels may only use the GIWW to cross from the marina or dock to reach some other channel or body of water, more than 65% of the 1.9 million trips cited as using the GIWW utilize it as an important highway for 5-50 miles per trip. A listing of the average mileage travelled on the GIWW per trip is in Table 8.

Another area of concern with regards to traffic hazards on navigation channels is recreational boats mooring overnight on a navigation channel. The safety of both private and commercial craft is jeopardized by this practice. This problem is aggravated by the limited availability of public facilities that allow the boater to remove them to get out of

TABLE 7

DEEP-DRAFT NAVIGATION CHANNEL TRIPS*
GENERATED BY DIFFERENT BOAT CLASSES

DEEP-DRAFT NAVIGATION CHANNEL	POWERBOATS 1-20'	POWERBOATS 21' & OVER	SAILBOATS 1-20'	SAILBOATS 21' & OVER	TOTAL TRIPS
Sabine-Neches Waterway	235,600	12,200	700	300	248,800
Houston Ship Channel	277,600	68,900	1,400	1,400	349,300
Texas City Ship Channel	128,600	17,300	2,000	200	148,100
Galveston Ship Channel	336,900	48,900	1,700	700	388,200
Matagorda Ship Channel	90,300	7,500	1,600	200	99,600
Aransas Pass Channel	64,500	19,900	1,200	300	85,900
Corpus Christi Ship Channel	85,300	18,000	1,100	1,100	105,500
Arroyo Colorado Channel	40,500	2,400	600	100	43,600
Port Mansfield Ship Channel	40,400	4,200	500	200	45,300
Brownsville Ship Channel	25,300	3,700	600	400	30,000
GIWW	1,736,090	207,070	14,680	5,260	1,963,100

*Including the GIWW.

TABLE 8

AVERAGE NUMBER OF TRIPS ON GIWW

BOAT CLASS	TRIPS 1 MILE OR LESS	TRIPS 2-5 MILES	TRIPS 6-10 MILES	TRIPS 11-15 MILES	TRIPS 16-25 MILES	TRIPS 26-50 MILES	TRIPS 51-200 MILES	TRIPS 201-400 MILES
Powerboats 1-20'	185,840	310,130	439,280	309,970	224,110	211,730	48,930	6,100
Powerboats 21' & Over	31,360	21,440	23,690	16,620	35,300	33,650	41,330	3,680
Sailboats 1-20'	1,820	3,650	3,040	2,340	1,930	1,600	300	0
Sailboats 21' & Over	1,070	740	820	610	270	960	560	230
TOTAL	220,090	335,960	466,830	329,540	261,610	247,940	91,120	10,010

the mainstream of traffic. Although it was learned that only 500, or less than 1%, of the recreational vessels moor overnight on a navigation

channel, their safety needs should be recognized. Fortunately, almost 80% of the recreational boats never moor overnight on any waters. See Table 9 for figures on overnight mooring.

TABLE 9

NUMBER OF BOATS
THAT MOOR OVERNIGHT

	NEVER	RIVER	BAY	NAVIGATION CHANNEL	GULF	MARINA	OTHER	TOTAL
Powerboats 1-20'	88,830	1,090	10,450	280	1,100	2,110	2,170	106,030
Powerboats 21' & Over	3,750	190	2,230	140	760	2,550	430	10,050
Sailboats 1-20'	620	20	120	3*	10	30	10	813
Sailboats 21' & Over	60	1*	70	1*	8*	50	10	200
TOTAL	93,260	1,301	12,870	424	1,878	4,740	2,620	117,093
	79.65%	1.11%	10.99%	0.36%	1.60%	4.05%	2.24%	100%

*Numbers less than 10 were not rounded off, but given full value.

POLITICAL OUTLOOK FOR RECREATIONAL BOAT INTERESTS

Many forms of cost recovery legislation have been evaluated by the federal government in recent months in an attempt to recover some or all funds that are to be spent on the operation, maintenance, and improvements of this country's inland navigation network. It is unlikely that any final legislation will occur this year, as most Capitol Hill sources will agree, but the Budget Committees continue to mark-up resolutions on the cost-recovery issue in hopes that one will meet Legislative approval.

The House Budget Committee submitted a resolution to the House in May, 1982, that contained a waterway users tax package for the fiscal year 1983.[4] In that package was a recommendation where charges to

[4]"Washington Notes - Recreational Boating", The Waterways Journal Weekly, 96 (May 22, 1982), p. 5.

recreational boat owners would be assessed to help defray the cost of Coast Guard services rendered to recreational boats. Revenues generated from these fees were proposed to go into the general fund, rather than directly to the Coast Guard through a Water Trust Fund. The channeling of funds in this manner does not appear truly destined for reimbursement of the Coast Guard's services, for which the taxes were originally intended. Although this particular resolution was later rejected by the House, its fundamentals do provide some foresight into the probable means of cost-recovery that eventually will be enacted.

Additional cost recovery methods that the federal government has seriously considered will be in the form of users fees for recreational boats. The fees levied for each vessel will be determined by its useage on either coastal waters or inland waters and by its length. The proposed fees for inland navigable waters are nominal and range from $4-$15, depending on the size of the vessel. Fees proposed for coastal users, however, are much higher and it is likely that many recreationists, especially from Tier III, will forego their trips to coastal waters. This will have a direct effect on the economies of the coastal areas. Coastal users fees are set up as follows:

BOAT LENGTH	AMOUNT OF TAX PER YEAR
16 feet and less	$ 50
17-26 feet	$110
27-40 feet	$200
41-65 feet	$400
66 feet and more	$600

The proposed schedule of recreational boating fees is designed to recover 100% of the Coast Guard's expenses incurred for services rendered (estimated at $212.4 million for the fiscal year 1983). The Coast Guard's budget allocations for search and rescue operations are directed to users

of coastal waters (estimated at $152.7 million for the fiscal year 1983), thus the exceedingly higher fees for recreational boats in that area.[6]

Revenues from the first user-fee tax for commercial navigation imposed on the inland navigation network in 1980, have been accruing in an open-ended navigation trust fund and have reached a total of $20 million. Although this tax is not considered a cost recovery measure, the revenues produced by it are to be used for inland waterway projects including recreational boating safety and facilities improvements. Presently, there is a "freeze" on these recreational boating funds, but an amendment by the House Merchant Marine and Fisheries Committee has been submitted to the House for approval which would allow the Secretary of Transportation to spend those monies on the enhancement of recreational boating.[7]

Hopefully, Texas will secure some of those monies, if made available, to help improve the quality of coastal recreation in this State. The value of land and the inflation of labor costs have climbed out of reach for local port authorities to pay for new recreational facilities. As of late, most new docking projects are predominantly for commercial use and although the public boat docks, parking lots, etc. are moderately satisfactory now, they will soon be woefully inadequate as recreational activities increase and as the population of Texas continues to rise. Texas' population growth in the 1970's experienced five metropolitan areas within 200 miles or less of the coast that grew more than 40% each.[8]

[6]Sport Fishing Institute Bulletin, March, 1982, No. 332, pp. 5-6.

[7]"Washington Notes - Recreational Boating", The Waterways Journal Weekly, 96 (May 22, 1982), p. 10.

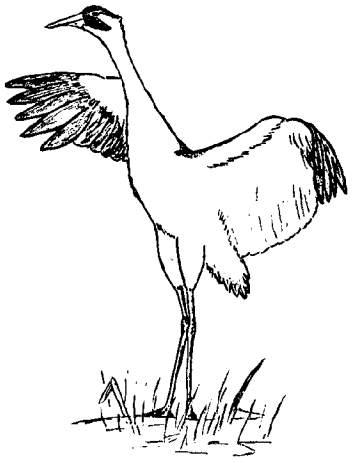
[8]Mary Young, The Future of Texas' Population - One Scenario (Texas A&M University: Texas Transportation Institute, 1981), p. 18.

If this is any indication of the next 10-15 years growth, there will certainly be a shortage of public recreational facilities to accommodate the large numbers of people.

It is time to set the plans in motion for meeting the needs of the expanding recreational industry, particularly in the coastal regions, before the limit of resources and the costs of developments are prohibitive.

CHAPTER FOUR

"INLAND WATERWAY USER TAXES AND CHARGES", PL-05-502, SEC. 205 IN REVIEW



"INLAND WATERWAY USER TAXES AND CHARGES", PL-05-502, SEC. 205 IN REVIEW

Since the 1930's, Congress has debated the levying of cost recovery fees to pay for continual operation and maintenance costs as well as costs of new construction for waterway port and channel projects. Although the Northwest Ordinance of 1787 made it clear that the founding fathers of this nation placed a special value on unhindered water transportation, this unlimited subsidy has come under ever increasing attacks. Supporters of cost recovery point out several undesirable results of the present level of funding for navigation with the foremost being the substantial competitive edge given to water carriers over other surface carriers. Secondly, it is stated that some regions and groups of shippers benefit at the expense of others who are not so favorably situated. Unlimited subsidy can encourage overdevelopment and overinvestment instead of more rational use of available resources.[9] Opponents of cost recovery state that tax burdens imposed on the efficient operations of the Gulf Intra-Coastal Waterway (GIWW) and the inland waterway system would exert a detrimental effect on the development of the immediate areas involved as well as the whole nation. "Extreme care should be taken not to disturb the efficiency of waterway transportation so that dependent industries may remain viable and be a working asset to the national economy."[10] But

[9] National Transportation: Trends and Choices to the Year 2000, U.S. Department of Transportation (January, 1977), p. 285.

[10] Dale Miller, President of Gulf Intracoastal Canal Association, Statement before the Subcommittee on Water Resources of the House Committee on Public Works and Transportation, March 18, 1982.

ultimately the "hands off" attitude toward unhindered water transportation has been changed, and the initial steps toward cost recovery have been taken.

THE FIRST TAX

In 1978, the Inland Water Revenue Act initiated an escalating marine fuel tax of four cents per gallon and set regular increases until a 10 cents per gallon charge is reached in 1985. This is the first tax ever imposed on navigation on the inland waterway system and most surely will be closely followed by more and even higher users fees.

A NEW STUDY

While the new fuel tax was not originally considered a cost recovery measure, all revenues were to be deposited in an open-ended navigation trust fund that would be available for partially funding inland waterway projects. Because the ten cents per gallon fuel tax could only provide a modest 20-25 percent recovery of navigation costs per year, Congress established Section 205 of Public Law 95-502 and instructed the Secretaries of Transportation and Commerce to conduct a study into the economic and financial impacts of further taxes and charges on barge operators, shippers, regional areas and other economic interests.* A most difficult aspect of the study was to decide exactly who should be required to pay the proposed user charges as many beneficiaries of the waterway system are unidentifiable and may even be hundreds of miles away from the waterway system. For example, recreational use of the waterway may be extensive in some areas and could possibly cause delays at locking

*Unless otherwise noted, all facts, tables, quotes and conclusions have been directly taken from the Sec. 205 study. This review is intended to present only the highlights of the study and to present any data that has reference to possible impacts on the Texas waterway economic system. Full report available from U.S. DOT, Secretary of Transportation.

systems that would add to their operation and maintenance costs. It seems natural that the costs attributed mainly to navigational needs should be paid largely by the commercial users who receive the greater benefits from the use of the waterways. The possibility of a congestion fee is feasible, as well as the possibility of a direct tax on recreational boats that use the system. These types of taxes have not been given serious consideration in this study.

It is necessary that should any taxes be imposed they should encourage economic efficiency and should not incur cross subsidization of waterway segments. The taxing system should be flexible, promote stability and be easily administered.

In order to formulate any recovery plan it is necessary that public costs for navigation be accurately determined. Data provided by the Corps of Engineers was used to compile the cost for each study segment (Table 10) and included the cost of operation, maintenance, and any pro-

TABLE 10

SHALLOW DRAFT NAVIGATION COST
1979 DOLLARS-($1000)

REGION	1977	1980	1985	1990	1995	2000
Upper Mississippi	29,485.6	29,485.6	31,091.6	31,091.6	31,091.6	31,091.6
Lower Upper Mississippi	9,010.5	9,010.5	15,102.5	38,380.5	46,608.5	46,608.5
Lower Mississippi	57,582.8	57,582.8	57,903.8	57,903.8	57,903.8	57,903.8
Baton Rouge to Gulf	0.0	0.0	0.0	0.0	0.0	0.0
Illinois Waterway	11,069.5	11,069.5	12,208.5	12,208.5	12,208.5	12,208.5
Missouri River	3,503.3	3,503.3	3,503.3	3,503.3	3,503.3	3,503.3
Ohio River	21,820.0	21,820.0	23,469.0	23,469.0	23,469.0	23,469.0
Monongahela/Allegheny	6,617.9	6,617.9	6,617.9	6,617.9	6,617.9	6,617.9
Kanahwa River	2,456.1	2,456.1	2,456.1	2,456.1	2,456.1	2,456.1
Kentucky River	709.2	709.2	709.2	709.2	709.2	709.2
Green River	835.6	835.6	835.6	835.6	835.6	835.6
Cumberland River	2,892.9	2,892.9	2,892.9	2,892.9	2,892.9	2,892.9
Tennessee River	3,561.5	3,561.5	3,561.5	3,561.5	3,561.5	3,561.5
Arkansas River/White	13,327.1	13,327.1	13,327.1	13,327.1	13,327.1	13,327.1
Alabama/Warrior System	10,661.4	10,661.4	10,661.4	83,740.4	83,740.4	83,740.4
ACF Rivers	5,664.3	5,664.3	5,664.3	5,664.3	5,664.3	5,664.3
Ouachita/Red Rivers	2,858.2	2,858.2	14,681.2	14,681.2	44,483.2	44,483.2
Columbia River System	5,080.7	5,080.7	5,080.7	5,080.7	5,080.7	5,080.7
GIWW-West	18,162.0	18,162.0	20,434.0	20,434.0	20,434.0	20,434.0
GIWW-East	3,484.6	3,484.6	3,484.6	3,484.6	3,484.6	3,484.6
TOTAL	208,783.1	208,783.1	233,685.1	330,042.1	368,072.1	368,072.1

ject that would be operational by the end of Fiscal Year 1982. These costs include only the segments (Table 11) specified for taxation in the Inland Revenue Waterway Act of 1978.

TABLE 11

USER CHARGE STUDY WATERWAY SEGMENTS

SEGMENT NUMBER	NAME	DESCRIPTION
1	Upper Mississippi	Minneapolis to L&D 26
2	Lower Upper Mississippi	L&D 26 to Cairo
3	Lower Mississippi	Cairo to Baton Rouge
4	Baton Rouge to Gulf	Baton Rouge including port to Mouth of Passes
5	Illinois River	Lake Michigan to Mouth of Illinois
6	Missouri River	Head of Navigation to Mouth
7	Ohio River	Head of Navigation to Mouth
8	Monongahela/Allegheny	Head of Navigation to Mouth
9	Kanahwa River	Head of Navigation to Mouth
10	Kentucky River	Head of Navigation to Mouth
11	Green River	Head of Navigation to Mouth
12	Cumberland River	Head of Navigation to Mouth at Ohio River, including Barkeley Canal
13	Tennessee River	Head of Navigation to Mouth
14	Arkansas River/White	Head of Navigation to Mouth
15	Tombigbee-Alabama/Coosa-Black Warrior River	Head of Navigation to Mouth, including Tennessee-Tombigbee Waterway
16	Apalachicola, Chattahoochee Flint Rivers	Head of Navigation to Mouth
17	Ouachita - Red Rivers	Camden Mouth at Red River, Red River from Daingerfield to the Old River
18	Columbia-Snake Waterway Willamette River	Lewiston to Mouth
19	Gulf Intracoastal Waterway-West	New Orleans to Brownsville
20	Gulf Intracoastal Waterway-East	New Orleans to St. Marks, FL

INITIAL ASSUMPTIONS

The research teams approached the study by forecasting how barge traffic would progress through the year 2000 if no taxes at all were imposed. This then formed a baseline to compare against the various tax scenarios imposed on the waterway system. Thirteen commodities and twenty river segments selected from the Mississippi River and its tributaries, the Columbia/Snake Rivers, and the Gulf Intracoastal Waterway (GIWW) were to be used in the study. The Gulf Intracoastal Waterway West, extending from New Orleans, Louisiana to Brownsville, Texas, is of particular interest to the State of Texas and the data about this segment will be included in this review.

TYPES OF TAXES OR FEES INVESTIGATED

The different fees used in the study scenarios center mainly around either system-wide fuel taxes or segment-specific taxes with various recovery percentages for each. Other types of taxes mentioned are lockage fees, license fees and even a congestion fee. Each one is discussed pointing out its advantages and its disadvantages.

A ton-mile tax could be assessed on either a segment or system-wide basis although it is usually associated with a segment-specific taxing system. While this type fee is a direct charge for moving a ton of goods, it does not tax the movement of empty barges and is insensitive to other towing operations. Such a tax structure would be dependent on accurate reporting of barge movements by the carrier and shippers. Even though the carrier now reports their barge movements to the Corp of Engineers (including origin, destination, commodity and routing information) the completeness and accuracy of these reports have been critized in the past. It is not believed that the imposition of a new tax would tend to

increase the accuracy of the carrier reports.

Fuel taxes are usually associated with system-wide taxation and are the easiest to administer since the tax is collected directly at the fuel pump. A fuel tax would be applicable whether the barge was loaded or unloaded, therefore, this type of tax could encourage operators to more actively solicit return trip cargos. Fuel taxes are more applicable for a system-wide tax rather than for a segment-specific tax that would require the keeping of fuel consumption records for individual segments. Generally, dry bulk commodities tend to pay a lower fuel tax per ton-mile than do petroleum and chemical products.

The lockage fee is probably the easiest tax to enforce because when a locking action occurs the fee is then paid. Precise data on the commodity being shipped could also be recorded at that time. However, some segments such as the lower Mississippi River, the Missouri River, the GIWW East, east of the Innerharbor Rock, and the Texas portion of the GIWW West have no locks. Some other type of cost recovery must then be added to make these segments contribute to a tax that is imposed on the whole waterway system.

A license fee to operate a piece of equipment for a given amount of time is administratively simple. This type of fee is collected only once a year and its enforcement would be easily maintained. While a segment-specific variant of this fee is feasible, the system-wide use has several readily apparent advantages.

DEVELOPMENT OF SCENARIOS:

A variety of alternative recovery scenarios was examined to estimate the diversion of waterway traffic caused by various imposed fees. Assumptions were formulated regarding the type of fee to be collected, the

percent of total costs to be recovered, and the degree of other mode rate response to increased barge rate charges (Table 12). It was assumed that profits had already reached a stable and competitive level with all modes of transportation and that the entire users fee is being passed along to the shippers. However, it was clearly noted that this most likely will not be the case in the early years of the taxing system. The carriers most likely would still be absorbing all or at least a large part of the tax just to retain their business and to remain competitive until the demand for their service was again high.

TABLE 12

USER FEE IMPLEMENTATION SCENARIOS

TYPE OF TAX	RECOVERY LEVEL	OTHER MODE RESPONSE
Segment-Specific Ton-Mile Tax	100%	0%
" " " "	75%	0%
" " " "	50%	0%
" " " "	100%	100%
" " " "	100%	50%
Systemwide Fuel Tax	100%	0%
" " "	100%	100%
" " "	100%	50%
Combination Systemwide Fuel Tax and Segment-Specific Ton-Mile Tax	100%	0%
Combination Systemwide Fuel Tax and Segment-Specific Lockage Fee	100%	0%

RATE REACTIONS BY OTHER TRANSPORTATION MODES

A major factor affecting the initial impact of the waterway fees will be the rate change response by other modes of transportation. Should the railroad carriers, for instance, not raise their rates along with the water carriers rates this would mean that the competitive edge for waterway transportation would be reduced or in some instances eliminated.

There exists some imaginary line, removed from the waterway itself, at which the cost to transport the goods to the waterway facilities and then ship them by waterway freight to a final destination is less expensive than any other mode of transportation available to the shipper. Higher rates in waterway carrier charges with no rate increase response by other modes of transportation will shift this line closer to the waterway traffic facilities and therefore, lose the carrier some of his trade. This effect will be most noticeable with diversion of transportation for grain, cotton, and other agricultural products that are located some distance from the waterway. Additional diversions of freight may be caused by the use of unit trains that may become more economical due to the lessening of barge traffic competitiveness. To circumvent this loss of competitiveness, the waterway carriers may have to absorb part or all of the taxes by reducing their own profits. This could be disasterous to the small carriers who even now are operating on a marginal profit.

SCENARIO RESULTS

BASELINE SCENARIO:

A user fee implementation scenario utilizing a segment-specific ton-mile tax is noted in Table 13. Recovery level is set at 100 percent with a zero percent railroad response. Costs are stated at 1979 dollar level. The pre-diversion column for each year indicates the estimated segment tolls based on public expenditure for operations and maintenance, and new construction under baseline or no tax conditions. Tolls shown for 1977 are only for comparison since fees were not in effect for that year. Post-diversion tolls show the equilibrium ton-mile fee after imposition of user fees and stabilization of traffic patterns.

The resulting data illustrates the widely varying required fees of

TABLE 13

SEGMENT TAX : $ COST PER TONMILE
100% RECOVERY - 0% RAILROAD RESPONSE

RIVER	1977 PRE-DIVERSION	1977 POST-DIVERSION	1980 PRE-DIVERSION	1980 POST-DIVERSION	1985 PRE-DIVERSION	1985 POST-DIVERSION
Upper Mississippi	0.00289	0.00395	0.00207	0.00245	0.00215	0.00249
Lower Upper Mississippi	0.00065	0.00086	0.00054	0.00065	0.00083	0.00099
Lower Mississippi	0.00082	0.00109	0.00069	0.00085	0.00059	0.00069
Baton Rouge to Gulf	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Illinois Waterway	0.00137	0.00189	0.00134	0.00177	0.00135	0.00175
Missouri River	0.00224	0.00383	0.00232	0.00377	0.00212	0.00325
Ohio River	0.00058	0.00067	0.00055	0.00062	0.00044	0.00047
Monongahela/Allegheny	0.00457	0.00479	0.00428	0.00446	0.00357	0.00368
Kanahwa River	0.00427	0.00462	0.00283	0.00294	0.00271	0.00279
Kentucky River	0.02374	999.00000	0.03142	999.00000	0.02799	999.00000
Green River	0.00079	0.00080	0.00073	0.00073	0.00050	0.00050
Cumberland River	0.00256	0.00335	0.00267	0.00358	0.00266	0.00358
Tennessee River	0.00100	0.00135	0.00091	0.00114	0.00085	0.00104
Arkansas River/White	0.00956	0.06251	0.00828	0.04176	0.00859	0.01313
Alabama/Warrior System	0.00247	0.00399	0.00258	0.00425	0.00250	0.00373
ACF Rivers	0.04553	999.00000	0.04835	999.00000	0.04638	999.00000
Ouachita/Red Rivers	0.01599	0.02024	0.01672	0.02432	0.08062	999.00000
Columbia River System	0.00476	0.00621	0.00348	0.00415	0.00338	0.00398
GIWW-West	0.00109	0.00128	0.00109	0.00127	0.00104	0.00118
GIWW-East	0.00099	0.00114	0.00100	0.00113	0.00094	0.00106

RIVER	1990 PRE-DIVERSION	1990 POST-DIVERSION	1995 PRE-DIVERSION	1995 POST-DIVERSION	2000 PRE-DIVERSION	2000 POST-DIVERSION
Upper Mississippi	0.00197	0.00228	0.00185	0.00210	0.00168	0.00185
Lower Upper Mississippi	0.00183	0.00225	0.00205	0.00251	0.00187	0.00222
Lower Mississippi	0.00048	0.00054	0.00042	0.00047	0.00038	0.00041
Baton Rouge to Gulf	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Illinois Waterway	0.00127	0.00168	0.00119	0.00156	0.00111	0.00142
Missouri River	0.00202	0.00314	0.00190	0.00286	0.00173	0.00250
Ohio River	0.00032	0.00034	0.00029	0.00030	0.00027	0.00028
Monongahela/Allegheny	0.00292	0.00298	0.00259	0.00263	0.00251	0.00255
Kanahwa River	0.00256	0.00261	0.00239	0.00243	0.00223	0.00227
Kentucky River	0.02459	999.00000	0.02319	999.00000	0.02149	999.00000
Green River	0.00039	0.00039	0.00034	0.00034	0.00031	0.00031
Cumberland River	0.00229	0.00286	0.00202	0.00240	0.00180	0.00209
Tennessee River	0.00071	0.00083	0.00057	0.00064	0.00047	0.00052
Arkansas River/White	0.00463	0.00616	0.00401	0.00494	0.00363	0.00434
Alabama/Warrior System	0.00212	0.00302	0.00180	0.00249	0.00165	0.00229
ACF Rivers	0.04227	999.00000	0.04006	999.00000	0.03812	999.00000
Ouachita/Red Rivers	0.07405	999.00000	0.21153	999.00000	0.20224	999.00000
Columbia River System	0.00322	0.00376	0.00305	0.00351	0.00293	0.00334
GIWW-West	0.00083	0.00090	0.00077	0.00083	0.00074	0.00079
GIWW-East	0.00080	0.00087	0.00066	0.00071	0.00058	0.00062

separate segments and reflects differing expenditure and traffic levels ranging from a low of $580 thousand to a high of $45.5 million per ton-mile for 1977. As noted for the latter years, the toll decreases as time passes, traffic levels increase, and no new projects are started.

"The degree of the impact of diversion on each segment's ton-mile fee is, of course, a function of the magnitude of diversion of traffic using that segment which is in turn sensitive to initial toll levels as well as the mix of traffic on the segment. Rivers whose traffic is dominated by relatively rate-insensitive traffic will show little diversion

and minimal difference between pre- and post-diversion toll levels. For example, tolls on the Green River which is dominated by utility coal traffic are not affected significantly by traffic diversion."

A summary of domestic traffic diversions of commodities due to a segment toll tax is shown in Table 14. "Overall traffic diversion across all commodities and regions amounts to 59.6 million tons (13%) at 1977 traffic levels. By 1990, the traffic impacts of the segment-specific ton-mile tax are reduced to 8% of total waterway tonnage in spite of higher public expenditures. First, overall traffic levels are higher (645.8 million tons in 1990 versus 454.8 million tons in 1977), leading to lower segment fees. Second, traffic growth is strongest in the less sensitive commodities (especially coal), leading to a traffic base in 1990 which is less susceptible to diversion than in the base year. Similar effects also lead to a further reduction in diversion in the year 2000 in both absolute and relative terms (48.1 million tons and 6%)."

TABLE 14

DOMESTIC TRAFFIC DIVERSION SUMMARY
SEGMENT TOLL TAX
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	17,765.8	23	33,630.2	28,489.4	15	37,779.5	33,093.0	12
Wheat	10,131.9	7,685.0	24	13,336.6	11,475.6	14	15,708.7	14,055.9	11
Soybeans	11,593.4	9,239.8	20	23,863.4	20,686.0	13	30,457.9	27,127.8	11
Coal	125,344.1	123,931.1	01	257,867.5	253,882.9	02	322,095.5	317,312.3	01
Crude Petroleum	36,339.2	33,080.9	09	34,108.8	32,295.1	05	35,402.5	33,922.7	04
Sand and Gravel	55,325.5	53,042.2	04	62,178.4	60,922.8	02	66,608.3	65,393.6	02
Chemicals	29,945.4	26,762.6	11	39,083.6	36,142.7	08	48,883.9	45,838.2	06
Fertilizers	7,132.2	5,930.2	17	9,079.1	7,920.5	13	10,324.5	9,087.6	12
Gasoline	24,995.9	16,490.4	34	17,829.7	13,543.2	24	15,149.5	12,094.4	20
Distillate	17,783.6	12,111.6	32	20,470.3	15,889.0	22	20,641.1	16,795.4	19
Residual	30,188.8	24,198.2	20	26,499.5	23,678.6	11	20,509.1	18,694.4	09
Steel	5,675.6	3,724.8	34	8,014.6	5,813.9	27	9,555.3	7,443.6	22
Other	77,280.8	61,291.1	21	99,814.5	84,759.7	15	117,579.0	101,714.5	13
TOTAL	454,842.9	395,253.5	13	645,796.4	595,499.6	08	750,654.7	702,573.4	06

In comparison, a scenario (Table 15) is presented for the same commodities but considers a system-wide fuel tax as the vehicle for

recovery of expenditures. "Under a system-wide fuel tax, waterborne traffic pays tolls in accordance with the amount of fuel consumed in carrying out the movement, with the amount of the toll bearing no direct relationship to the public expenditures, either capital or operating, made on the segments actually used. The level of the tax per gallon depends on the amount of fuel consumed on the taxable waterways and the total recoverable public expenditures. In accordance with the traffic forecasts, operating characteristics, and public costs developed for this study, a system-wide fuel tax of 29.4¢ per gallon (in 1979 dollars) would have been required at 1977 traffic levels to recover full public operating and maintenance costs. Allowing for traffic changes resulting from this tax, the fee would have to have been increased to 37.9¢ per gallon to achieve full cost recovery. Unlike the segment-specific ton-mile tax, which was seen to decline over time as traffic growth increased, fuel tax levels actually increase by 1990 (38.1¢ per gallon after diversion) and decline only slightly by 2000 (35¢ per gallon after diversion)."

This failure of the fuel tax levels to significantly decline is due

TABLE 15

DOMESTIC TRAFFIC DIVERSION SUMMARY
SYSTEM FUEL TAX
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	19,349.9	16	33,630.2	29,035.7	14	37,779.5	33,073.0	12
Wheat	10,131.9	9,326.7	08	13,336.6	12,370.8	07	15,703.7	14,666.2	07
Soybeans	11,593.4	10,420.6	10	23,863.4	21,506.4	10	30,457.9	27,701.9	09
Coal	125,344.1	124,556.3	01	257,887.5	254,101.2	01	322,095.5	317,539.8	01
Crude Petroleum	36,339.2	31,924.9	12	34,108.8	30,037.7	12	35,402.5	31,417.3	11
Sand and Gravel	55,325.5	51,778.1	06	62,178.4	58,471.2	06	66,608.3	63,450.0	05
Chemicals	29,945.4	25,824.1	14	39,083.6	33,532.7	14	48,883.9	42,207.6	14
Fertilizers	7,132.2	6,306.2	12	9,079.1	8,061.9	11	10,324.5	9,222.9	11
Gasoline	24,995.9	14,540.7	42	17,829.7	10,600.3	41	15,149.5	9,146.6	40
Distillate	17,783.6	11,089.6	38	20,470.3	12,900.5	37	20,641.1	13,186.7	36
Residual	30,188.8	23,393.5	23	26,499.5	22,043.5	17	20,509.1	17,242.7	16
Steel	5,675.6	4,122.1	27	8,014.6	5,768.8	28	9,555.3	7,101.4	26
Other	77,280.8	64,168.2	17	99,814.5	82,609.3	17	117,539.0	97,976.4	17
TOTAL	454,842.9	396,800.9	13	645,796.4	581,040.0	10	750,654.7	683,932.5	09

to system-wide increases in the tax to fully cover all new projects as they "come on line" rather than being paid for as handled in a segment-specific system. "In 1990, the system-wide fuel tax results is 10% less barge traffic (compared to 8% under the segment specific ton-mile toll). By 2000, diversion under the system-wide fuel tax is 9% versus 6% under the segment-specific ton-mile toll. As in the case of the segment toll, impacts to traffic vary by commodity and region, although not necessarily in the same way. All other things being equal, traffic impacts under a fuel tax are relatively greater than under a segment toll for relatively low-cost rivers (e.g. the Ohio), and for commodities which are relatively fuel intensive (e.g. liquid bulks)."

PETROLEUM:

Of particular interest are Tables 16 and 17 that contract the effects of the different users fees on the petroleum industry. While the movement of crude petroleum along the GIWW is not what it once was, the movement of petroleum products is continuing to increase and is one of the largest volume items moving on the GIWW and other inland waterways. But it seems that petroleum product traffic on the inland waterway is one of the most sensitive products to increased user fees. "Faced with average tolls per ton of 21¢ and 24¢ in 1990, 22% to 24% of gasoline and distillate traffic switches to other modes (pipe for long haul and truck for short haul markets) or sources." Non-pipeable, residual fuel oil traffic will have a lower diversion rate, 11% in 1990, and will have an average toll of about 19¢. Most short haul traffic of crude petroleum will have only 14¢ per ton toll and will only be subjected to a 4%-5% shift in mode transportation.

Short haul, high volume petroleum movements inside the Gulf area are

only slightly affected by a segment-specific tax (Table 16), but long-haul shipments up into the inland waterways could be more heavily affected.

TABLE 16

PETROLEUM TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SEGMENT-SPECIFIC TON-MILE TAX

	1990			2000		
COMMODITY SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Crude Petroleum						
Gulf Intracoastal-West	19.04	0.13	3.4	19.73	0.11	2.9
New Orleans/Baton Rouge	11.25	0.07	1.1	11.88	0.06	0.8
Lower Mississippi	2.51	0.21	23.1	2.46	0.16	15.2
Gasoline						
Ohio	3.72	0.22	21.9	3.07	0.18	15.7
Gulf Intracoastal-West	2.67	0.16	2.4	2.31	0.14	2.0
Lower Mississippi	2.36	0.23	28.5	2.01	0.18	20.7
New Orleans/Baton Rouge	2.00	0.09	0.9	1.76	0.08	0.6
Upper Mississippi	1.06	0.41	61.9	0.92	0.33	61.0
Distillate Fuel Oil						
Gulf Intracoastal-West	4.58	0.11	2.2	4.65	0.10	1.9
Ohio	3.96	0.28	22.0	3.93	0.23	15.4
New Orleans/Baton Rouge	2.90	0.04	0.5	3.03	0.03	0.4
Lower Mississippi	2.31	0.17	25.8	2.37	0.13	19.3
Illinois Waterway	1.32	0.34	59.6	1.27	0.27	50.0
Residual Fuel Oil						
New Orleans/Baton Rouge	10.77	0.10	1.1	8.53	0.08	0.8
Gulf Intracoastal-West	7.49	0.11	1.8	5.93	0.09	1.5
Lower Mississippi	2.03	0.28	26.6	1.54	0.22	20.2
Arkansas/White	0.91	1.15	62.5	0.71	0.84	59.1

TABLE 17

PETROLEUM TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SYSTEM-WIDE FUEL TAX

	1990			2000		
COMMODITY SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Crude Petroleum						
Gulf Intracoastal-West	19.04	0.32	8.2	19.73	0.29	7.7
New Orleans/Baton Rouge	11.25	0.17	3.4	11.88	0.16	3.2
Lower Mississippi	2.51	0.62	60.9	2.46	0.58	86.0
Gasoline						
Ohio	3.72	0.91	62.1	3.07	0.84	61.7
Gulf Intracoastal-West	2.67	0.40	6.9	2.31	0.37	6.4
Lower Mississippi	2.36	0.63	60.8	2.01	0.58	60.2
New Orleans/Baton Rouge	2.00	0.22	2.5	1.76	0.20	2.3
Upper Mississippi	1.06	0.46	62.2	0.92	0.41	61.7
Distillate Fuel Oil						
Gulf Intracoastal-West	4.58	0.28	6.0	4.65	0.26	5.5
Ohio	3.96	1.12	61.9	3.93	1.03	61.5
New Orleans/Baton Rouge	2.90	0.10	1.4	3.03	0.08	1.2
Lower Mississippi	2.31	0.46	59.3	2.37	0.41	58.3
Illinois Waterway	1.32	0.58	62.2	1.27	0.52	61.7
Residual Fuel Oil						
New Orleans/Baton Rouge	10.77	0.21	2.4	8.53	0.19	2.1
Gulf Intracoastal-West	7.49	0.27	4.4	5.93	0.24	4.0
Lower Mississippi	2.03	0.65	59.0	1.54	0.58	57.7
Arkansas/White	0.91	1.04	61.7	0.71	0.95	61.3

Due to relative fuel intensity use of smaller tows that make up the bulk of the petroleum product movement, a system-wide fuel tax (Table 17) is more expensive. In 1990, an average fuel tax will be 30¢ per ton versus a segment-specific fee of 14¢ per ton-mile and 28¢ versus 11¢ in 2000, respectively. Response to these high system-wide fuel fees could lead to a 36%-41% diversion of gasoline shipments and a 11%-17% diversion of crude oil and residual fuel shipments.

CHEMICALS:

Traffic with chemical products presents a high to low range in values of cargo as well as requiring different handling characteristics due to the sometimes hazardous nature of the materials being shipped. "Although some modal and source reallocation of barge chemicals is indicated by the diversion analysis, there is little evidence that the levels of user fees identified in this analysis would bring about any measurable change in chemical industry production levels or regional patterns." Table 18 shows the average toll costs of chemical products per ton-mile under a segment-specific tax for 1990 and 2000. While the

TABLE 18

CHEMICAL TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SEGMENT-SPECIFIC TON-MILE TAX

	1990			2000		
COMMODITY SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Chemicals						
Gulf Intracoastal-West	12.56	0.15	5.1	15.32	0.14	4.3
New Orleans/Baton Rouge	7.15	0.13	2.7	8.14	0.12	2.5
Ohio	5.78	0.59	2.5	7.94	0.43	1.8
Illinois Waterway	3.38	1.37	8.8	4.32	1.20	7.5
Tennessee	2.60	0.75	21.8	3.18	0.56	15.8
Fertilizer						
Illinois Waterway	2.04	1.01	40.5	2.25	0.89	40.1
Upper Mississippi	1.96	1.60	2.6	2.20	1.35	2.2
Ohio	1.47	0.55	0.9	1.84	0.43	0.7
Gulf Intracoastal-West	0.56	0.43	8.3	0.63	0.37	6.9
Lower Mississippi	0.51	0.25	0.8	0.57	0.19	0.4

average tolls for these products moving to the upper river markets are higher, the tolls for short-haul movements in the Gulf area are lower.

Like petroleum products, chemicals are more likely to pay higher fees per ton-mile under a system-wide fuel tax because of the same fuel intensity syndrome suffered by dedicated tows. Table 19 shows that the effect of imports due to a system-wide fuel tax is roughly twice that of the segment-specific tax.

TABLE 19

CHEMICALS TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SYSTEM-WIDE FUEL TAX

	1990			2000		
COMMODITY SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Chemicals						
Gulf Intracoastal-West	12.56	0.35	11.3	15.32	0.37	11.0
New Orleans/Baton Rouge	7.15	0.28	4.2	8.14	0.30	4.4
Ohio	5.78	2.22	11.9	7.94	1.85	10.7
Illinois Waterway	3.38	2.63	13.4	4.32	2.44	12.2
Tennessee	2.60	2.04	41.5	3.18	1.87	41.1
Fertilizer						
Illinois Waterway	2.04	0.96	40.3	2.25	0.89	40.1
Upper Mississippi	1.96	1.15	0.9	2.20	1.04	1.5
Ohio	1.47	0.94	1.7	1.84	0.86	1.6
Gulf Intracoastal-West	0.56	0.70	16.0	0.63	0.65	14.9
Lower Mississippi	0.51	0.37	1.2	0.57	0.34	0.9

FERTILIZERS:

Combined with chemical products in Tables 18 and 19 is the data for fertilizer traffic. Fertilizer is generally a dry-bulk product that is less fuel intensive and is often associated with back-hauling of commodities such as grain. Therefore, when back-hauling is in use there is less penalty under a system-wide fuel tax. System-wide fuel taxes for 1990 will be about 88¢ per ton decreasing to 81¢ per ton in 2000. Taxes using a segment-specific tax would be approximately 96¢ per ton in 1990 and 79¢ per ton in 2000. These fees would translate to a diversion rate of 11% for both years of the fuel tax versus a 12%-13% diversion for the

segment-specific tax. Liquid fertilizers transported in tank barges have no back-haul prospect so the diversion rate of this product could be higher.

COAL PRODUCTS:

Of all the commodities studied in this report, it is coal that is recorded as having the highest tonnage freight movement of them all. Referring again to Tables 14 and 15 it is noted that the shipment of coal is projected to double by the year 2000. Only one other commodity, soybeans, is projected to have this growth rate and its' total volume is only about 10% of coal. It should be noted that major investments on riverfront sites and facilities for handling coal would make conversions to any other type of delivery economically unfeasible for many utilities or individual users. While the majority of the coal traffic is in the upper inland river system, the possibility of the coal industry competing actively on the foreign coal market makes the Port of New Orleans an attractive demarcation point for overseas exports. Should the proposed deepening of the lower Mississippi to a depth of 55 feet be accomplished, large ocean-going super-colliers will be able to on-load directly from the up-river barges and could be a factor in making U.S. coal prices much more competitive on the world market.

Even though coal is not now widely used in Texas, there are vast stores of readily accessible coal available. It is estimated that 12.2 billion short tons of lignite coal are available at a depth of 200 feet or less. An additional 100 billion tons is available from the 200 foot to 5000 foot depth.[11]

[11] Texas Almanac, 1976-1977, p. 425.

The general availability of oil and natural gas has placed the earlier part of the century's rather significant use of coal, but these large deposits are again gaining the interest of energy suppliers. In 1979, the Texas Railroad Commission issued two permits for bituminous coal surface mines in Coleman and Erath Counties with the probability of more permits to be issued. So should there be full scale mining of these deposits it is very possible that Texas could gain another valuable export item that is ideally suited for barge transportation. There will be a definite battle between rail and barge carriers for the inland trade as the coal deposits are not closely situated to the GIWW. Barge transportation rates would have to overcome the additional transportation costs of bringing the coal to the barges for shipment up the inland water chain.

Tables 20 and 21 show low diversion percentages of coal transportation traffic caused by the two types of users fees. The Lower Upper Mississippi River area between Lock and Dam 26 and the Ohio River are the only areas to show significant sensitivity among the major coal producing regions.

TABLE 20

COAL TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SEGMENT-SPECIFIC TON-MILE TAX

	1990			2000		
SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Ohio	98.80	0.11	0.0	111.50	0.09	0.1
Allegheny/Monongahela	41.75	0.14	0.3	48.26	0.12	0.2
New Orleans/Baton Rouge	17.11	0.83	0.4	27.17	0.59	0.3
Gulf Intracoastal-West	20.03	0.88	0.2	24.54	0.72	0.1
Lower U. Mississippi	13.49	0.42	25.2	17.29	0.40	24.1
Gulf Intracoastal-East	13.38	0.60	0.1	20.71	0.48	0.2
Tennessee	11.19	0.16	0.1	14.16	0.12	0.1
Upper Mississippi	10.03	0.92	1.6	14.17	0.68	1.2
Alabama/Warrior	10.19	0.89	0.7	17.86	0.65	0.4

TABLE 21

COAL TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SYSTEM-WIDE FUEL TAX

SEGMENT	1990 BASE TRAFFIC (Million ST)	1990 AVERAGE TOLL ($1979)	1990 DIVERSION (%)	2000 BASE TRAFFIC (Million ST)	2000 AVERAGE TOLL ($1979)	2000 DIVERSION (%)
Ohio	98.80	0.27	0.0	111.50	0.25	0.1
Allegheny/Monongahela	41.75	0.18	0.3	48.26	0.16	0.3
New Orleans/Baton Rouge	17.11	0.86	0.3	27.17	0.78	0.3
Gulf Intracoastal-West	20.03	1.64	0.4	24.54	1.50	0.3
Lower U. Mississippi	13.49	0.48	23.5	17.29	0.45	22.2
Gulf Intracoastal-East	13.38	0.83	0.3	20.71	0.76	0.3
Tennessee	11.19	0.37	0.4	14.16	0.34	0.4
Upper Mississippi	10.03	0.53	0.8	14.17	0.44	0.7
Alabama/Warrior	10.19	0.44	0.3	17.86	0.50	0.3

STEEL PRODUCTS:

The most sensitive commodity to the imposition of user fees seems to be those included in the steel product group. Strong modal competition by rail and truck vie with the barge-served markets. "The average ton of barge-carried steel products bears a toll of 67¢ in 1990 and 58¢ in 2000, resulting in 27% diversion in the earlier year and 22% in the latter (Table 22). Although barge line-haul rates are typically well below rail

TABLE 22

STEEL TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SEGMENT-SPECIFIC TON-MILE TAX

SEGMENT	1990 BASE TRAFFIC (Million ST)	1990 AVERAGE TOLL ($1979)	1990 DIVERSION (%)	2000 BASE TRAFFIC (Million ST)	2000 AVERAGE TOLL ($1979)	2000 DIVERSION (%)
Gulf Intracoastal-West	2.03	0.49	19.9	2.34	0.42	16.0
Ohio	1.30	0.35	12.8	1.56	0.29	9.9
Lower Mississippi	1.15	0.28	35.9	1.39	0.22	31.5
Arkansas/White	0.74	2.12	69.6	0.89	1.55	48.8
Illinois Waterway	0.55	1.35	19.5	0.71	1.20	17.7
Lower U. Mississippi	0.51	0.74	18.8	0.62	0.67	18.1

and truck line-haul rates for most movements, a variety of factors including transfer and distribution costs, preferred shipment sizes, speed of delivery, etc., make these other modes quite competitive in certain submarkets; hence, the sensitivity. The largest end market, the GIWW West,

faces almost 20% diversion, made up of a heavier traffic impacts in the longer-haul, higher toll markets and lower-level impacts in local movements (Table 23).

TABLE 23

STEEL TRAFFIC IMPACTS BY SELECTED DESTINATION SEGMENT
SYSTEM-WIDE FUEL TAX

	1990			2000		
SEGMENT	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)	BASE TRAFFIC (Million ST)	AVERAGE TOLL ($1979)	DIVERSION (%)
Gulf Intracoastal-West	2.03	0.80	36.8	2.34	0.75	33.5
Ohio	1.30	0.67	21.0	1.56	0.62	19.2
Lower Mississippi	1.15	0.39	40.3	1.39	0.35	38.6
Arkansas/White	0.74	0.80	20.0	0.89	0.73	18.0
Illinois Waterway	0.55	1.43	20.2	0.71	1.32	18.6
Lower U. Mississippi	0.51	0.82	18.9	0.62	0.74	18.3

Diversion is especially severe in end-markets which involve hauls on high-cost segments. For example, steel traffic into the Arkansas River faces an average toll of $2.12 in 1990, causing diversion of nearly 70% of that traffic. Low tolls on the Ohio River, on the other hand, keep diversion in the 10%-13% range.

Low toll levels relative to total steel production and marketing costs give rise to some possibility that these steel traffic impacts are somewhat on the high side, particularly for some areas like the Lower Mississippi River, where average tolls tend to be low whether the steel moves upriver from import ports or downriver from northern producing areas. The desire to avoid biasing impacts downward led to adherence to the high sensitivities in the survey results.

The practice of absorbing freight differentials to maintain market competitiveness would tend to reduce final market impacts for domestic waterborne steel when reduced shipments (rather than modal shift) were the option to paying higher user fees. Such absorption would not be available to imported steel moving up from New Orleans because such

price reduction would probably violate trigger price guidelines.

Steel traffic also pays a modest premium compared to the dry bulks under a system-wide fuel tax, paying an average toll of 71¢ per ton in 2000 compared to 58¢ per ton under a segment-specific ton-mile toll. Diversion in that year is up from 22% to 26% compared to the segment-specific ton-mile tax case.

The distribution of steel traffic impacts is affected even more by the tax approach than by the overall magnitude of diversion. Thus, fuel taxes are considerably higher than segment fees for markets using low cost rivers (e.g., GIWW West, Ohio) resulting in higher diversion in those markets, while high cost markets such as the Arkansas pay only about half as great a toll under the system-wide fuel tax preserving a greater share of base traffic."

COMBINATION OF TAX TYPES:

All preceeding examples have dealt with either system-wide fuel taxes or segment-specific taxes on a 100% recovery level. This presented the greatest opportunity for traffic diversion to occur using either type of tax system.

Another scenario using the 100% recovery level was a combination of fuel and segment taxes applied to the system. Table 24 shows the diversion loss for this combination tax as it applies to individual commodities for the years 1990 and 2000. A system-wide fuel tax of 9.9¢ per gallon of fuel was applied that would recover about 25% of the total system costs and would cover the Ohio River Public costs as the lowest cost river system. Consequently, the applied segment tax would need to recover the remaining 75% of each segment's costs. Bear in mind that the present fuel tax will reach 10¢ per gallon by 1985.

TABLE 24

DOMESTIC TRAFFIC DIVERSION SUMMARY
FUEL-SEGMENT COMBINATION
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.8	18,783.8	19	33,630.2	29,245.3	13	37,779.5	33,440.9	11
Wheat	10,131.9	8,563.5	15	13,336.6	11,980.8	10	15,708.7	14,313.3	09
Soybeans	11,593.4	9,932.3	14	23,863.4	21,565.3	10	30,457.9	27,293.2	10
Coal	125,344.1	124,450.5	01	257,887.5	253,930.5	02	322,095.5	317,236.2	02
Crude Petroleum	36,339.2	32,420.3	11	34,108.8	31,612.1	07	35,402.5	33,242.0	06
Sand and Gravel	55,325.5	53,042.7	04	62,178.4	60,890.6	02	66,608.3	65,336.9	02
Chemicals	29,945.4	26,223.8	12	39,083.6	35,461.4	09	48,883.9	44,723.9	09
Fertilizers	7,132.2	6,085.6	15	9,079.1	7,942.5	13	10,324.5	9,093.9	12
Gasoline	24,995.9	14,752.1	41	17,829.7	12,030.0	33	15,149.5	10,815.0	29
Distillate	17,783.6	11,160.2	37	20,470.3	14,394.9	30	20,641.1	15,206.1	26
Residual	30,188.6	23,568.3	22	26,499.5	23,165.4	13	20,509.1	18,131.3	12
Steel	5,675.6	3,816.8	33	8,014.6	5,942.7	26	9,555.3	7,449.3	22
Other	77,280.8	60,630.3	22	99,814.5	83,255.2	17	117,539.0	99,111.6	16
TOTAL	454,842.9	393,430.1	14	645,796.4	591,416.7	08	750,654.7	695,393.5	07

Comparison of the table results shows that this combination tax impact to the waterway system falls between the diversion limits set by using each type tax separately. The combination tax results in a diversion of 8% of the waterway traffic in 1990 (compared to 8% under the segment tax and 10% under the fuel tax), and a 7% diversion in 2000 versus 6% for segment and 9% for fuel tax.

LESS THAN FULL RECOVERY SCENARIOS:

Scenarios using less than 100% recovery were investigated with a segment toll set to recover 50% and 75% of the costs. Tables 25 and 26 show the comparative results of these studies. These studies show a smaller diversion effect on the industry than does the 100% recovery plan. Two findings are of particular interest: the four high-cost river segments that were forced to shut down under full recovery costs were still unable to remain in operation. Also, impacts decline more than proportionally with recovery levels i.e., a 50% reduction in cost recovery tends to reduce traffic impacts by more than half.

TABLE 25

DOMESTIC TRAFFIC DIVERSION SUMMARY
SEGMENT TOLL - 50% RECOVERY
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	21,204.8	08	33,630.2	31,489.7	06	37,779.5	35,651.3	06
Wheat	10,131.9	9,261.2	09	13,336.6	12,589.2	06	15,708.7	14,987.1	05
Soybeans	11,593.4	10,754.6	07	23,863.4	22,240.2	07	30,457.9	28,604.9	06
Coal	125,344.1	125,030.6	00	257,887.5	256,166.0	01	322,095.5	320,053.1	01
Crude Petroleum	36,339.2	35,086.0	03	34,108.8	33,469.7	02	35,402.5	34,894.7	01
Sand and Gravel	55,325.5	54,820.2	01	62,178.4	61,623.3	01	66,608.3	66,077.2	01
Chemicals	29,945.4	28,789.2	04	39,083.6	37,925.9	03	48,883.9	47,742.1	02
Fertilizers	7,132.2	6,378.3	11	9,079.1	8,246.1	09	10,324.5	9,446.8	08
Gasoline	24,995.9	21,272.0	15	17,829.7	15,882.8	11	15,149.5	13,864.7	08
Distillate	17,783.6	15,335.5	14	20,470.3	18,443.8	10	20,641.1	19,107.5	07
Residual	30,188.8	27,535.9	09	26,499.5	25,136.4	05	20,509.1	19,681.8	04
Steel	5,675.6	4,709.7	17	8,014.6	7,026.8	12	9,555.3	8,718.9	09
Other	77,280.8	72,017.7	07	99,814.5	94,580.1	05	117,539.0	112,749.3	04
TOTAL	454,842.9	432,195.7	05	645,796.4	624,820.0	03	750,654.7	731,581.2	03

TABLE 26

DOMESTIC TRAFFIC DIVERSION SUMMARY
SEGMENT TOLL - 75% RECOVERY
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	LOSS	1990	1990 DIVERSION	LOSS	2000	2000 DIVERSION	LOSS
Corn	23,106.6	19,902.8	14	33,630.2	30,264.1	10	37,779.5	34,492.8	09
Wheat	10,131.9	8,647.5	15	13,336.6	12,131.6	09	15,708.7	14,544.3	07
Soybeans	11,593.4	10,183.8	12	23,863.4	21,568.8	10	30,457.9	27,903.2	08
Coal	125,344.1	124,746.1	00	257,887.5	254,750.2	01	322,095.5	318,489.4	01
Crude Petroleum	36,339.2	34,023.3	06	34,108.8	32,852.6	04	35,402.5	34,377.5	03
Sand and Gravel	55,325.5	54,188.9	02	62,178.4	61,123.8	02	66,608.3	65,536.7	02
Chemicals	29,945.4	27,729.8	07	39,083.6	37,023.4	05	48,883.9	46,722.0	04
Fertilizers	7,132.2	6,134.4	14	9,079.1	8,000.7	12	10,324.5	9,165.7	11
Gasoline	24,995.9	18,743.5	25	17,829.7	14,551.3	18	15,149.5	12,879.7	15
Distillate	17,783.6	13,636.5	23	20,470.3	16,992.2	17	20,641.1	17,804.1	14
Residual	30,188.8	26,000.9	14	26,499.5	24,368.5	06	20,509.1	18,184.5	06
Steel	5,675.6	4,182.9	26	8,014.6	6,378.9	20	9,559.3	9,050.1	16
Other	77,280.8	64,822.9	16	99,814.5	87,939.3	12	117,539.0	109,241.7	07
TOTAL	454,842.9	412,943.2	09	645,796.4	607,945.6	06	750,654.7	718,391.7	04

VARIABLE OTHER MODE RATE RESPONSES:

As mentioned earlier in this review the rate response of other transportation modes is very important if user fees are imposed on the waterway systems. In order to investigate how those responses would influence diversion from waterway traffic two basic scenarios were formulated. The first scenario compared commodity diversions under separate fuel and segment fees using a 100% recovery level and a 100% railroad rate increase response. As shown in Tables 27 and 28 diversion

of all other commodities not directly affected by the railroad response is reduced some because of the additional traffic growth. It was assumed that the competitive position of barge carriers is unaffected because the users fees increases were matched exactly by the railroad response.

TABLE 27

DOMESTIC TRAFFIC DIVERSION SUMMARY
SYSTEM FUEL TAX : 100% RAILROAD RESPONSE
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	23,106.6	00	33,630.2	33,630.2	00	37,779.5	37,779.5	00
Wheat	10,131.9	10,131.9	00	13,336.6	13,336.6	00	15,708.7	15,708.7	00
Soybeans	11,593.4	11,593.4	00	23,863.4	23,864.4	00	30,457.9	30,457.9	00
Coal	125,344.1	124,607.7	01	257,887.5	254,342.3	01	322,095.5	317,615.5	01
Crude Petroleum	36,339.2	32,058.8	12	34,108.8	30,153.9	12	35,402.5	31,550.1	11
Sand and Gravel	55,325.5	52,296.3	05	62,178.4	58,824.6	05	66,608.3	63,717.6	04
Chemicals	29,945.4	29,945.4	00	39,083.6	39,083.6	00	48,883.9	48,883.9	00
Fertilizers	7,132.2	7,132.2	00	9,079.1	9,079.1	00	10,324.5	10,324.5	00
Gasoline	24,995.9	14,631.1	41	17,829.7	10,654.8	40	15,149.5	9,185.6	39
Distillate	17,783.6	11,148.7	37	20,470.3	12,950.8	37	20,641.1	13,250.2	36
Residual	30,188.8	23,479.8	22	26,499.5	22,093.9	17	20,509.1	17,296.9	16
Steel	5,675.6	5,675.6	00	8,014.6	8,014.6	00	9,555.3	9,555.3	00
Other	77,280.8	64,746.7	16	99,814.5	83,248.4	17	117,539.0	98,720.1	16
TOTAL	454,842.9	410,554.3	10	645,796.4	599.276.5	07	750,654.7	704,045.7	06

TABLE 28

DOMESTIC TRAFFIC DIVERSION SUMMARY
SEGMENT TAX : 100% RAILROAD RESPONSE
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	23,106.6	00	33,630.2	33,630.2	00	37,779.5	37,779.5	00
Wheat	10,131.9	10,131.9	00	13,336.6	13,336.6	00	15,708.7	15,708.7	00
Soybeans	11,593.4	11,593.4	00	23,863.4	23,863.4	00	30,457.9	30,457.9	00
Coal	125,344.1	124,520.1	01	257,887.5	253,485.5	02	322,095.5	316,879.7	02
Crude Petroleum	36,339.2	33,378.8	08	34,108.8	32,319.7	05	35,402.5	33,910.6	04
Sand and Gravel	55,325.5	53,854.1	03	62,178.4	59,638.2	04	66,608.3	64,046.5	04
Chemicals	29,945.4	29,945.4	00	39,083.6	39,083.6	00	48,883.9	48,883.9	00
Fertilizers	7,132.2	7,132.2	00	9,079.1	9,079.1	00	10,324.5	10,324.5	00
Gasoline	24,995.9	17,259.4	31	17,829.7	13,759.8	23	15,149.5	12,225.4	19
Distillate	17,783.6	12,663.9	29	20,470.3	16,173.5	21	20,641.1	16,985.2	18
Residual	30,188.8	25,061.1	17	26,499.5	23,871.6	10	29,509.1	18,787.8	08
Steel	5,675.6	5,675.6	00	8,014.6	8,014.6	00	9,555.3	9,555.3	00
Other	77,280.8	62,732.9	19	99,814.5	85,471.6	14	117,539.0	101,879.2	13
TOTAL	454,842.8	417,055.4	06	645,796.4	611,727.6	05	750,654.7	717,424.1	04

"In the aggregate, this results in 7% diversion in 1990 and 6% diversion in 2000 with full rail response in the case of a system-wide fuel tax, compared to 10% and 9%, respectively, when there is no rail

response. In the segment-specific ton-mile toll case, 1990 traffic reductions are reduced to 5% by full rail response in the affected commodities (versus 8% without), and 4% in 2000 (versus 6% without railroad response)."

The second scenario compared the results of the separate taxes when only a 50% rate increase response was made by the railroad. The results of the system-wide fuel tax is reported in Table 29 for the river segments previously noted, while the segment-specific tax reaction on selected commodities is presented in Table 30.

"If an other-mode response of 50% is factored in, reductions in traffic diversions are, of course, reduced. This occurs not only because the relevant commodities (grain, chemicals, fertilizer, steel) show some diversion due to the altered competitive conditions of the user fee, but also because traffic in the commodities not directly affected by other-mode response must, as a result, bear a greater portion of the recovery burden. Thus, 6% of grain traffic is lost in 1990 under a segment-specific ton-mile toll with 50% rail response (compared to 0% under a 100% rail response scenario), and additional diversion of petroleum products and other commodities is experienced due to marginally higher tolls. Similar effects are seen in 2000 and both years under the system-wide fuel tax (see Tables 29 and 30).

Comparison of a 50% rail response under a segment-specific ton-mile toll to the 50% recovery scenario examined in the previous section shows considerably lower total diversion in the latter scenario (e.g. 3% for the partial recovery case in 1990 versus 6% in the partial rail response case). This difference results from the fact that the 50% recovery alternative provides relief to all commodities while the rail response

only impacts the commodities which were prespecified as subject to strong rail competition."

TABLE 29

DOMESTIC TRAFFIC DIVERSION SUMMARY
SYSTEM FUEL TAX - 50% RAILROAD RESPONSE
ORIGINATING TONS
(1000 Short Tons)

REGION	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Upper Mississippi	21,799.7	20,236.7	07	36,097.4	34,167.6	05	44,136.1	42,102.4	05
Lower Upper Mississippi	21,961.9	17,488.6	20	37,629.1	32,470.4	14	46,027.4	40,856.5	11
Lower Mississippi	11,980.4	9,982.0	17	17,821.9	15,483.1	13	20,900.6	18,510.6	11
Baton Rouge to Gulf	61,954.0	49,974.0	19	65,712.2	54,406.5	17	69,428.4	58,404.2	16
Illinois Waterway	28,760.7	24,359.8	15	35,191.7	30,225.5	14	39,267.4	34,247.5	13
Missouri River	5,612.2	3,858.6	31	7,031.1	4,738.2	33	7,765.8	5,453.2	30
Ohio River	88,433.2	80,934.7	08	170,443.7	161,226.5	05	200,546.7	190,978.4	05
Monongahela/Allegheny	29,000.8	28,630.7	01	42,437.5	41,943.9	01	50,948.2	50,415.5	01
Kanahwa River	5,468.4	5,401.0	01	9,792.5	9,695.6	01	11,036.0	10,895.3	01
Kentucky River	0.0	0.0	NC	0.0	0.0	NC	0.0	0.0	NC
Green River	13,399.7	13,356.6	00	27,624.9	27,552.2	00	34,284.6	34,195.8	00
Cumberland River	3,910.8	3,664.6	06	4,646.4	4,453.1	04	5,923.1	5,683.1	04
Tennessee River	10,489.8	9,851.9	06	16,880.6	15,868.6	06	27,294.5	26,152.8	04
Arkansas River/White	6,629.7	5,817.4	12	11,736.8	11,046.5	06	14,780.7	14,132.4	04
Alabama/Warrior System	22,880.3	21,480.3	06	26,169.1	24,822.8	05	31,212.0	29,904.1	04
ACF Rivers	499.0	493.3	01	634.7	629.4	01	734.3	728.5	01
Ouachita/Red Rivers	768.8	671.4	13	1,164.6	1,044.7	10	1,374.4	1,247.2	09
Columbia River System	21,004.1	20,338.0	03	28,474.5	27,862.7	02	31,024.7	30,477.6	02
GIWW-West	85,855.2	73,942.6	14	93,052.5	80,104.9	14	100,433.0	87,100.7	13
GIWW-East	14,434.2	12,645.3	12	13,255.2	11,428.0	14	13,536.5	11,623.5	14
TOTAL	454,842.9	403,127.5	11	645,796.4	589,171.0	09	750,654.7	693,109.4	08

TABLE 30

DOMESTIC TRAFFIC DIVERSION SUMMARY
SEGMENT TAX - 50% RAILROAD RESPONSE
(1000 Short Tons)

COMMODITY	1977	1977 DIVERSION	% LOSS	1990	1990 DIVERSION	% LOSS	2000	2000 DIVERSION	% LOSS
Corn	23,106.6	21,042.9	09	33,630.2	31,386.2	07	37,779.5	35,509.8	06
Wheat	10,131.9	9,169.5	09	13,336.6	12,561.0	06	15,708.7	14,956.5	05
Soybeans	11,593.4	10,629.4	08	23,863.4	22,156.6	07	30,457.9	28,491.0	06
Coal	125,344.1	124,381.3	01	257,887.5	253,917.2	02	322,095.5	317,394.3	01
Crude Petroleum	36,339.2	33,222.9	09	34,108.8	32,373.3	05	35,402.5	33,931.2	04
Sand and Gravel	55,325.5	53,708.1	03	62,178.4	60,944.6	02	66,608.3	65,393.6	02
Chemicals	29,945.4	28,527.5	05	39,083.6	37,738.3	03	48,883.9	47,501.0	03
Fertilizers	7,132.2	6,207.2	13	9,079.1	8,079.4	11	10,324.5	9,266.8	10
Gasoline	24,995.9	16,716.8	33	17,829.7	13,633.8	24	15,149.5	12,149.6	20
Distillate	17,783.6	12,293.2	31	20,470.3	16,026.0	22	20,641.1	16,884.5	18
Residual	30,188.8	24,665.7	18	26,499.5	23,787.9	10	20,509.1	18,760.6	09
Steel	5,675.6	4,602.6	19	8,014.6	6,948.0	13	9,555.3	8,599.3	10
Other	77,280.8	62,169.2	20	99,814.5	85,401.1	14	117,539.0	101,989.6	13
TOTAL	454,842.9	407,336.3	10	645,796.4	604,953.3	06	750,654.7	710,827.8	05

BALANCED PAYMENTS

The national balance of payments can be affected by the change in delivered prices both of export and import goods after a user fee is employed. Two of the more important commodities that can affect the balance of payments are export grains and steel imports and as noted earlier, both are highly sensitive to the assessment of additional taxes. The effect of a user fee on U.S. grain sales abroad will depend on foreign demand for the grains at that time. When the demand is weak the user charges will have to shift back to the barge operator, the grain elevator and the farmer. Should the demand be stronger, then these charges can be included in the sales price of the grain and the charge effect will be nil. Steel imports as a whole would most likely drop slightly since the delivered price of waterborne goods would be higher. "In sum, then, the impact of waterway user charges on the United States balance of payments can be expected to be negligible. Probably the most important point that can be made is that other factors, the value of the dollar, harvests in other countries and the general state of the world economy, will have far greater impacts on either grain exports or steel imports than will user charges."

ECONOMIC IMPACTS

Regional economic impacts will be felt first in the job market and secondly as income losses to the primary water-served industries. Lower spending within the region will have secondary impacts on suppliers and to some extent to the local consumer. Job losses can sometimes be offset within a region by compensating gains in other-mode activity. Costs of producing goods will rise causing a corresponding rise in the price of those goods to the consumer.

Regardless of however other areas or businesses are affected, it basically comes down to how the water carrier will adjust to the user charges. "The initial burden of any waterway user charge falls on the water carrier. While carriers may attempt to absorb some of the tax in the short run as they adjust equipment levels and compete for the reduced traffic, they are likely to try to pass on the charges to shippers and receivers in the long run. Naturally, each operator will strive to develop a pricing strategy that is best for his firm. The net result may well be that the operators absorb part of the charge for quite a while, but as discussed earlier, the assumption of 100 percent pass-through was made since this maximizes the impacts of user charges on shippers and permits examination of the worst case. As the fee is added to barge rates, traffic is diverted. Since waterway traffic is growing for most commodities, traffic for the industry as a whole will eventually return to the levels prevailing before the user charge was imposed and continue to grow from that point.

Most of the adverse effects will be felt by the carriers during the period before traffic regains its pre-user-charge levels. It has to be recognized that it is at least conceivable that some small carriers, already in marginal financial condition, might not survive the adjustment period. Further, although traffic will continue to grow for the industry, it will always be less than what it would have been without user charges. Once the barge operators are required to build their right-of-way costs into their rates, their competitive position with respect to other modes will be permanently altered."

FUTURE FACILITIES

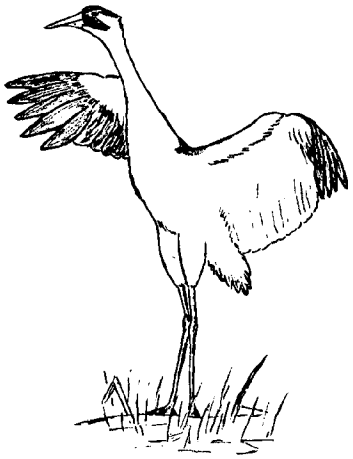
User charges will change timing needs for new facilities by reducing

the volume of traffic on the existing waterway. Basically, the study projections show that the present system, including the projects now under construction, will meet all requirements through the end of the century. "This is true even if the level of the present waterway user charge is not changed." This statement will most likely be challenged by those whose businesses, both manufacturing and transporting, are being restricted by widths, depths, sharp turning radii of the waterway and delay times at antiquated structures.

"In conclusion, the main impact of waterway user charges on the need for new facilities is to delay the time at which construction is required to accommodate future growth. Future traffic growth will result in the need for new structures. The timing will depend on the particular commodity mix of traffic through the present facility and its sensitivity to traffic diversion."

CHAPTER FIVE

"EFFECTS OF USER CHARGES ON TEXAS COASTAL WATERWAYS", IN SUMMARY



"EFFECTS OF USER CHARGES
ON TEXAS COASTAL WATERWAYS",
IN SUMMARY

In response to the need for strong, knowledgeable input into the recommendations of the Section 205 Federal Waterways Study, the Texas State Department of Highways and Public Transportation (SDHPT) in cooperation with the Texas Transportation Institute (TTI) began a study of the impact of navigation user-fees on the economy of Texas.* The objectives of this study were to identify and establish values for primary commodity flows along the Texas Gulf Intracoastal Waterway; to identify expected trends in modal diversion or market abandonment as a result of user charges; and to project effects of increased shipping rates on regional economies of Texas.

USER CHARGE HISTORY

The present tax (which was implemented October 1, 1980) began at four cents per gallon and will increase in two cent increments to a maximum of ten cents in 1985. Other proposals include President Reagan's 30 cent per gallon tax designed to recover the total 1983 federal outlay for operation and maintenance. Also, Senators Stafford (R-VT) and Abdnor's (R-SD) bill (S.810) proposed to recover 90 percent of all navigation projects and varying percentages of other types of projects

*The formal report "Effects of User Charges on Texas Coastal Waterways", Study 2-10-81-1068, may be obtained from the Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843.

with a schedule of fees established yearly on the basis of

1) anticipated Federal expenditures,
2) expected commercial traffic volume,
3) peaking factors,
4) congestion, and
5) other factors;

Further, Senator Domenici's (R-NM) Amendment calls for 75 percent recovery of operation and maintenance, and 50 percent of capital costs. Although no new proposals have been accepted as yet, the current political climate of federal budget cutting continues to give impetus to the push for cost recovery.

After years of debate, the initial four cent per gallon tax was brought about by Congress through the Inland Waterways Revenue Act in 1978. Controversy has continued over the user charge with proponents claiming that it is needed for equity in modal competition. Opponents of the fee assert that all major modes of transportation are federally subsidized and that the benefits of waterway subsidies accrue to the public as a whole and not to special interest groups only.

TEXAS GIWW

In Texas, the Intracoastal Waterway extends approximately 426 miles from Orange by the Louisiana border to Brownsville at the southern tip of the State. Because water transportation provides the lowest cost method of moving many commodities, it has been instrumental in Texas economy. In 1979, 67.8 million tons were moved along the Texas coast. The 1977 Census of Transportation indicated that 22.2 percent of all manufactured goods in Texas were shipped by water on at least the first leg of the journey to the consumer. For the same year, foreign imports and exports at the 10 major Texas ports exceeded 132 million tons while domestic shipments totaled more than 114 million tons.

Activity on the GIWW and in the ports is an economic plus for Texas with benefits including increased employment and income, a larger tax base, and energy savings from an energy efficient method of transportation. The GIWW also affords commercial fishing boats and recreational boats a means of navigating along the coast and out to sea. In the past, much of the cost for construction, maintenance and operation of the GIWW has been borne by its federal sponsor, the U.S. Army Corps of Engineers. In 1975, the Texas Coastal Waterway Act authorized the State Department of Highways and Public Transportation to fulfill the role of non-federal sponsor for the GIWW. Because of a conflict between the federal statutes and the Texas Constitution, the Army Corps of Engineers continues to dredge the GIWW to ensure safe navigation, but the burden of operations, maintenance and construction could be shifted to the State as soon as the conflict is resolved.

USER CHARGE OPTIONS

To fully understand the potential effects of current and proposed user charges, an understanding of types and levels of charges is essential. Of the four user charges discussed in the literature only three apply to Texas:

1) Fuel Tax;
2) Segment Toll;
3) License Fee.

The use of the fourth, the lockage fee, is not applicable to the Texas portion of the GIWW because there are no locks except the flooding locks of the Colorado River.

FUEL TAX

The fuel tax, which is presently in effect, was chosen because it required little or no additional administrative or record keeping capacity. It is the responsibility of the commercial haulers to report fuel consumption and pay the tax to the Internal Revenue Service. Since higher ton-mileage generates more fuel consumption, users of higher volume segments will generate more revenue. As a result, the GIWW-West (Texas GIWW plus New Orleans) with its high ton-mileage and medium range operations and maintenance costs is probably subsidizing the higher operation and maintenance costs of the Mississippi River System (See Table 31).

TABLE 31

CORPS OF ENGINEERS OPERATION AND MAINTENANCE EXPENDITURES SUBJECT TO RECOVERY AND COSTS PER MILE FOR SELECTED INLAND WATERWAYS (IN THOUSANDS OF CURRENT DOLLARS)

SEGMENT	Year 1977	1978	1979	1980	1981	1982 (Forecast)
Upper Mississippi						
Total	$34,614.5	$48,443.5	$38,488.7	$40,277.5	$34,352.6	$44,637.9
Per Mile	40.3	56.3	44.8	46.8	39.9	51.9
Lower Mississippi						
Total	53,268.8	60,135.1	59,730.7	60,721.0	69,823.5	69,500.4
Per Mile	54.5	61.6	61.1	62.2	71.5	71.1
Tennessee River						
Total	2,762.0	3,573.5	3,777.4	4,280.0	4,468.5	4,335.3
Per Mile	4.2	5.55	5.8	6.6	6.9	6.7
Ohio River						
Total	19,805.8	20,574.5	24,062.7	25,292.9	25,302.4	30,437.4
Per Mile	20.2	20.9	24.5	25.8	25.8	31.0
Red River						
Total	992.7	529.2	56.3	189.9	1,278.0	1,341.9
Per Mile	2.2	1.2	0.1	0.4	2.8	2.9
Missouri River						
Total	3,617.0	3,279.8	3,823.6	3,694.8	4,009.2	4,772.5
Per Mile	1.7	1.6	1.8	1.8	1.9	2.3
GIWW-East						
Total	3,686.9	2,980.4	3,079.7	4,642.0	3,186.8	5,225.0
Per Mile	8.7	7.0	7.2	10.9	7.5	12.3
GIWW-West						
Total	16,414.4	19,675.7	18,609.0	16,723.3	24,707.6	27,221.4
Per Mile	23.9	28.7	27.2	24.4	36.0	39.7

Source: U.S. Army Corps of Engineers Office of Chief of Engineers (Unpublished tables reproduced by the National Waterways Conference, Inc.)

SEGMENT TOLL

One way of dealing with cross-sectional subsidization is to structure the fee schedule on the amount of federal expenditure for each segment. Separate expenditures have been calculated for the five portions of the Texas GIWW in Table 32. Clearly, some segments will be affected more than others. The Corpus Christi to Brownsville segment is characterized by high O&M costs and low ton miles which results in high cost per ton-mile. The first impacts of a user fee in this area would be loss of low value bulk shipments.

The types of segment tolls most often discussed are a ton-mile tax or a fuel tax based on the costs for each segment. Those firms shipping

TABLE 32

LENGTH, TON-MILES, AND ESTIMATED COSTS FOR THE TEXAS GULF INTRACOASTAL WATERWAY BY SEGMENT, 1977

	Length (Miles)	Ton-Miles (Millions)	Cost Per Ton-Mile*
Sabine River to Houston Ship Channel	61.4	2,023	$.00136
Houston Ship Channel to Freeport Harbor Channel	44.9	517	$.00362
Freeport Harbor Channel to Matagorda Ship Channel	76.8	771	$.00536
Matagorda Ship Channel to Corpus Christi Channel	63.0	462	$.0080
Corpus Christi Channel to Brownsville Ship Channel	133.6	239	$.02031

*Costs per ton-mile represent the amount needed to recover maintenance expenditures for 1977 plus one-fiftieth of the costs of the most probable improvements for the next 50 years.

Source: Texas State Department of Highways and Public Transportation.

on segments with the higher segment tolls would be affected more adversely, but the extent of the impact would depend on the firms' demand and costs structures.

LICENSE FEE

The third alternative, the license fee, would apply a fixed operating charge on towboats and barges based on horsepower, registered tonnage or cargo capacity. It would represent a fixed cost to the firm which could be distributed over the shipping season so that slack periods are not so severely taxed. One aspect of the license fee that sets it apart from other forms is that it encourages operators to scrap or sell unprofitable equipment.

There have been many proposals within the past few months as to the type and level of user charges for the inland waterways. It appears that the initial Reagan proposal for a full cost recovery fuel charge has been set aside. Also, it has been agreed that uniform fuel taxes result in too much cross-subsidization, and some sort of segment specific charge seems more likely. The Office of Management and Budget has since directed the Secretary of the Army to develop a proposal for complete cost recovery of navigation operation and maintenance, with construction costs amortized over 50 years. An additional bill to authorize the Secretary of Transportation to establish fees and charges for Coast Guard Services has been recommended, but there is little hard data on the impacts of these various recommendations and proposals.

IMPACT OF USER CHARGES

One of the objectives of this study was to identify and establish values for the primary commodity flows along the Texas GIWW. In terms of volume, the primary commodities moved in 1977 were fuels, chemicals, and

crude petroleum followed by general mining shipments, and primary iron and steel (See Table 33). In terms of value, the three main commodities remain the same, but in a slightly different order - chemicals, fuels, and crude petroleum followed by fabricated metals, and primary iron and steel. Grain and coal which are dominant on other inland waterways constitute less than one percent each, both in tonnage and value of total commodities shipped (See Table 33). Although low-value, low-volume commodity shipments would probably be the first to feel the effects of a user charge, the greatest effects on the Texas economy would result from the affects that user charges have on the high volume-high value shipments of fuels, chemicals and crude petroleum which make up over eighty percent of volume and value shipped on the GIWW. It is expected that the potential increases in shipping rates inititated by increased user charges could

TABLE 33

ESTIMATES OF TONNAGE AND VALUE FOR SELECTED COMMODITIES MOVED ON THE TEXAS GIWW IN 1977 (in 1000's)

Group	1977 Tonnage	Percent of Total Tonnage	1977 Total Value	Percent of Total Value
Fuels	24,533	39.8	$3,152,914	29.4
Chemicals	13,571	22.0	5,052,686	47.1
Crude Petroleum	13,115	21.3	1,335,898	12.5
Mining (NEC)	6,483	10.5	150,013	1.4
Primary Iron and Steel	1,015	1.7	221,350	2.1
Scrap Metal	506	0.8	30,299	0.3
Grains	353	0.6	33,039	0.3
Durables (NEC)	308	0.5	171,799	1.6
Coal	236	0.4	7,957	0.1

Source: 1977 Statistical Abstracts, U.S. Department of Commerce.

lead to traffic loss on the GIWW and higher energy costs for the general consumer.

Further negative effects might include a slowing of new industry moving into the Texas coastal area accompanied by the attendant loss of employment and other economic opportunities. Although the greatest overall impact would probably result from the effects of the user charge on the three high volume-high value commodities, the effect on high volume-low value shipments could be devastating for certain waterway segments. Further, the effect on lower volume-lower value commodity movements might remove certain firms from competition. All of these segment and firm specific effects could also affect rates and prices for shipping other commodities as carriers try to shift the burden of rate increases to less rate-sensitive commodity movements. Of the five segments that make up the Texas GIWW, the most sensitive to changes in the shipping market is the section from Corpus Christi to Brownsville because of its relatively low ton-mileage and high maintenance and construction costs. This segment of the Texas GIWW would be especially affected by a segment toll at any cost recovery level.

In Table 34, the total maintenance and construction cost, total ton miles, and the costs per-ton mile for varying levels of cost recovery are presented for the five segments of the Texas GIWW. The lowest per ton-mile cost for all levels of cost recovery exists on the segment from the Sabine River to the Houston Ship Channel which is also the segment with the greatest volume of shipping. The segment from the Houston Ship Channel to the Freeport Harbor has the lowest cost per ton-mile. Generally, however, the distribution by type of commodity moved along the coast is fairly uniform so that no one segment relies entirely on low volume or

TABLE 34

ESTIMATED COSTS PER TON-MILE FOR THE FIVE SEGMENTS OF THE TEXAS GIWW (BASED ON 1977 DATA)

	Sabine to Houston S.C. Segment 1	Houston to Sabine Segment 2	Freeport to Matagorda Segment 3	Matagorda to Corpus Christi Segment 4	Corpus Christi to Brownsville Segment 5
Ton-Miles (1,000's)	2,023,201	517,882	771,675	462,013	239,517
1977 Cost (1,000's)	$ 2,757	$ 1,876	$ 4,134	$ 3,697	$ 4,864
Cost-Per Ton-Mile					
100%-100%*	$0.00136	$0.00362	$0.00536	$0.00800	$0.02031
100%-50%*	$0.00089	$0.00240	$0.00366	$0.00585	$0.01382
50%-50%*	$0.00068	$0.00181	$0.00268	$0.00400	$0.01015

*The first percentage refers to percent of maintenance cost; the second refers to percent cost of construction cost.

low value commodity movements. As long as segment tolls are avoided, the segments should each be able to make the adjustments necessary to spread the burden of user charge effects and minimize them on the low volume-low value movements which have a smaller profit margin.

EQUIVALENT TAX LEVELS

To determine the range and tenor of waterway user responses to possible user charge impositions, questionnaires were utilized to survey the different types of users on the GIWW. Using cost estimates from SDHPT, it was possible to estimate that for a 100 percent recovery of maintenance and construction costs a fuel tax rate of $0.75 per gallon would have to be initiated. A 100 percent maintenance and 50 percent construction cost recovery would require a $0.51 per gallon fuel tax, and

a 50 percent maintenance and construction cost recovery scheme would require a $0.38 per gallon fuel tax. When questionnaires for this study were prepared, the assumption was made that one of several cost recovery schemes might be chosen. The initial level was the current four cent per gallon fuel tax which is scheduled to rise in two cent increments to ten cents per gallon by 1985. Twenty, thirty, fifty, and seventy-five cents per gallon were chosen because they seemed to bracket most other cost recovery schemes (including the Domenici Amendment to Senate Bill 810 which called for varying levels of maintenance and construction cost recovery and President Reagan's thirty cent per gallon across the board fuel tax). Two series of questionnaires were prepared based on information gathered from calculating the revenue that would be raised by seven levels of fuel tax and comparable levels of ton-mile and license fees. The first step was to estimate the number of gallons of fuel used on the GIWW. With an average fuel efficiency of 200 ton-miles per gallon, and 5.1 billion miles traveled on the GIWW in 1977, there would be approximately 23 million gallons of fuel consumed. Multiplying this estimate of fuel consumption by each of the seven selected tax levels results in the amount of revenue raised by each tax level. Table 35 summarizes these calculations as well as the equivalent levels of license and ton-mile taxes that would be necessary to generate the same amounts of revenue. The ton-mile segment rates represent the segment tax levels necessary to generate the equivalent revenues for the entire Texas portion of the GIWW.

The segment rates in Table 35 parallel the costs summarized in Table 34 to illustrate the relative effect that a segment tax would have on the five segments. The highest rates fall on segment five from Corpus Christi to Brownsville which has the lowest ton-mile and the highest maintenance

TABLE 35

ESTIMATED TAX LEVELS FOR EQUIVALENT FUEL, LICENSE, AND SEGMENT TON-MILE TAX STRUCTURES ON THE TEXAS GIWW (1977 DATA)

Fuel Tax Level (per gallon)	Fuel Tax Revenue ($1,000's)	Equivalent Fee (per HP)	License* Levels (per ton)	Ton-Mile Segment Tax Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
$.04	920	$0.16	$0.08	$.0004	$.0014	$.0009	$.0016	$.0030
.06	1,380	0.24	0.12	.0005	.0021	.0014	.0024	.0046
.08	1,840	0.32	0.16	.0007	.0028	.0019	.0032	.0061
.10	2,300	0.40	0.20	.0009	.0035	.0024	.0039	.0076
.20	4,600	0.79	0.40	.0018	.0070	.0047	.0078	.0152
.30	6,900	1.19	0.60	.0027	.0105	.0071	.0118	.0228
.50	11,733	2.02	1.02	.0046	.0179	.0120	.0201	.0387
.75	17,252	2.97	1.50	.0067	.0263	.0177	.0295	.0569

*Based on a 53:41 split for barges and towboats respectively as indicated on Modal Traffic Impacts of Waterway User Charges, Vol. 1, p. 42.

and construction cost. The lowest rates fall on the segment from the Sabine River to the Houston Ship Channel which has the highest ton-mileage but the lowest cost per ton-mile. It would seem that the most affected segment in any segment specific cost recovery scheme would be Corpus Christi to Brownsville.

Even the lowest cost recovery level would necessitate a $0.38 per gallon fuel tax while a 100 percent cost recovery scheme would require a $0.75 per gallon charge. Table 36 shows a 40 percent rate increase at the $0.75 per gallon charge level and a 20 percent decrease in tons shipped.

TABLE 36

EXPECTED CHANGES IN SHIPPING RATES AND VOLUMES ON THE TEXAS GIWW AS A RESULT OF VARYING FUEL TAX LEVELS

Fuel Tax Rate (per gal.)	Volume Change (%)	Rate Change (%)
$0.04	-0.3%	+4%
0.10	-2	+7
0.50	-10	+30
0.75	-20	+40

The fact that users expect a rate increase at $0.75 per gallon that is ten times the rate increase expected at $0.04 per gallon is itself noteworthy.

According to the waterway users, the effects of user taxes other than fuel tax would vary from firm to firm and segment to segment, as well as by level and type of tax implemented. The least detrimental tax is believed to be a low-level across the board fuel tax. Of the two remaining types of fees, segment and license, license fees were thought to be less detrimental than segment tolls. Although the data collected are insufficient to establish definitive guidelines for future policy implementation, there are some indications of the effects that the people most involved in the waterways expect, and it is possible to make some qualified judgements about the possible market structures given certain user responses. It also gives an indication of the wide gaps in existing information on the waterway user charge issue and the general lack of accessible data.

The overall reaction of the questionnaire participants reflects the expected reactions to the three types of user charges as discussed earlier. The present four cent per gallon tax has the least effect while segment taxes are expected to have the most detrimental effect overall due to the severe effects on certain segments. License fees are generally viewed as somewhat less detrimental than segment tolls.

Although there is a great deal of controversy surrounding the question of whether any user charge should be implemented on the waterways, the response from the participants in this report was that the waterway industry should bear some portion of the operating, maintenance, and construction costs of the waterways. The chief controversies center

around fair treatment of each transportation mode in terms of government subsidy, the problems of cost allocation between navigation and non-navigation functions, the appropriate level of cost recovery in relation to other modes, and the cost allocation procedure.

FURTHER RESEARCH

Before any effective stand can be taken on the inland waterway user charge issue, many questions must be raised, but there are two chief questions that must be answered: "What effect will user charges have on the inland waterway?" and, "What effect will that have on local, regional and national economies?". Unfortunately, neither of these has simple answers. The SDHPT/TTI Study is an attempt to synthesize the existing information regarding the potential effects of varying levels and types of user charges on the Texas GIWW, and to give some insight into the impact of these on Texas' economy. Many questions remain to be answered in regard to Texas and the nation as a whole.

One of the most urgent needs in this area is for a thorough data collection system and an accessible, convenient information storage and retrieval system. In addition to the collection and storage of data, an annotated bibliography of user charge and inland waterway literature would be a useful source of information for future researchers, decision makers and others involved in this issue. Other historical research might include comparative studies of government subsidies and policies among the transportation modes.

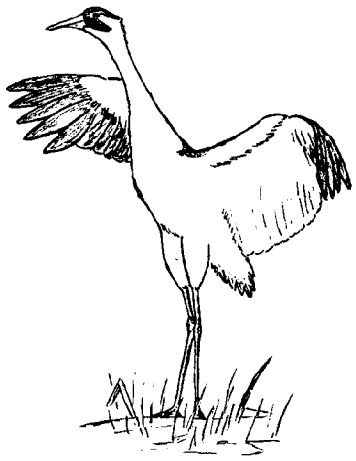
There is also a need for research in cost accounting and allocation procedures for tracking navigation and non-navigation costs on the nation's inland waterways, as well as for new administrative models and management plans for user tax collection, both intra- and interstate, including

coordination of multiple agency responsibility.

All of the above research needs presuppose the existence of adequate analytic forecasting techniques, more applicable modelling frameworks, and other tools. More accurate forecasting of commodity flows and other pertinent information is essential for the development of more realistic alternative scenarios for short and long range planning on the inland waterways.

CHAPTER SIX

THE INCREASING ROLE OF THE NON-FEDERAL SPONSOR



THE INCREASING ROLE OF THE NON-FEDERAL SPONSOR

Since 1975 and the enactment of the Texas Coastal Waterway Act, the State Department of Highways and Public Transportation acting as the agent for the State of Texas, has conducted a continuing investigation and evaluation of the Gulf Intracoastal Waterway. The four published reports, including this report, have presented historical background as well as many facts and figures concerning the commercial and recreational use and value of the waterway. The accumulation of this background material has been necessary in order to obtain the basic data needed for the tasks that will be required in the most immediate future.

CUTBACK OF FEDERAL SERVICES

Federal legislation and budget cutbacks are pushing the role of the non-federal sponsor toward a more active participation in the management of the GIWW. As a case in point, the Corps of Engineers has announced a $150 million cutback in the operation and maintenance funds of its 1983 budget. This cutback could place the maintenance of the GIWW in jeopardy. In particular, the segment from Corpus Christi to Brownsville would be affected. This segment, although of significant economic value to the State, is listed as one of the nation's inland waterway segments that has a low waterborne commerce volume level (see Figures 4, 5, and 6, Chapter 2). Therefore, according to the Galveston District Engineer of the Corps of Engineers, it is probable that in 1983 the cutback in maintenance funds could cause this portion of the Texas GIWW to be removed

from their maintenance schedule and presumably the non-federal sponsor would have to assume the responsibility of maintaining the segment.

NON-FEDERAL SPONSOR TO FILL THE GAP

In addition to budget cuts that could curtail services previously assumed by the Federal government, the proposal of assessing cost recovery taxes on the portion of those services that are furnished is a threat to all involved with waterborne transportation. While it is not yet known at what level cost recovery taxes will be levied, and therefore what effect they will have, it is imperative that the non-federal sponsor be ready to assume the responsibility of operation and maintenance costs caused by the federal budget costs. In order to do this, the State of Texas during the Sixty-Eighth Legislative Session, should set aside funds to at least maintain the "status quo" of the GIWW through the fiscal years of 1984 and 1985. Little can be done for fiscal year 1983, and therefore it is hoped that some arrangement can be made with the Corps of Engineers so that the channel can somehow be maintained during that period. By that time the cost recovery picture should be clear and future planning may be accomplished. The State budgeted funds should be adequate to cover all operation and maintenance costs that are necessary to keep the main channel of the GIWW in safe, operable condition. It must be determined if the State will aid in maintaining any tributary channels leading to industrial complexes that are privately owned. According to the Corps of Engineers District Engineer, two of these channels, the Arroyo Colorado channel and Port Mansfield channel would not be maintained in 1983, with some doubt also of maintaining the channel to Victoria.

AGREEMENT AND AUTHORIZATION REQUIRED

The conflict that exists between the Texas Constitution and Section 221 of Public Law 91-611, the Federal Flood Control Act of 1970, still has not been resolved on a federal level. The provisions of Section 221 forbid the commencement of construction on any water resource project until "each non-federal interest has entered into a written agreement with the Secretary of the Army to furnish its required cooperation for the project". The proposed contract submitted by the Corps of Engineers contained the requirement that the State Highway Commission, acting for the State of Texas, hold and save the United States free from any damages resulting from the construction work and maintenance of the channels. This contract could not be signed by the State Highway Commission with that indemnity clause included as that would pledge the credit of the State and would be in violation of the Texas Constitution. The Corps of Engineers meanwhile was restricted in compromising by the terms of Section 221. Numerous attempts have been made to reword the troublesome clause but to date all have proven unsuccessful. To break this stalemate between federal statutes and the state constitution, a waiver or limitation of these indemnity requirements must be inserted in some federal legislation. With such action, the indemnity requirements could be opened to the Corps of Engineers so that a satisfactory solution to the problem may be reached. Attempts to accomplish this have failed when legislative bills that the proposal has been attached to have failed to pass. Renewed efforts must be made to remove this stumbling block.

In addition, legislation on the State level is necessary to authorize the State Department of Highways and Public Transportation

to assume the responsibilities of the Corps of Engineers should their participation in any maintenance of, or improvement to, the waterway be removed or limited. Presently, the SDHPT has authority only to evaluate the GIWW, to purchase property for needed improvements (including spoil disposals), and to make recommendations to the State Legislature. Authorization to issue contracts for dredging the channel and to make improvements would be required so SDHPT could perform its function as agent for the State.

In order to more easily grasp what the maintenance operation would entail, should the State need to assume that responsibility, Table 37 lists the average shoaling or silting-up rates of the main channel and its tributary channels. Constant shoaling of the channels requires a continuing maintenance program to keep the channel open and safe for movement of commerce. Table 37 shows that the dredging frequency and volumes of material removed for different segments varies over the 426 miles of the GIWW.

IMPROVEMENTS TO GIWW

While the majority of this chapter has concentrated on operation and maintenance of the GIWW, it is necessary that future improvements to the system be considered. In 1962, Congress authorized widening and deepening the channel to 16 feet by 150 feet. Unfortunately, at that time, no local sponsors could or would support the project and it was placed on an inactive status. The findings of the study that led to that authorization are now badly outdated in that commerce volumes moved on the GIWW have almost doubled that of the early 1960 era. With the prospect of the federal government withdrawing its full financial support from any new improvement projects, it will be necessary for the state or others to

TABLE 37

DREDGING FREQUENCY AND DISPOSAL VOLUMES

PROJECT AND REACH	DREDGING FREQUENCY (MONTHS)	DISPOSAL MATERIAL (CUBIC YARDS)
Port Arthur to High Island	60	400,000
Main Channel, High Island to Port Bolivar	18	1,100,000
Main Channel and Alternate Route, Port Bolivar to North Deer Island	24	500,000
Main Channel, North Deer Island through Chocolate Bay	24	750,000
Main Channel, Chocolate Bay to Freeport Harbor	36	750,000
Main Channel, Freeport Harbor to Cedar Lakes	24	1,000,000
Main Channel, Cedar Lakes to Colorado River	24	1,000,000
Tributary Channel in San Bernard River	24	1,000,000
Tributary Channel in Colorado River	12	25,000
Main Channel, Colorado River to Matagorda Bay	24	750,000
Main Channel, Matagorda Bay to San Antonio Bay	30	600,000
Main Channel, Across San Antonio Bay	24	750,000
Main Channel, San Antonio Bay to Aransas Bay	48-72	300,000
Main Channel, Across Aransas Bay	24-48	100,000
Main Channel, Aransas Bay to Corpus Christi Ship Channel	60	100,000
Main Channel, Corpus Christi Bay to Baffin Bay	24	750,000
Main Channel, Baffin Bay to Mud Flats	18	800,000
Tributary Channel, Channel to Palacios and Turning Basin	36	500,000
Tributary Channel, Channel to Victoria (Mile 0 to Approximate Mile 14.0)	24	400,000
Tributary Channel, Channel to Victoria (Approximate Mile 14 to Mile 34.6)	42	60,000
Tributary Channel, Channel to Seadrift	24	125,000
Lydia Ann Channel	60	60,000
Tributary Channel, Channel to Aransas Pass and Basins	60	55,000
Main Channel, Mud Flats to Channel to Port Mansfield	15	540,000
Main Channel, Channel to Port Mansfield to Arroyo Colorado	20	245,000
Main Channel, Arroyo Colorado to Port Isabel	18	390,000
Tributary Channels, Port Isabel Side Channels and Small Boat Harbor Channel and Basin	60	38,000
Tributary Channel, Channel to Harlingen	12	530,000
Tributary Channel to Port Mansfield	15	515,000
Tributary Channel, Port Mansfield Entrance Channel	12	130,000
TOTAL		14,263,000

SOURCE OF DATA: U.S. Army Corps of Engineers, Final Environmental Statement: Maintenance Dredging, Gulf Intracoastal Waterway, Texas Section, Main Channel and Tributary Channels.

assume wholly, or in part, these responsibilities. A thorough feasibility study should be made and the findings of the study acted upon as soon as possible to deepen, widen, and straighten the channel.

Deepening of the channel will cause less drag on the towboats and barges, thereby increasing their efficiency, while the widening and straightening of the channel will permit more barges to be added to the tow capacity. At present, a maximum of five large barges lashed in a single file is capable of navigating the GIWW. This restriction reduces the cost-efficiency of the tows, reduces the capability of competing for business, and increases cost to the shippers.

The dedication of the new Vermillion Lock in Louisiana, now called the Leland Bowman Lock, has removed a highly restrictive lock on the Louisiana are actively pushing for more modernization of their portion of the GIWW. If their efforts bear fruits, they will also be beneficial to the Texas portion.

To further grasp the magnitude of modernizing the GIWW, Tables 38, 39, and 40 are taken from the GIWW 1978 report and updated to 1981 costs. Statistics for channel improvements are presented in Table 38 which list property acquisition, dredging, levee, and open-water disposal requirements. Table 39 lists construction and 50 year maintenance costs and includes the estimated federal cost for maintenance dredging during the 50 year maintenance period. As noted, portions of the Texas GIWW may no longer be maintained by the Corps of Engineers and that cost will have to be borne by the non-federal sponsor or others if the channel is to remain navigable. Appendices B through G break each channel construction option into five separate segments along the GIWW and give construction and maintenance costs for each segment. The five segments are as follows:

1. Sabine-Neches Waterway to Houston Ship Channel
2. Houston Ship Channel to Freeport Harbor Channel
3. Freeport Harbor Channel to Matagorda Ship Channel
4. Matagorda Ship Channel to Corpus Christi Channel
5. Corpus Christi Channel to Brownsville Ship Channel

TABLE 38

ESTIMATED QUANTITIES FOR CHANNEL IMPROVEMENTS

Property Requirements

Channel	Right-of-Way	Disposal Sites	Total Property
250' x 12'	2,046.5 Ac.	6,493.8 Ac.	8,540.3 Ac.
250' x 14'	2,046.5 Ac.	7,579.4 Ac.	9,625.9 Ac.
250' x 16'	2,046.5 Ac.	8,899.9 Ac.	10,946.4 Ac.
300' x 12'	3,070.8 Ac.	7,739.8 Ac.	10,810.6 Ac.
300' x 14'	3,070.8 Ac.	9,698.5 Ac.	12,769.3 Ac.
300' x 16'	3,070.8 Ac.	11,531.6 Ac.	14,602.4 Ac.

Dredging Requirements

Channel	Construction	Maintenance	Total
250' x 12'	116,893,000 C.Y.	401,756,000 C.Y.	518,649,000 C.Y.
250' x 14'	167,192,000 C.Y.	401,756,000 C.Y.	568,948,000 C.Y.
250' x 16'	219,696,000 C.Y.	401,756,000 C.Y.	621,452,000 C.Y.
300' x 12'	163,656,000 C.Y.	401,756,000 C.Y.	565,412,000 C.Y.
300' x 14'	221,269,000 C.Y.	401,756,000 C.Y.	623,025,000 C.Y.
300' x 16'	281,135,000 C.Y.	401,756,000 C.Y.	682,891,000 C.Y.

Levee Requirements

Channel	Construction	Maintenance	Total
250' x 12'	805,380 C.Y.	7,006,980 C.Y.	7,812,360 C.Y.
250' x 14'	1,630,170 C.Y.	7,704,990 C.Y.	9,335,160 C.Y.
250' x 16'	2,897,650 C.Y.	8,399,420 C.Y.	11,297,070 C.Y.
300' x 12'	1,764,890 C.Y.	8,000,330 C.Y.	9,765,220 C.Y.
300' x 14'	3,395,090 C.Y.	8,479,450 C.Y.	11,874,540 C.Y.
300' x 16'	5,553,820 C.Y.	8,199,270 C.Y.	13,753,090 C.Y.

Open-Water Disposal Requirements

Channel	Construction	Maintenance	Total
250' x 12'	26,337,000 C.Y.	168,057,000 C.Y.	194,394,000 C.Y.
250' x 14'	40,779,000 C.Y.	168,057,000 C.Y.	208,836,000 C.Y.
250' x 16'	56,091,000 C.Y.	168,057,000 C.Y.	224,148,000 C.Y.
300' x 12'	35,026,000 C.Y.	168,057,000 C.Y.	203,083,000 C.Y.
300' x 14'	51,533,000 C.Y.	168,057,000 C.Y.	219,590,000 C.Y.
300' x 16'	68,234,000 C.Y.	168,057,000 C.Y.	236,291,000 C.Y.

TABLE 39

COST SUMMARY FOR CHANNEL IMPROVEMENTS

Channel	Construction	50-Year Maintenance*	Total Project*
250' x 12'	$221,025,000	$347,364,000	$568,389,000
250' x 14'	$316,670,000	$351,565,000	$668,235,000
250' x 16'	$418,993,000	$355,310,000	$774,303,000
300' x 12'	$313,736,000	$353,265,000	$667,000,000
300' x 14'	$427,626,000	$356,586,000	$784,212,000
300' x 16'	548,405,000	$355,656,000	$904,061,000

*Includes estimated federal cost for maintenance dredging during 50-year period of $302,297,000. This cost may be deducted to determine required initial cost of project.

TABLE 40

COST DISTRIBUTION FOR CHANNEL IMPROVEMENTS

Channel	Federal Cost*	State Cost	Total Project*
250' x 12'	$426,292,000	$142,097,000	$568,389,000
250' x 14'	$501,176,000	$167,059,000	$668,235,000
250' x 16'	$580,727,000	$193,576,000	$774,303,000
300' x 12'	$500,250,000	$166,750,000	$667,000,000
300' x 14'	$588,159,000	$196,053,000	$784,212,000
300' x 16'	$678,046,000	$226,015,000	$904,061,000

*Includes estimated federal cost for maintenance dredging during 50-year period of $302,297,000.

Decisions on proposed new depths and widths should be made based on flow volumes of the separate segments and must be compatible with the GIWW as a whole so that no bottlenecks remain. Cost figures shown are for construction of the Channel and the disposal sites only and do not include moving any utilities or pipelines, nor reconstruction of restricting bridges. These charges also would need to be included in the final project costs.

No less consideration should be given to the replacement of the few locking systems here in Texas. Since the GIWW is a tidal facility, there are only two locking structures on the waterway.

The Brazos River floodgate is not a true locking facility; but, rather, two single gate chambers on each side of the river that are designed to prevent heavy siltation and the excessive influx of fresh water into the GIWW when the river is at flood stage.. A differential head in excess of 1.8 feet, between the river and the GIWW, make navigation impossible when the current rushes out of the gates. In addition, traffic is limited to one loaded or two empty barges when the head differential reaches 0.8 feet or the river current exceeds 2 miles per hour. The alignment of the channel at this point further complicates the problems. The GIWW channel swings south to cross the river and then turns north to rejoin the original alignment of the GIWW. Supposedly, this crossing was designed when tows were carried astern on a tow line. The current practice of pushing a string of barges is not very compatible with this alignment.

The other locking facility is at the Colorado River Crossing of the GIWW. Locking chambers measure 125 by 1,200 feet with a horizontal gate clearance of 75 feet. This facility can lock traffic across the Colorado

River during flood stages as long as the differential water head does not exceed 10 feet. This facility seems adequate at this time but tow operators would like to see the lock moved further away from the river so that more speed could be obtained before crossing the swift river current to reach the other side.

CONCLUSION

Without a doubt there will be some form of user fee tax and cost-recovery plan enacted by Congress. Legislation may not be forthcoming this year but will have some priority for the next legislative session.

It appears that operation and maintenance furnished by the Corps of Engineers will be reduced or eliminated completely for some low traffic volume segments of the GIWW and completely stopped for some tributary channels.

New construction cost to the State percentage-wise will likely be much higher than it would have been if the 1962 authorization for improvement of the waterway had been used. Table 40 assumes a 75 percent federal, 25 percent non-federal sponsor split for construction costs necessary to improve the GIWW. The sponsor's actual percent of participation will not be known until all legislation has been passed. User fees are expected to be enacted to recover costs of the federal participation and are expected to cause a small recession in waterway shipping service. Methods to provide the portion of the sponsor's cost responsibility must be studied to determine how it will be funded.

The anticipated population explosion along the Sun Belt areas will cause tremendous overloading of coastal recreation areas and facilities. This overcrowding, in addition to increasing traffic on the GIWW, will be detrimental to the fragile ecological system of the coastal areas.

Unless public facilities are greatly enlarged and regulated the spill-over of the public into the dune and marshland areas could cause irreparable damage.

RECOMMENDATIONS

The sponsorship of the GIWW has passed from the county, port authority, navigation district, and other local parties, to a single agent with the ability to act in the interests of all previous sponsors as well as for the interest of the whole state. With increasing responsibility being thrust on it by the federal government, the State Highway and Public Transportation Commission has formulated actions and suggestions for management and for improvements concerning the GIWW.

The recommendations are believed to be the most appropriate solutions to the mounting problems facing the people of Texas and of one of their most valuable assets, the Texas Gulf Intracoastal Waterway and the coastal recreational playground. Consequently, the Commission recommends the following actions be taken:

Required Legislation -

1. Action on the State and Federal Legislative level to resolve the conflict existing between the Texas Constitution and Section 221 of Public Law 91-611.
2. State legislative authorization for the State to enter into contracts for dredging and improvement of the GIWW and, in general, to assume responsibilities of the Corps of Engineers should their participation in operation and maintenance of the GIWW be reduced or withdrawn.

3. State funding provided in an amount sufficient to cover operational and maintenance costs of the GIWW that may be withdrawn or reduced by the Corps of Engineers.

Improvements to the GIWW -

1. The GIWW from the Sabine River to Corpus Christi should be widened to a minimum of 250' in order to facilitate larger and more cost-efficient tows.
2. The depth of the GIWW from the Sabine River to Corpus Christi should be increased to a minimum of 16' to reduce frictional loss to tows and help in maintaining bottom clearance.
3. Where possible, the GIWW should be straightened and all bends or curves restricted to a 1 degree curvature or less.
4. The Brazos River flood gates should be replaced with true locking facilities so that small rises in the river do not shut down traffic.
5. Additional public launching and recreation areas should be constructed at appropriate locations so that the anticipated increase in recreational use of the GIWW can be safe and orderly.

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APPENDIX A

YEARLY AVERAGE NUMBER OF COASTAL TRIPS (IN BOATS)

APPENDIX A

YEARLY AVERAGE NUMBER OF COASTAL TRIPS
(IN BOATS)

	ZERO TRIPS PER YEAR	1-5 TRIPS PER YEAR (AVERAGE 2.5)	5-15 TRIPS PER YEAR (AVERAGE 10)	15-25 TRIPS PER YEAR (AVERAGE 20)	25-40 TRIPS PER YEAR (AVERAGE 32.5)	40-60 TRIPS PER YEAR (AVERAGE 50)	60-80 TRIPS PER YEAR (AVERAGE 70)	80-100 TRIPS PER YEAR (AVERAGE 90)	OVER 100 TRIPS PER YEAR (AVERAGE 120)
TIER I, REGION I BOATS	9,700	1,800	4,600	4,000	1,350	1,450	450	300	650
TIER I, REGION II BOATS	37,700	14,900	21,650	12,800	7,250	4,750	1,350	950	1,750
TIER I, REGION III BOATS	1,100	700	1,000	1,000	500	250	100	7**	150
TIER I, REGION IV BOATS	3,400	1,150	2,200	1,700	900	600	200	50	300
TIER I, REGION V BOATS	900	450	1,050	750	350	200	50	50	100
TIER I (BOATS)	52,800	19,000	30,500	20,250	10,350	7,250	2,150	1,357	2,950
TRIPS GENERATED		47,500	305,500	405,000	336,375	362,500	150,500	122,130	354,000
TIER II (BOATS)	11,600	3,100	4,450	1,950	750	300	150	150	250
TRIPS GENERATED		7,750	44,500	39,000	24,375	15,000	10,500	13,500	30,000
TIER III (BOATS)	58,900	5,400	4,400	1,200	900	50	200	18**	50
TRIPS GENERATED		13,500	44,000	24,000	29,250	2,500	14,000	1,620	6,000
TOTAL BOATS	123,300	27,500	39,350	23,400	12,000	7,600	2,500	1,525	3,250
TOTAL TRIPS*		68,740	394,000	468,000	390,000	380,000	175,000	137,250	390,000

*The number of trips was calculated by summing the average number of trips made by each boat. The total number of all recreational boat trips in 1979 summed up to 2,403,000.
**Any values less than 50 were not rounded off.

APPENDIX B

COST ESTIMATE
FOR
250 FOOT x 12 FOOT CHANNEL

APPENDIX B

COST ESTIMATE FOR 250' x 12' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	687.3 Acres	$1,300.00	$ 893,490	
Dredging	21,165,840 C.Y.	1.67	35,346,953	
Disposal Sites	14.5 Acres	1,300.00	18,850	
Levees	45,934 C.Y.	3.90	179,143	
			$36,438,436	
		Miscellaneous	9,451,353	
		Subtotal		$45,889,788
		Federal Share	$34,417,341	
		State Share	$11,472,447	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	42,932,550 C.Y.	$0.69	$29,623,460	
Disposal Sites	1,502.9 Acres	$1,300.00	1,953,770	
Levees	1,549,383 C.Y.	$3.90	6,042,594	
			$37,619,824	
		Miscellaneous	9,777,818	
		Subtotal		$47,397,642
		Federal Share	$35,548,232	
		State Share	$11,849,410	
			Project Total	$93,287,430
		Total Federal Share	$69,965,573	
		Total State Share	$23,321,857	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	342.1 Acres	$1,300.00	$ 444,730	
Dredging	15,164,800 C.Y.	$1.47	22,292,256	
Disposal Sites	47.9 Acres	$1,300.00	62,270	
Levees	79,520 C.Y.	$3.90	310,128	
			$23,109,384	
		Miscellaneous	6,022,451	
		Subtotal		$29,131,835
		Federal Share	$21,848,877	
		State Share	$ 7,282,958	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	37,769,300 C.Y.	$0.62	$23,416,966	
Disposal Sites	301.3 Acres	$1,300.00	391,690	
Levees	475,518 C.Y.	$3.90	1,854,520	
			$25,663,176	
		Miscellaneous	6,618,774	
		Subtotal		$32,281,950
		Federal Share	$24,211,462	
		State Share	$ 8,070,488	
			Project Total	$61,413,785
		Total Federal Share	$46,060,339	
		Total State Share	$15,353,446	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	690.2 Acres	$1,300.00	$ 897,260	
Dredging	23,245,420 C.Y.	$1.47	34,150,767	
Disposal Sites	295.9 Acres	$1,300.00	384,700	
Levees	376,257 C.Y.	$3.90	1,467,402	
			$36,920,129	
		Miscellaneous	9,653,648	
		Subtotal		$46,573,777
		Federal Share	$34,930,333	
		State Share	$11,643,444	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	95,172,550 C.Y.	$0.62	$59,006,981	
Disposal Sites	1,781.3 Acres	$1,300.00	2,315,690	
Levees	2,231,780 C.Y.	$3.90	8,703,942	
			$70,026,613	
		Miscellaneous	18,052,432	
		Subtotal		$88,079,045
		Federal Share	$66,059,284	
		State Share	$22,019,761	
			Project Total	$134,652,822
		Total Federal Share	$100,989,617	
		Total State Share	$ 33,663,205	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	326.9 Acres	$1,300.00	$ 424,970	
Dredging	19,449,980 C.Y.	$1.47	28,591,471	
Disposal Sites	211.3 Acres	$1,300.00	274,690	
Levees	217,268 C.Y.	$3.90	847,345	
			$30,138,476	
		Miscellaneous	7,852,179	
		Subtotal		$37,990,655
		Federal Share	$28,492,991	
		State Share	$ 9,497,664	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	87,966,900 C.Y.	$0.62	$54,539,478	
Disposal Sites	2,117.2 Acres	$1,300.00	2,752,360	
Levees	2,570,130 C.Y.	$3.91	10,023,507	
			$67,315,345	
		Miscellaneous	17,349,873	
		Subtotal		$84,665,218
		Federal Share	$63,498,913	
		State Share	$21,166,304	
			Project Total	$122,655,873
		Total Federal Share	$91,991,905	
		Total State Share	$30,663,968	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	-	-	-	
Dredging	37,766,670 C.Y.	$1.28	$48,341,338	
Disposal Sites	52.5 Acres	$1,300.00	68,250	
Levees	86,400 C.Y.	$3.90	336,960	
			$48,746,548	
		Miscellaneous	12,692,282	
		Subtotal		$61,438,830
		Federal Share	$46,079,122	
		State Share	$15,359,708	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	137,914,550 C.Y.	$0.54	$74,473,857	
Disposal Sites	169.0 Acres	$1,300.00	219,700	
Levees	180,172 C.Y.	$3.90	702,671	
			$75,396,228	
		Miscellaneous	19,543,761	
		Subtotal		$94,939,989
		Federal Share	$71,204,992	
		State Share	$23,734,997	
			Project Total	$156,378,819
		Total Federal Share	$117,284,114	
		Total State Share	$ 39,094,705	

COST SUMMARY

TOTAL GIWW - 250' x 12' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 34,417,341	$11,472,447	$ 45,889,788
2	21,848,877	7,282,958	29,131,835
3	34,930,333	11,643,444	46,573,777
4	28,492,991	9,497,664	37,990,655
5	46,079,122	15,359,708	61,438,830
	$165,768,664	$55,256,221	$221,024,885

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 35,548,232	$11,849,410	$ 47,397,642
2	24,211,462	8,070,488	32,281,950
3	66,059,284	22,019,761	88,079,045
4	63,498,913	21,166,304	84,665,218
5	71,204,992	23,734,997	94,939,989
	$260,522,883	$86,840,960	$347,363,844

Total Project

Segment	Federal Share	State Share	Total
1	$ 69,965,573	$ 23,321,857	$ 93,287,430
2	46,060,339	15,353,446	61,413,785
3	100,989,617	33,663,205	134,652,822
4	91,991,905	30,663,968	122,655,873
5	117,284,114	39,094,705	156,378,819
	$426,291,548	$142,097,181	$568,388,729

APPENDIX C

COST ESTIMATE
FOR
250 FOOT x 14 FOOT CHANNEL

APPENDIX C
COST ESTIMATE FOR 250' x 14' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	687.3 Acres	$1,300.00	$ 893,490	
Dredging	28,576,430 C.Y.	$1.67	47,722,638	
Disposal Sites	54.8 Acres	$1,300.00	71,240	
Levees	119,373 C.Y.	$3.90	465,555	
			$49,152,922	
		Miscellaneous	12,749,349	
		Subtotal		$61,902,271
		Federal Share	$46,426,703	
		State Share	$15,475,568	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	42,932,550 C.Y.	$0.69	$29,623,460	
Disposal Sites	1,449.7 Acres	$1,300.00	1,884,610	
Levees	1,636,118 C.Y.	$3.90	6,380,860	
			$37,888,930	
		Miscellaneous	9,846,816	
		Subtotal		$47,735,746
		Federal Share	$35,801,810	
		State Share	$11,933,936	
			Project Total	$109,638,017
		Total Federal Share	$82,228,513	
		Total State Share	$27,409,504	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	342.1	Acres	$1,300.00	$ 444,730	
Dredging	20,770,133	C.Y.	$1.47	30,532,096	
Disposal Sites	112.5	Acres	$1,300.00	146,250	
Levees	180,805	C.Y.	$3.90	705,140	
				$31,831,215	
			Miscellaneous	8,293,891	
			Subtotal		$40,125,106
			Federal Share	$30,093,830	
			State Share	$10,031,276	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	37,769,300	C.Y.	$0.62	$23,416,966	
Disposal Sites	459.4	Acres	$1,300.00	597,220	
Levees	709,371	C.Y.	$3.90	2,766,547	
				$26,780,732	
			Miscellaneous	6,905,316	
			Subtotal		$33,686,048
			Federal Share	$25,264,537	
			State Share	$ 8,421,511	
				Project Total	$73,811,154
			Total Federal Share	$55,358,367	
			Total State Share	$18,452,787	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	690.2 Acres	$1,300.00	$ 897,260	
Dredging	32,336,787 C.Y.	$1.47	47,535,077	
Disposal Sites	467.5 Acres	$1,300.00	607,750	
Levees	543,624 C.Y.	$3.90	2,120,134	
			$51,160,220	
		Miscellaneous	13,324,759	
		Subtotal		$64,484,979
		Federal Share	$48,363,734	
		State Share	$16,121,245	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	95,172,500 C.Y.	$0.62	$59,006,950	
Disposal Sites	2,157.3 Acres	$1,300.00	2,804,490	
Levees	2,680,670 C.Y.	$3.90	10,454,613	
			$72,266,053	
		Miscellaneous	18,626,633	
		Subtotal		$90,892,686
		Federal Share	$68,169,515	
		State Share	$22,723,171	
			Project Total	$155,377,665
		Total Federal Share	$116,533,249	
		Total State Share	$ 38,844,416	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	326.9 Acres	$1,300.00	$ 424,970	
Dredging	28,528,780 C.Y.	$1.47	41,937,307	
Disposal Sites	494.1 Acres	$1,300.00	642,330	
Levees	648,241 C.Y.	$3.90	2,528,140	
			$45,532,747	
		Miscellaneous	11,857,465	
		Subtotal		$57,390,212
		Federal Share	$43,042,659	
		State Share	$14,347,553	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	87,966,900 C.Y.	$0.62	$54,539,478	
Disposal Sites	2,135.2 Acres	$1,300.00	2,775,760	
Levees	2,521,221	$3.90	9,832,762	
			$67,148,800	
		Miscellaneous	17,306,965	
		Subtotal		$84,454,965
		Federal Share	$63,341,224	
		State Share	$21,113,741	
			Project Total	$141,845,177
		Total Federal Share	$106,383,883	
		Total State Share	$35,461,294	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	--		--	--	
Dredging	56,979,433	C.Y.	$1.28	$72,933,674	
Disposal Sites	101.0	Acres	$1,300.00	131,300	
Levees	138,130	C.Y.	$3.90	538,707	
				$73,603,681	
			Miscellaneous	19,164,174	
			Subtotal		$92,767,855
			Federal Share	$69,575,891	
			State Share	$23,191,964	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	137,914,550	C.Y.	$0.54	$74,473,857	
Disposal Sites	147.9	Acres	$1,300.00	192,270	
Levees	157,611	C.Y.	$3.90	614,683	
				$75,280,810	
			Miscellaneous	19,514,167	
			Subtotal		$94,794,977
			Federal Share	$71,096,233	
			State Share	$23,698,744	
				Project Total	$187,562,832
			Total Federal Share	$140,672,124	
			Total State Share	$ 46,890,708	

COST SUMMARY

TOTAL GIWW - 250' x 14' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 46,426,703	$15,475,568	$ 61,902,271
2	30,093,830	10,031,276	40,125,106
3	48,363,734	16,121,245	64,484,979
4	43,042,659	14,347,553	57,390,212
5	69,575,891	23,191,964	92,767,855
	$237,502,817	$79,167,606	$316,670,423

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 35,801,810	$11,933,936	$ 47,735,746
2	25,264,537	8,421,511	33,686,048
3	68,169,515	22,723,171	90,892,686
4	63,341,224	21,113,741	84,454,965
5	71,096,233	23,698,744	94,794,977
	$263,673,319	$87,891,103	$351,564,422

Total Project

Segment	Federal Share	State Share	Total
1	$ 82,228,513	$ 27,409,504	$109,638,017
2	55,358,367	18,452,787	73,811,154
3	116,533,249	38,844,416	155,377,665
4	106,383,883	35,461,294	141,845,177
5	140,672,124	46,890,708	187,562,832
	$501,176,136	$167,058,709	$668,234,845

APPENDIX D

COST ESTIMATE
FOR
250 FOOT x 16 FOOT CHANNEL

APPENDIX D

COST ESTIMATE FOR 250' x 16' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	687.3 Acres	$1,300.00	$ 893,490	
Dredging	36,133,270 C.Y.	$1.67	60,342,561	
Disposal Sites	182.7 Acres	$1,300.00	237,510	
Levees	359,112 C.Y.	$3.90	1,400,537	
			$62,874,098	
		Miscellaneous	16,306,211	
		Subtotal		$79,180,308
		Federal Share	$59,385,231	
		State Share	$19,795,077	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	42,932,550 C.Y.	$0.69	$29,623,460	
Disposal Sites	1,623 Acres	$1,300.00	2,109,900	
Levees	1,921,906 C.Y.	$3.90	7,495,433	
			$39,228,793	
		Miscellaneous	10,190,358	
		Subtotal		$49,419,151
		Federal Share	$37,064,363	
		State Share	$12,354,788	
			Project Total	$128,599,459
		Total Federal Share	$96,449,594	
		Total State Share	$32,149,865	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	342.1 Acres	$1,300.00	$ 444,730	
Dredging	26,571,820 C.Y.	$1.47	39,060,575	
Disposal Sites	176.4 Acres	$1,300.00	229,320	
Levees	315,617 C.Y.	$3.90	1,230,906	
			$40,965,531	
		Miscellaneous	$10,673,887	
		Subtotal		$51,639,418
		Federal Share	$38,729,564	
		State Share	$12,909,854	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	37,769,300 C.Y.	$0.62	$23,416,966	
Disposal Sites	627.6 Acres	$1,300.00	815,880	
Levees	815,668 C.Y.	$3.90	3,181,105	
			$27,413,951	
		Miscellaneous	7,067,674	
		Subtotal		$34,481,625
		Federal Share	$25,861,218	
		State Share	$ 8,620,406	
			Project Total	$86,121,043
		Total Federal Share	$64,590,782	
		Total State Share	$21,530,261	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	690.2 Acres	$1,300.00	$ 897,260	
Dredging	41,600,320 C.Y.	$1.47	61,152,470	
Disposal Sites	990.8 Acres	$1,300.00	1,288,040	
Levees	1,082,199 C.Y.	$3.90	4,220,576	
			$67,558,346	
		Miscellaneous	17,588,618	
		Subtotal		$85,146,964
		Federal Share	$63,860,223	
		State Share	$21,286,741	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	95,172,550 C.Y.	$0.62	$59,006,981	
Disposal Sites	2,026.3 Acres	$1,300.00	2,634,190	
Levees	2,855,110 C.Y.	$3.90	11,134,929	
			$72,776,100	
		Miscellaneous	18,757,401	
		Subtotal		$91,533,501
		Federal Share	$68,650,124	
		State Share	$22,883,377	
			Project Total	$176,680,465
		Total Federal Share	$132,510,347	
		Total State Share	$ 44,170,118	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	326.9	Acres	$1,300.00	$ 424,970	
Dredging	38,013,900	C.Y.	$1.47	55,880,433	
Disposal Sites	838.6	Acres	$1,000.00	1,090,180	
Levees	948,158	C.Y.	$3.90	3,697,816	
				$61,093,399	
			Miscellaneous	15,908,016	
			Subtotal		$77,001,415
			Federal Share	$57,751,062	
			State Share	$19,250,353	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	87,966,900	C.Y.	$0.62	$54,539,478	
Disposal Sites	2,156.8	Acres	$1,300.00	2,803,840	
Levees	2,672,865	C.Y.	$3.90	10,424,174	
				$67,767,492	
			Miscellaneous	17,465,804	
			Subtotal		$85,233,295
			Federal Share	$63,924,972	
			State Share	$21,308,323	
				Project Total	$162,234,710
			Total Federal Share	$121,676,034	
			Total State Share	$ 40,558,676	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	-	-	-	
Dredging	77,376,302 C.Y.	$1.28	$99,041,667	
Disposal Sites	152.1 Acres	$1,300.00	197,730	
Levees	192,567 C.Y.	$3.90	751,011	
			$99,990,408	
		Miscellaneous	26,034,534	
		Subtotal		$126,024,942
		Federal Share	$94,518,706	
		State Share	$31,506,236	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	137,914,550 C.Y.	$0.54	$74,473,857	
Disposal Sites	125.6 Acres	$1,300.00	163,280	
Levees	133,870 C.Y.	$3.90	522,093	
			$75,159,230	
		Miscellaneous	19,482,994	
		Subtotal		$94,642,224
		Federal Share	$70,981,668	
		State Share	$23,660,556	
			Project Total	$220,667,166
		Total Federal Share	$165,500,374	
		Total State Share	$ 55,166,792	

COST SUMMARY

TOTAL GIWW - 250' x 16' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 59,385,231	$ 19,795,077	$ 79,180,308
2	38,729,564	12,909,854	51,639,418
3	63,860,223	21,286,741	85,146,964
4	57,751,062	19,250,353	77,001,415
5	94,518,706	31,506,236	126,024,942
	$314,244,789	$104,748,261	$418,993,047

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 37,064,363	$12,354,788	$ 49,419,151
2	25,861,218	8,620,406	34,481,625
3	68,650,124	22,883,377	91,533,501
4	63,924,972	21,308,323	85,233,295
5	70,981,668	23,660,556	94,642,224
	$266,482,345	$88,827,450	$355,309,796

Total Project

Segment	Federal Share	State Share	Total
1	$ 96,449,594	$ 32,149,865	$128,599,459
2	64,590,782	21,530,261	86,121,043
3	132,510,347	44,170,118	176,680,465
4	121,676,034	40,558,676	162,234,710
5	165,500,374	55,166,792	220,667,166
	$580,727,131	$193,575,712	$774,302,843

APPENDIX E

COST ESTIMATE
FOR
300 FOOT x 12 FOOT CHANNEL

APPENDIX E

COST ESTIMATE FOR 300' x 12' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	1,031.0 Acres	$1,300.00	$ 1,340,300	
Dredging	29,613,690 C.Y.	$1.67	49,454,862	
Disposal Sites	64.1 Acres	$1,300.00	83,330	
Levees	160,012 C.Y.	$3.90	624,047	
			$51,502,539	
		Miscellaneous	13,357,111	
		Subtotal		$64,859,650
		Federal Share	$48,644,737	
		State Share	$16,214,913	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	42,932,550 C.Y.	$0.69	$29,623,460	
Disposal Sites	1,462.6 Acres	$1,300.00	1,901,380	
Levees	1,832,876 C.Y.	$3.90	7,148,216	
			$38,673,056	
		Miscellaneous	10,081,198	
		Subtotal		$48,754,254
		Federal Share	$36,565,690	
		State Share	$12,188,563	
			Project Total	$113,613,904
		Total Federal Share	$85,210,428	
		Total State Share	$28,403,476	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	513.1 Acres	$1,300.00	$ 667,030	
Dredging	21,230,980 C.Y.	$1.47	31,209,541	
Disposal Sites	121.9 Acres	$1,300.00	158,470	
Levees	190,795 C.Y.	$3.90	774,101	
			$32,779,141	
		Miscellaneous	8,540,662	
		Subtotal		$41,319,803
		Federal Share	$30,989,852	
		State Share	$10,329,951	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	37,769,300 C.Y.	$0.62	$23,416,966	
Disposal Sites	496.4 Acres	$1,300.00	645,320	
Levees	742,470 C.Y.	$3.90	2,895,633	
			$26,957,919	
		Miscellaneous	6,950,746	
		Subtotal		$33,908,665
		Federal Share	$25,431,499	
		State Share	$ 8,477,166	
			Project Total	$75,228,468
		Total Federal Share	$56,421,351	
		Total State Share	$18,807,117	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	1,035.3 Acres	$1,300.00	$ 1,345,890	
Dredging	32,683,600 C.Y.	$1.47	48,044,892	
Disposal Sites	539.8 Acres	$1,300.00	701,740	
Levees	696,978 C.Y.	$3.90	2,718,214	
			$52,810,736	
		Miscellaneous	13,750,174	
		Subtotal		$66,560,911
		Federal Share	$49,920,683	
		State Share	$16,640,228	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	95,172,550 C.Y.	$0.62	$59,006,981	
Disposal Sites	2,216.2 Acres	$1,300.00	2,881,060	
Levees	2,699,173 C.Y.	$3.90	10,526,775	
			$72,414,815	
		Miscellaneous	18,664,767	
		Subtotal		$91,079,583
		Federal Share	$68,309,687	
		State Share	$22,769,896	
			Project Total	$157,640,494
		Total Federal Share	$118,230,371	
		Total State Share	$ 39,410,123	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	491.4 Acres	$1,300.00	$ 638,820	
Dredging	27,257,700 C.Y.	$1.47	40,068,819	
Disposal Sites	432.3 Acres	$1,300.00	561,990	
Levees	582,631 C.Y.	$3.90	2,272,261	
			$43,541,889	
		Miscellaneous	11,338,862	
		Subtotal		$54,880,752
		Federal Share	$41,160,564	
		State Share	$13,720,188	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	87,966,900 C.Y.	$0.62	$54,539,478	
Disposal Sites	2,159.6 Acres	$1,300.00	2,807,480	
Levees	2,566,610 C.Y.	$3.90	10,009,779	
			$67,356,737	
		Miscellaneous	17,360,486	
		Subtotal		$84,717,223
		Federal Share	$63,537,917	
		State Share	$21,179,306	
			Project Total	$139,597,975
	Total Federal Share		$104,698,481	
	Total State Share		$ 34,899,494	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	-		-		
Dredging	52,869,972	C.Y.	$1.28	$67,673,564	
Disposal Sites	97.6	Acres	$1,300.00	126,880	
Levees	134,474	C.Y.	$3.90	524,449	
				$68,324,893	
			Miscellaneous	17,789,619	
			Subtotal		$86,114,512
			Federal Share	$64,585,884	
			State Share	$21,528,628	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	137,914,550	C.Y.	$0.54	$74,473,857	
Disposal Sites	149.3	Acres	$1,300.00	194,090	
Levees	159,205	C.Y.	$3.90	620,900	
				$75,288,846	
			Miscellaneous	19,516,228	
			Subtotal		$94,805,075
			Federal Share	$71,103,806	
			State Share	$23,701,269	
				Project Total	$180,919,587
			Total Federal Share	$135,689,690	
			Total State Share	$ 45,229,897	

COST SUMMARY

TOTAL GIWW - 300' x 12' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 48,644,737	$16,214,913	$ 64,859,650
2	30,989,852	10,329,951	41,319,803
3	49,920,683	16,640,228	66,560,911
4	41,160,564	13,720,188	54,880,752
5	64,585,884	21,528,628	86,114,512
	$235,301,720	$78,433,908	$313,735,628

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 36,565,690	$12,188,563	$ 48,754,254
2	25,431,499	8,477,166	33,908,665
3	68,309,687	22,769,896	91,079,583
4	63,537,917	21,179,306	84,717,223
5	71,103,806	23,701,269	94,805,075
	$264,948,599	$88,316,200	$353,264,799

Total Project

Segment	Federal Share	State Share	Total
1	$ 85,210,428	$ 28,403,476	$113,613,904
2	56,421,351	18,807,117	75,228,468
3	118,230,371	39,410,123	157,640,494
4	104,698,481	34,899,494	134,597,975
5	135,689,690	45,229,897	180,919,587
	$500,250,321	$166,750,107	$667,000,428

APPENDIX F

COST ESTIMATE
FOR
300 FOOT x 14 FOOT CHANNEL

APPENDIX F
COST ESTIMATE FOR 300' x 14' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	1,031.0	Acres	$1,300.00	$ 1,340,300	
Dredging	38,181,670	C.Y.	$1.67	63,763,389	
Disposal Sites	210.4	Acres	$1,300.00	273,520	
Levees	395,265	C.Y.	$3.90	1,541,534	
				$66,918,743	
			Miscellaneous	17,353,761	
			Subtotal		$84,272,503
			Federal Share	$63,204,378	
			State Share	$21,068,125	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	42,932,550	C.Y.	$0.69	$29,623,460	
Disposal Sites	1,747.3	Acres	$1,300.00	2,271,490	
Levees	2,006,986	C.Y.	$3.90	7,827,245	
				$39,722,195	
			Miscellaneous	10,316,866	
			Subtotal		$50,039,061
			Federal Share	$37,529,295	
			State Share	$12,509,766	
				Project Total	$134,311,564
			Total Federal Share	$100,733,673	
			Total State Share	$ 33,577,891	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	513.1 Acres	$1,300.00	$ 667,030	
Dredging	27,706,420 C.Y.	$1.47	40,728,437	
Disposal Sites	194.3 Acres	$1,300.00	252,590	
Levees	393,150 C.Y.	$3.90	1,533,285	
			$43,181,342	
		Miscellaneous	11,249,295	
		Subtotal		$54,430,637
		Federal Share	$40,822,977	
		State Share	$13,607,660	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	37,769,300 C.Y.	$0.62	$23,416,966	
Disposal Sites	698.7 Acres	$1,300.00	908,310	
Levees	839,363 C.Y.	$3.90	3,273,516	
			$27,598,792	
		Miscellaneous	7,115,067	
		Subtotal		$34,713,859
		Federal Share	$26,035,394	
		State Share	$ 8,678,465	
			Project Total	$89,144,496
		Total Federal Share	$66,858,372	
		Total State Share	$22,286,124	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	1,035.3	Acres	$1,300.00	$ 1,345,890	
Dredging	43,153,800	C.Y.	$1.47	63,436,086	
Disposal Sites	1,244.7	Acres	$1,300.00	1,618,110	
Levees	1,413,370	C.Y.	$3.90	5,512,143	
				$71,912,229	
			Miscellaneous	18,714,912	
			Subtotal		$90,627,141
			Federal Share	$67,970,356	
			State Share	$22,656,785	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	95,172,550	C.Y.	$0.62	$59,006,981	
Disposal Sites	2,211.9	Acres	$1,300.00	2,875,470	
Levees	2,759,449	C.Y.	$3.90	10,761,851	
				$72,644,302	
			Miscellaneous	18,723,607	
			Subtotal		$91,367,909
			Federal Share	$68,525,932	
			State Share	$22,841,977	
				Project Total	$181,995,050
			Total Federal Share	$136,496,288	
			Total State Share	$ 45,498,762	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	491.4	Acres	$1,300.00	$ 638,820	
Dredging	37,661,980	C.Y.	$1.47	55,363,111	
Disposal Sites	795.9	Acres	$1,300.00	1,034,670	
Levees	1,000,328	C.Y.	$3.90	3,901,279	
				$60,937,880	
			Miscellaneous	15,865,886	
			Subtotal		$76,803,766
			Federal Share	$57,602,824	
			State Share	$19,200,942	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	87,966,900	C.Y.	$0.62	$54,539,478	
Disposal Sites	2,317.4	Acres	$1,300.00	3,012,620	
Levees	2,739,959	C.Y.	$3.90	10,685,840	
				$68,237,938	
			Miscellaneous	17,586,426	
			Subtotal		$85,824,364
			Federal Share	$64,368,273	
			State Share	$21,456,091	
				Project Total	$162,628,130
			Total Federal Share	$121,971,098	
			Total State Share	$ 40,657,032	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	-		-	-	
Dredging	74,565,367	C.Y.	$1.28	$95,443,670	
Disposal Sites	152.5	Acres	$1,300.00	198,250	
Levees	192,972	C.Y.	$3.90	752,591	
				$96,394,511	
			Miscellaneous	25,097,924	
			Subtotal		$121,492,435
			Federal Share	$91,119,326	
			State Share	$30,373,109	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	137,914,550	C.Y.	$0.54	$74,473,857	
Disposal Sites	125.4	Acres	$1,300.00	163,020	
Levees	133,697	C.Y.	$3.90	521,418	
				$75,158,295	
			Miscellaneous	19,482,755	
			Subtotal		$94,641,051
			Federal Share	$70,980,788	
			State Share	$23,660,263	
				Project Total	$216,133,486
			Total Federal Share	$162,100,116	
			Total State Share	$ 54,033,371	

COST SUMMARY

TOTAL GIWW - 300' x 14' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 63,204,378	$ 21,068,125	$ 84,272,503
2	40,822,977	13,607,660	54,430,637
3	67,970,356	22,656,785	90,627,141
4	57,602,824	19,200,942	76,803,796
5	91,119,326	30,373,109	121,492,435
	$320,719,861	$106,906,621	$427,626,482

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 37,529,295	$12,509,766	$ 50,039,061
2	26,035,394	8,678,465	34,713,859
3	68,525,932	22,841,977	91,367,909
4	64,368,273	21,456,091	85,824,364
5	70,980,788	23,660,263	94,641,051
	$267,439,682	$89,146,562	$356,585,244

Total Project

Segment	Federal Share	State Share	Total
1	$100,733,673	$ 33,577,891	$134,311,564
2	66,858,372	22,286,124	89,144,496
3	136,496,288	45,498,762	181,995,050
4	121,971,098	40,657,032	162,628,130
5	162,100,115	54,033,371	216,133,486
	$588,159,546	$196,053,180	$784,212,726

APPENDIX G

COST ESTIMATE
FOR
300 FOOT x 16 FOOT CHANNEL

APPENDIX G
COST ESTIMATE FOR 300' x 16' CHANNEL

SEGMENT #1
SABINE-NECHES WATERWAY TO HOUSTON SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	1,031.0	Acres	$1,300.00	$ 1,340,300	
Dredging	46,942,200	C.Y.	$1.67	78,393 474	
Disposal Sites	363.2	Acres	$1,300.00	472,160	
Levees	584,178	C.Y.	$3.90	2,278,294	
				$82,484,228	
			Miscellaneous	21,389,675	
			Subtotal		$103,873,903
			Federal Share	$77,905,427	
			State Share	$25,968,476	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	42,932,550	C.Y.	$0.69	$29,623,460	
Disposal Sites	2,001.9	Acres	$1,300.00	2,602,470	
Levees	2,256,801	C.Y.	$3.90	8,801,524	
				$41,027,453	
			Miscellaneous	10,651,534	
			Subtotal		$ 51,678,988
			Federal Share	$38,759,241	
			State Share	$12,919,747	
				Project Total	$155,552,891
			Total Federal Share	$116,664,668	
			Total State Share	$ 38,888,223	

SEGMENT #2
HOUSTON SHIP CHANNEL TO FREEPORT HARBOR CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	513.1	Acres	$1,300.00	$ 667,030	
Dredging	34,381,800	C.Y.	$1.47	50,541,246	
Disposal Sites	268.5	Acres	$1,300.00	349,050	
Levees	674,090	C.Y.	$3.90	2,628,951	
				$54,186,277	
			Miscellaneous	14,113,748	
			Subtotal		$68,300,025
			Federal Share	$51,225,019	
			State Share	$17,075,006	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	37,769,300	C.Y.	$0.62	$23,416,966	
Disposal Sites	891.3	Acres	$1,300.00	1,158,690	
Levees	836,407	C.Y.	$3.90	3,261,987	
				$27,837,643	
			Miscellaneous	7,176,308	
			Subtotal		$35,013,951
			Federal Share	$26,260,463	
			State Share	$ 8,753,488	
				Project Total	$103,313,976
			Total Federal Share	$77,485,482	
			Total State Share	$25,828,494	

SEGMENT #3
FREEPORT HARBOR CHANNEL TO MATAGORDA SHIP CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	1,035.3 Acres	$1,300.00	$ 1,345,890	
Dredging	53,896,160 C.Y.	$1.47	79,227,355	
Disposal Sites	2,078.7 Acres	$1,300.00	2,702,310	
Levees	2,488,595 C.Y.	$3.90	9,705,521	
			$92,981,076	
		Miscellaneous	24,185,822	
		Subtotal		$117,166,898
		Federal Share	$87,875,173	
		State Share	$29,291,725	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	95,172,550 C.Y.	$0.62	$59,006,981	
Disposal Sites	2,128.4 Acres	$1,300.00	2,766,920	
Levees	2,367,729 C.Y.	$3.90	9,234,143	
			$71,008,044	
		Miscellaneous	18,304,072	
		Subtotal		$89,312,116
		Federal Share	$66,984,087	
		State Share	$22,328,029	
			Project Total	$206,479,014
		Total Federal Share	$154,859,261	
		Total State Share	$ 51,619,753	

SEGMENT #4
MATAGORDA SHIP CHANNEL TO CORPUS CHRISTI CHANNEL

New Construction

Item	Quantity	Unit Price	Cost	
ROW	491.4 Acres	$1,300.00	$ 638,820	
Dredging	48,471,480 C.Y.	$1.47	71,253,076	
Disposal Sites	1,239.6 Acres	$1,300.00	1,611,480	
Levees	1,552,782 C.Y.	$3.90	6,055,850	
			$79,599,226	
		Miscellaneous	20,709,687	
		Subtotal		$100,268,912
		Federal Share	$75,201,684	
		State Share	$25,067,228	

50-Year Maintenance

Item	Quantity	Unit Price	Cost	
Dredging	87,966,900 C.Y.	$0.62	$54,539,478	
Disposal Sites	2,249.7 Acres	$1,300.00	2,924,610	
Levees	2,631,327 C.Y.	$3.90	10,262,175	
			$67,726,263	
		Miscellaneous	17,455,233	
		Subtotal		$ 85,181,496
		Federal Share	$63,886,122	
		State Share	$21,295,374	
			Project Total	$185,450,408
		Total Federal Share	$139,087,806	
		Total State Share	$ 46,362,602	

SEGMENT #5
CORPUS CHRISTI CHANNEL TO BROWNSVILLE SHIP CHANNEL

New Construction

Item	Quantity		Unit Price	Cost	
ROW	-		-	-	
Dredging	97,442,956	C.Y.	$1.28	$124,726,984	
Disposal Sites	210.0	Acres	$1,300.00	273,000	
Levees	254,178	C.Y.	$3.90	991,294	
				$125,991,278	
			Miscellaneous	32,803,851	
			Subtotal		$158,795,129
			Federal Share	$119,096,347	
			State Share	$ 39,698,782	

50-Year Maintenance

Item	Quantity		Unit Price	Cost	
Dredging	137,914,550	C.Y.	$0.54	$74,473,857	
Disposal Sites	100.3	Acres	$1,300.00	130,390	
Levees	107,006	C.Y.	$3.90	417,323	
				$75,021,570	
			Miscellaneous	19,447,699	
			Subtotal		$ 94,469,269
			Federal Share	$70,851,952	
			State Share	$23,617,317	
				Project Total	$253,264,398
			Total Federal Share	$189,948,298	
			Total State Share	$ 63,316,100	

COST SUMMARY

TOTAL GIWW - 300' x 16' CHANNEL

New Construction

Segment	Federal Share	State Share	Total
1	$ 77,905,427	$ 25,968,476	$103,873,903
2	51,225,019	17,075,006	68,300,025
3	87,875,173	29,291,725	117,166,898
4	75,201,684	25,067,228	100,268,912
5	119,096,347	39,698,782	158,795,129
	$411,303,650	$137,101,217	$548,404,867

50-Year Maintenance

Segment	Federal Share	State Share	Total
1	$ 38,759,241	$12,919,747	$ 51,678,988
2	26,260,463	8,753,488	35,013,951
3	66,984,087	22,328,029	89,312,116
4	63,886,122	21,295,374	85,181,496
5	70,851,952	23,617,317	94,469,269
	$266,741,865	$88,913,955	$355,655,820

Total Project

Segment	Federal Share	State Share	Total
1	$116,664,668	$ 38,888,223	$155,552,891
2	77,485,482	25,828,494	103,313,976
3	154,859,261	51,619,753	206,479,014
4	139,087,806	46,362,602	185,450,408
5	189,948,298	63,316,100	253,264,398
	$678,045,515	$226,015,172	$904,060,687

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