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16. Abstract

The purpose of this study is to update a 1989 study of the economic impact of the Gulf Intracoastal Watersay System in Texas. The study uses a variety of factors to determine the current impact of the GIWW on Texas including cargo value of domestic goods, Gulf Intracoastal Waterway maintenance dredging, water transportation/services revenue.

In addition, the ramifications and economic impact of a possible extension of the GIWW into Mexico is presented.

This study is being continued under the auspices of a new sponsor, the Texas Waterway Operators Association. The second part involves a more in-depth review of the economic impact that the barge industry has on Texas, particularly as related to industries that are heavily dependent on low-cost transportation for bulk commodities.

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ECONOMIC IMPACT OF BARGE TRANSPORTATION ON THE TEXAS PORTION OF THE GULF INTRACOASTAL WATERWAY (GIWW) AND EXTENSION OF THE GIWW INTO MEXICO

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Implementation Statement

The findings of this research can be implemented when making policy decisions concerning the Texas portion of the Gulf Intracoastal Waterway (GIWW) and when providing public information on the GIWW in Texas. The results will be useful in educating the public, media, industry, and government agencies of the importance of GIWW barge transportation to the economy of Texas and the possible outcomes of an extension of the GIWW into Mexico. The findings can also be implemented when providing information on a national scale about the economic importance of barge transportation on the Texas portion of the GIWW.

Disclaimer

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation or the Universities involved. This report does not constitute a standard, specification, or regulation.

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Summary

The purpose of "Economic Impact of Barge Transportation on the Texas Portion of the Gulf Intracoastal Waterway (GIWW) and Extension of the GIWW into Mexico" is to update a 1989 study by Hillary Garrett and Dock Burke titled "Economic Impact of the Gulf Intracoastal Waterway System in Texas." Chapter 1 includes a brief history of the GIWW with major milestones and legislation. Chapter 2 focuses on a comparison of transportation modes, specifically barges, pipelines, rail, and truck. Chapter 3 looks at the economic impact of the waterway. Specifically, Chapter 3 discusses first the type and quantity of cargo shipped on the Texas portion of the waterway. Second, the chapter analyzes two manufacturing and mining sectors that depend heavily on inland water transportation. Third, the chapter includes the value of cargo in Texas ports determined by the same methodology used in the 1989 study and by Martin Associates in both their 1986 and 1994 studies. Fourth is a review of the economic impact on Texas of water transportation and water transportation services. Lastly, the authors discuss the recreational and commercial uses of the GIWW. Chapter 4 looks at a similar assessment of the extension of the GIWW into Mexico.

This study is being continued under the auspices of a new sponsor, the Texas Waterway Operators Association. The second part involves a more in-depth review of the economic impact that the barge industry has on Texas, particularly as related to industries that are heavily dependent on low-cost transportation for bulk commodities.

Summary of Findings

1. The Texas portion of the GIWW has a long history of providing an important link in the national transportation system.

2. Texas has more miles of GIWW, pipeline, and railroad than any other state. Any changes that affect bulk commodities and modes of transportation heavily impact the state.

3. For the first 20 years after the GIWW opened, the Corps of Engineers through its operation and maintenance (dredging) of the Laguna Madre Section of the GIWW was credited with reducing salinity and favorably impacting fish and sea grasses. The Corps currently dredges on an emergency basis only, pending the outcome of 14 environmental studies currently investigating the effects of dredging or related environmental topics on the Laguna Madre. The total investment on the environmental studies is $3,604,095.

4. From 1986 to 1994, the total short tons handled on the Texas portion of the GIWW has increased over a million tons. Based on values from the Bureau of Census, the cargo value in 1994 was $26,497,269,000.

5. In 1993, Chemical and Allied Products, Petroleum and Coal Products, Oil and Gas Extraction and Non-Metallic Minerals located in the Gulf Coast area of Texas and

heavily dependent on inland water transportation created:

- Total demand (revenues) of $137,459,720,000;
- Total income (payroll) of $20,718,190,000;
- Total employment of 902,680;
- Sales tax revenues of $209,688,415.

6. In 1995, 94 percent (or $2.05 billion) of capital improvements and expansion in Texas in the chemical industry were along the Gulf Coast, and 82 percent (or over $600 million) of capital improvements and expansion in petroleum and coal products facilities in Texas were along the Gulf Coast.

7. Port cargo values attributable to the Texas portion of the GIWW increased from $1.47 billion in 1986 to $2.8 billion in 1994.

8. The Arthur Andersen study concludes that the extension of the GIWW to the Canal Intracostero Tamaulipeco would increase trade between NAFTA partners and reduce transportation costs. Texas would be a major beneficiary. Inland water traffic between Corpus Christi and Brownsville would increase. The Port of Brownsville would benefit.

9. Following is the impact attributable to the GIWW in Texas for 1994 including indirect and induced influence:

SECTOR	TOTAL ECONOMIC IMPACT*
DEMAND	
Total Port Cargo Value	$ 2,842,600,000
Intracoastal Waterway Maintenance Dredging	$ 64,980,000
Water Transportation Revenues	$ 700,400,000
Water Transportation Services Revenues	$ 1,202,800,000
TOTAL DEMAND	**$ 4,810,780,000**
INCOME (PAYROLL)	
Water Transportation	$ 101,400,000
Water Transportation Services	$ 88,400,000
TOTAL INCOME	**$ 189,800,000**
EMPLOYMENT	
Water Transportation	4,965
Water Transportation Services	8,525
TOTAL EMPLOYMENT**	**13,490**
State Sales Tax	**$ 3,914,375**
Federal Fuel Tax	**$ 2,920,534**

*Numbers have been rounded.

** GIWW only. Total employment including all port-related employment is 162,000 (Zane A. Goff, et. al., Identify and Assess the Collective Contribution (Value) of Texas to Texas and the Nation, draft, Texas Transportation Institute, November 1996).

CHAPTER 1: HISTORY OF THE GIWW IN TEXAS

A report by the Secretary of the Treasury Albert Gallatin in 1808 states the vision and philosophy behind the U.S. plan for national transportation, including the Texas portion of the Gulf Intracoastal Waterway. Public Roads and Canals formulated "...a plan for federal promotion of inland transportation and established the principles that have guided the government's role in water-related public works since that time."[1]

> Gallatin advocated considerable federal assistance, arguing that private capital was not being used to develop essential roads and canals. Many areas through which potential avenues of traffic would run were settled only sparsely, if at all, and more attractive investments diverted the precious supply of available capital. Gallatin maintained the federal government could overcome these obstacles by participating in construction of extensive projects that would, in turn, stimulate private enterprise to carry on further improvements.[2]

"Gallatin based his justification on the military, political and commercial needs of the growing nation."[3] The War of 1812 delayed implementation of the plan but reinforced the military value of inland communication and transportation. In 1819, Secretary of War John C. Calhoun recommended that Army Engineers supervise the construction of internal improvements since there were mutual benefits to both military and commercial objectives.

While many dreamed of a canal that would tie the Atlantic Ocean to the Gulf of Mexico, others focused on difficulties and expenses involved. The federal reserves at that time were not great enough to accomplish this dream, especially since the Civil War required money.

"Railroad growth accelerated at an enormous rate between 1850 and 1910. Workers laid more miles (70,335) of track between 1880 and 1890 than during any other decade in the nation's history."[4]

> Seeking to entice commerce away from the waterways, the railroads successfully adopted various techniques to drive competing water carriers out of business. Rate-cutting practices became prevalent soon after the Civil War. In locations where water transportation was available, the railroads would reduce their freight rates to artificially low levels, even hauling water-competitive commerce at a loss if necessary. Another technique they employed was purchasing competing water lines and then discouraging their use by raising the water rates. By gaining control of waterfront facilities, the railroads hampered freight delivery to and from water carriers. Also, they often refused to transship goods that might be moved in combination by rail and water.[5]

"As commerce abandoned the waterways for the railroads, many channels fell into disrepair and were not maintained by the private companies for which they had ceased to be

profitable."[6] In the late 1800s interest in the waterways revived because the railroad did not have the capability of meeting demand and because the Interstate Commerce Act of 1887 failed to end the discriminatory practices of railroads. During this time, Theodore Roosevelt became a champion of national transportation. Following his leadership, Congress in 1909 "authorized sweeping surveys for a host of waterways improvements including a system of connected intracoastal waterways stretching from Boston to Brownsville."[7]

In the private sector in 1905, businessmen in Victoria, Texas, organized the Interstate Inland Waterway League dedicated to the goal of a continuous system of waterways that would tie together the navigable waters from the Great Lakes through the Mississippi Valley and along the Louisiana and Texas coastlines. The league is known today as the Gulf Intracoastal Canal Association. It has played a crucial role in the leadership of and perseverance in pressing for legislation, donation of right-of-ways, rebuilding bridges, etc.

World War II facilitated the transformation of the Gulf Intracoastal Waterway into a reality. The heavy movement of personnel, troops, and defense materials emphasized the need for protected inland transportation. The presence of German submarines along the Eastern and Gulf Coast of the U.S. demonstrated the extreme vulnerability of coastal traffic. "The enemy vessels sunk more than two dozen merchant ships in the Gulf of Mexico, severely disrupting commerce. Towboats, tugs, and barges, pressed into service on the protected inland waterways, moved tremendous quantities of strategic commodities essential to wartime production."[8] "...The barges coordinated with pipelines, tank cars, and tank trucks to deliver a total of 1,731,030,385 barrels of petroleum and petroleum products during the war."[9] The Office of Defense Transportation reportedly said, "If our waterways rendered no service beyond that of transporting petroleum and its products during the war, they would have amply justified their improved existence."[10]

> Vital war-related industries located production facilities along the GIWW and its tributaries. This waterside industrial development offered innumerable benefits to the adjacent communities. The experience of Houston provides an outstanding case in point. The spectacular rise of the petrochemical industry along the banks of the Houston Ship Channel not only supported the war effort but also contributed significantly to that city's tremendous postwar boom. The advantages of low-cost barge service for bulk-loading commodities attracted many manufacturers to the Gulf Coast area, enabling them to move large quantities of raw materials from one stage of production to the next along the intracoastal canal.
>
> ...Today, chemical plants, glass plants, paper mills, oil refineries, steel-fabricating plants, power plants, shipyards, grain elevators, and fertilizer and synthetic rubber plants are among the industrial facilities lining the waterway. Picturesque fishing vessels, sleek pleasure boats, and graceful sailboats dot the channel, joining the bustling stream of barge traffic.[11]

The waterways have a long history of milestones and legislative regulation. The following table summarizes some of the legislation and milestones more pertinent to the Texas portion of the Gulf Intracoastal Waterway.

TABLE 1.1 Selected Milestones and Legislative History of the GIWW

DATE	EVENT
1873	Rivers and Harbors Act provided funds for a survey of the Texas coastline
1874	Texas coastline survey completed
1901	Oil discovery at Spindletop in Texas renewed interest in a canal for transportation of petroleum products
1905	Construction of GIWW begins (connecting Corpus Christi to Aransas Pass; Aransas Pass to Pass Cavallo; Brazos River to West Galveston Bay)
1909	Above canals (dredged 5 feet deep and 40 feet wide) completed
1925	Congress appropriates $9 million for GIWW extension to connect Galveston
1934	Construction connecting segment between Sabine River and Galveston Bay
1939-1945	World War II reveals the importance of water transportation to the nation's defense
1942	9 foot channel completed to Corpus Christi
1949	Channel completed between Corpus Christi and Brownsville
1949	GIWW dredged to 12 feet deep and 125 feet wide
1961	Total of almost 90 tributaries incorporated into GIWW
1972	Federal Water Pollution Control Act Amendments "provide for potentially severe penalties for the discharge into water of a hazardous substance determined to be non-removable."[12]
1972	Marine Protection Research and Sanctuaries Act (MPRSA), as amended, requires that the Corps evaluate proposed projects that require the transportation of dredged material for the purpose of disposal in the open ocean.
1975	The Texas Coastal Waterway Act appointed the State Highway and Public Transportation Commission (now Texas Transportation Commission) to act as agent of the State of Texas as the nonfederal sponsor for the GIWW in Texas. The act also instructed the commission to evaluate continually the GIWW as it relates to Texas.
1975	Final EIS for entire Texas portion of GIWW prepared.
1976	Resource Conservation and Recovery Act (RCRA), as amended, prohibits land disposal of hazardous wastes unless the wastes meet specified treatment standards.

1977	Clean Water Act (CWA) as amended includes separate permit programs for wetlands protection and for dredging and dredged material disposal.
March 1989	Issue paper prepared by maintenance dredging working group (NMFS, TGLO, TPWD, USFWS, and NPS) urging preparation of a new EIS because of concerns over effects of dredged material disposal and changes in circumstances and new information since the 1975 EIS.
1990	Corps prepared environmental assessment with a finding of no significant impact (EA/FONSI) for upland disposal on the Kenedy/King Ranch.
September 1993	King Ranch prepared White Paper on environmental effects of dredged material disposal on uplands and urged preparation of a new EIS.
February 1994	Acquisition of 750 upland acres in the Baffin Bay area of the upper Laguna Madre suspended by the Texas Transportation Commission pending the completion and review of the U.S. Army Corps of Engineer's Section 216 feasibility study.
March 1994	Dredging operations planned for March 1994 temporarily deferred in the lower Laguna Madre area due to concerns about the environmental impacts of open-water disposal.
July 1994	Corps completed draft reconnaissance report for section 216 study (authorized by the Flood Control Act of 1970) on Corpus Christi Bay to Port Isabel segment. Section 216 studies initiated for the entire GIWW (to be done in 5 separate sections) in response to the concerns raised in the 1989 issue paper.
July 1994	The Corps completed a draft of the first phase of a two phase Section 216 study.
September 1994	The National Audubon Society, the Lower Laguna Madre Foundation, the Sierra Club, the National Wildlife Foundation, the Gulf Coast Conservation Association, and the Sportsmen Conservation of Texas file suit to enjoin the Corps from dredging to greater depths than legally required and enjoin the disposal of spoil to sites below mean low tide in the Laguna Madre and requested completion of a new or supplemental EIS covering the GIWW dredging program from Corpus Christi to Port Isabel, TX.
September 1994	U.S. District Court for the Southern District of Texas, Brownsville Division, denied the plaintiffs request and dismissed the above case based on the Court's finding that the Corps "is currently engaged in a review of the maintenance and operation...pursuant to the National Environmental Policy Act."

February 1995	First meeting of Interagency Coordination Team (ICT) composed of TxDOT, TGLO, TWDB, TPWD, TRNCC, USACE, USFWS, NMFS, EPA, and CCBNEP (Corpus Christi Bay National Estuary Program--advisory). Charter to identify environmental concerns associated with the GIWW in the Laguna Madre and to develop scopes of work to address those concerns.
February 1996	Corps announces intent to prepare supplemental EIS.
April 1996	Joint Motion for Voluntary Dismissal of Audubon's appeal of 1994 suit. Stipulation of Settlement provided that Corps would use its best efforts to complete a SEIS by 12/31/98; to conduct public scoping and evaluate reasonable alternatives; to hold a public scoping meeting in Cameron County, Texas, before 10/1/96.
Summer 1996	Corps holds series of workshops as part of NEPA scoping process.
September 1996	Corps holds public meeting as part of NEPA scoping process.

A variety of both state and federal agencies are involved in managing the section of the GIWW which spans the Texas coast. The Texas Department of Transportation, the Texas Department of Health, the Texas Water Development Board, and the Texas Department of Agriculture have jurisdiction over various issues that affect the Texas portion of the GIWW. In addition, the "[Texas] General Land Office manages submerged lands; the [Texas] Railroad Commission regulates the oil industry; the [Texas] Department of Parks and Wildlife enforces policy for coastal fisheries; and the Texas Natural Resource Conservation Commission monitors water quality."[13] Also, more than 30 separate federal agencies influence the Texas portion of the GIWW, including the U.S. Coast Guard, the U.S. Army Corps of Engineers, and the U.S. Maritime Administration.[14]

The Texas portion of the GIWW has a long history of providing an important link in the national transportation system. The waterway has also encouraged extraction, refining, and manufacturing companies and related industries to locate along the waterway, thus providing a major source of employment for Texans and facilitating interstate and international trade for Texas and the nation.

CHAPTER 2: TRANSPORTATION MODE ANALYSIS

2.1 BACKGROUND

Texas has a major stake in all transportation-related issues and legislation. It has more miles of waterways*, pipeline, and railroad lines than any other state.

Texas has:

- 423 miles of GIWW canal[15]
- 172,000 miles of petroleum pipeline[16]
- 11,370 miles of railroad[17]
- 294,495 miles of highways[18]

The systems or modes compared below are barge, petroleum pipeline,** rail, and truck. The following factors are compared in the analysis: market and service structure; cost; environmental concerns; safety; consumer awareness and understanding; and global and NAFTA trends.

While it is possible to transport an industrial commodity using only one mode, it is extremely rare for a commodity to reach a non-industrial consumer by using only one mode. Multiple variations of transportation modes are possible—pipeline to barge; barge to rail; barge or rail to truck, etc. Commodities transported in bulk by pipeline, barge, or rail are usually transported on trucks for final disposition to consumers. All modes have a built-in market, and the elimination of any of the options could cause cost increases for industry and consumers and reduce U.S. international competitiveness.

2.2 MARKET AND SERVICE STRUCTURE

Each mode's normal cargo market and general organizational structure are covered below. Then a more in-depth analysis of the effect that volume shipped and distance traveled have on mode selection is presented.

Barges are most suitable for bulk commodities that have a low commodity value per unit of

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*Galveston District Corps of Engineers maintains 1000 miles of Texas waterways (760 miles classified as shallow draft and 240 miles classified as deep draft).

** The two major types of pipeline in Texas involve natural gas and crude or refined petroleum products. Only pipelines carry natural gas in Texas. Therefore, this study will focus on petroleum pipeline data.

volume and that require long-distance shipping, but have a low time-to-market sensitivity.[19] Along the Texas portion of the GIWW, the most common bulk or raw materials shipped are chemical, petroleum, and related products; sand/gravel; and grain. Most barges are owned by for-hire carrier; however, some private carriers own barges which are used primarily for their own use. Barge rates are not currently regulated.

Pipelines serve limited markets and have limited commodities. They may be gathering lines used to bring oil from the fields to the storage areas or may be trunk lines that move liquid or gas products long distances. In Texas, most pipelines transport petroleum, petroleum-related commodities, or natural gas. "Most consumption within Texas of pipeline products is for industrial uses as opposed to residential uses."[20] Pipelines are the only mode with no backhaul—products move in only one direction. Pipelines are oligopolistic in that a small number of very large carriers dominate the industry. Products move slowly through the pipeline at an average of 3-5 miles per hour. Pipelines have a fixed route of service (limited geographic flexibility). Pipelines must be operated as common carriers regardless of whether privately owned.

Railroads also have oligopolistic characteristics—there are a few interdependent large companies. Mergers are the current trend, e.g., Union Pacific and Southern Pacific. The relative market share of railroad intercity ton-miles has been declining because of aggressive modal competition. In the early years of the industry, railroads moved almost every type of product; but today, more than 50 percent of total rail carloads involve large quantities of heavy-weight, low-value, bulk commodities.[21] Coal, farm products, chemicals and allied products, and transportation equipment compose the largest segments of commodities shipped--but trailer on flatcar (TOFC) and container on flatcar (COFC) service is an increasingly important market niche for the railroads. Railroads have fixed right-of-ways; therefore, completeness of service depends on whether the shipper and receiver possess rail sidings. While each railroad serves a specific geographic region, freight and equipment are automatically exchanged at interchange points that provide a unique service but can create rate-division problems and delays in delivery.

Trucks are very versatile. They may operate as a private carrier or as a for-hire carrier. They may serve only a small local area or large intercity area. They may specialize in truckload (TL) service or less-than-truckload (LTL) service. Trucks handle almost all types of commodities, but high value equipment, delicate products, and commodities that need to arrive at the user's door in a short time frame are the most favored commodities. Less than 50 percent of the commodities are bulk materials. Trucks have the most flexibility in delivering products because either paved or unpaved roads and streets are accessible for any consumer/user/ company desiring their service. They are a universal coordinator and provide the bridge between the pickup and delivery facilities of other modes. Competition within the industry is keen with many large and small companies. With a relatively small investment of capital, an individual can start a trucking business—unlike the other mode carriers. The small size of many motor carriers has facilitated the strong customer/service responsiveness of this mode.

2.2.1 Volume

The quantity of bulk commodities being transported affects the mode selected. For large continuous volumes of liquids or gas, trunk-line pipelines that average 30 to 50 inches in diameter can transport the greatest volume. The larger the diameter of the pipe, the larger the volume. Pipeline volume measurement is dependent upon the compressibility, pressure, and temperature conditions as well as the unique characteristics of each sub-classification of the product. Capacity of a pipeline system varies by time of year. An estimated 20 percent of all freight movement in Texas is via pipelines.[22]

In 1995, there were far more petroleum-related products transported from Petroleum Administration for Defense (PAD) District III (which includes Texas, New Mexico, Arkansas, Louisiana, Mississippi, and Alabama) by tanker and barge than by pipeline.[23] The national figures reported by the Association of Oil Pipelines show a larger percent of crude petroleum transported by pipeline (see Table 2.1). However, according to Don Riley, consultant for the Association of Oil Pipelines, these figures include the Alaskan

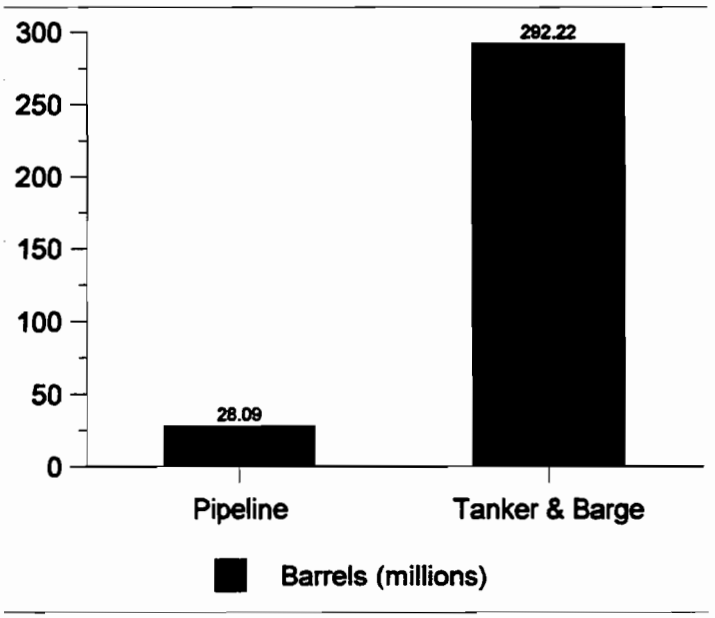

FIGURE 2.1 Transportation of Petroleum-Related Products, PAD III, 1995
Source: Office of Oil and Gas, Energy Information Administration.

Transportation Pipeline, which accounts for approximately 15 percent of the crude petroleum transported by pipeline. Mr. Riley reports that the amount of crude petroleum flowing through the Alaskan Transportation Pipeline exhibits a downward trend.[24]

TABLE 2.1 Trends in Petroleum Transportation

Total Crude Petroleum and Petroleum Products Carried in Domestic Transportation and Percent of Total Carried by Each Mode of Transportation

Year	Total Crude Products Ton-Miles	Pipelines†		Water Carriers		Motor Carriers‡		Railroads	
		Ton-Miles	% of Total	Ton-Miles	% of Total	Ton-Miles	% of Total	Ton-Miles	% of Total
1986	1,187.8	577.9	48.65	568.1	47.83	29.7	2.50	12.1	1.02
1987	1,195.8	586.8	49.08	566.5	47.37	30.4	2.54	12.1	1.01
1988	1,188.1	601.1	50.59	543.7	45.76	30.5	2.57	12.8	1.08
1989	1,094.2	584.2	53.39	466.2	42.61	30.4	2.78	13.4	1.22
1990	1,076.8	584.1	54.24	449.0	41.70	29.7	2.76	14.0	1.30
1991	1,086.1	578.5	53.27	465.0	42.81	28.8	2.65	13.8	1.27
1992	1,091.7	588.8	53.93	459.3	42.07	28.8	2.64	14.8	1.36
1993	1,034.6	592.9	57.31	401.7	38.82	24.8	2.40	15.2	1.47
1994	1,046.7	591.4	56.50	411.4	39.31	28.1	2.68	15.8	1.51

† The amounts carried by pipelines are based on ton-miles of crude and petroleum products for Federally regulated pipelines (84%) plus an estimated breakdown of crude and petroleum products of the ton-miles for pipelines not Federally regulated (16%).
‡ The amounts carried by motor carriers are estimated.
Source: Association of Oil Pipelines.

For non-continuous loads of liquids, gas, or dry bulk goods, barges have the largest volume capacities followed by rail. Trucks carry the least volume at any one time. Capacities of the various transportation modes are as follows:

River Barge	1,500 tons or	52,500 bushels or	453,600 gallons
Jumbo hopper rail car	100 tons or	3,500 bushels or	30,240 gallons
Large semi truck	26 tons or	910 bushels or	7,865 gallons
Pipeline		Not Applicable*	

In other words, one river barge can carry the same quantity as 15 jumbo hoppers or 58 trucks (see Figure 2.2 on the following page).

A 15 river barge tow that is approximately ¼ mile in length would carry the same quantity as a train that is 2 ¼ miles long or trucks that would take 34 ½ miles (870 trucks, assuming 150 feet between trucks).[25]

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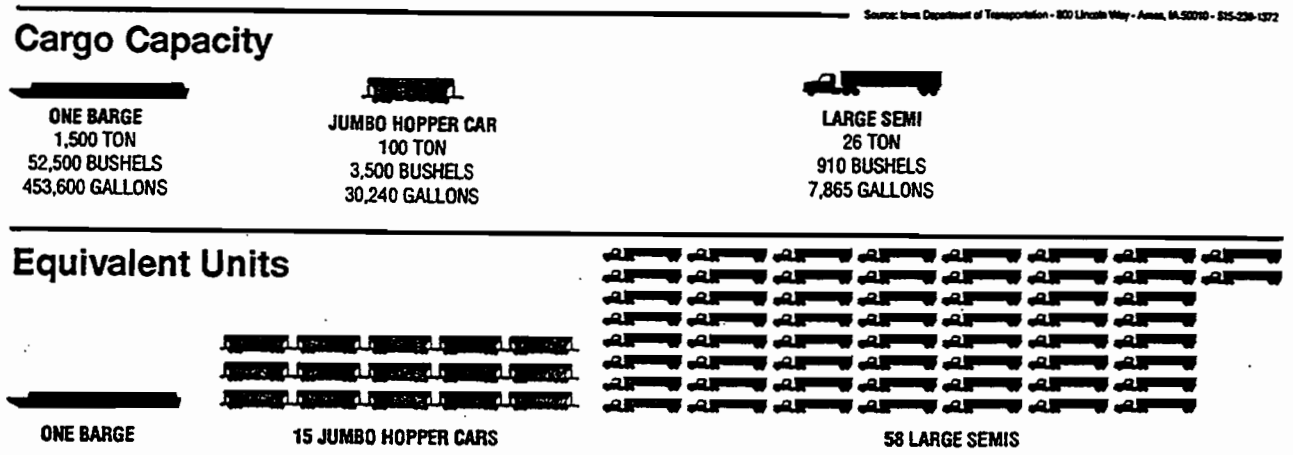
* Pipeline volume is measured by year rather than by trip. Nationally in 1993, pipelines delivered 18,493,845 cubic feet of natural gas to consumers, as well as 1,060 million tons of crude and petroleum products. (Source: U.S. Department of Transportation, Bureau of Transportation Statistics, "National Transportation Statistics, 1996," 55-56.) In 1993, pipeline transportation of crude oil in Texas reached an estimated 6.9 billion barrels. In 1991, pipelines transported approximately 4.5 trillion cubic feet of natural gas in Texas. (Source: Texas Department of Transportation, The Texas Transportation Plan: Pipelines, 5.)



Source: U.S. Department of Transportation, Maritime Administration, "Environmental Advantages of Inland Barge Transportation," 9.

FIGURE 2.2 Transportation Mode Capacities

The barges used to transport petroleum products and chemicals on the GIWW may range from slightly smaller than river barges (10,000 barrels or 420,000 gallons) to considerably larger (30,000 barrels or 1,260,000 gallons). The typical GIWW barge carries 25,000 barrels or 1,050,000 gallons.

2.2.2 Distance

Transport distance directly impacts the mode used to ship commodities. The percentage of bulk commodities moved by truck (particularly SIC 28 and 29, chemical and petroleum related commodities) decreases with distance. Trucks ship up to 280 miles, over 66.94 percent of commodities; trucks ship zero percent more than 1,130 miles.[26] A telephone survey of 55 firms located along the waterway, performed as part of the 1993 study entitled, "Closure of the GIWW and its Impact on the Texas Highway Transportation System: Final Report, Volume I," indicates that companies use water for long distance; rail for intermediate distance and as overflow when quantities needed could not be moved on the water; and trucks for shorter distances.* The survey did not discuss pipelines. The study concluded that "there is no viable, cost-effective alternative for long distance freight movements by water."[27]

The 1996 National Transportation Statistics reports that the average length of haul by pipeline for crude petroleum is 825 statute miles while the average length for petroleum products is 375 statute miles.[28]

The mode selected for other types of commodities are tied more to how fast they need to arrive and how easily they can be damaged in transit. Trucks are best when speed or smoothness of ride is an issue.

*Conversely, in the Texas Gulf Coast refining/chemical complex, barges are widely used for short plant-to-plant moves.

2.3 COST/REVENUE PER TON-MILE

Before setting product or service prices, a company must consider many variables in order to cover expenses and earn a profit. Each transportation mode has some fixed costs and some variable costs that influence how costly it is for them to provide transport services. After the brief discussion of costs, a comparison of revenue per ton-mile is shown.

2.3.1 Fixed/Variable Costs

Barges have high variable costs. Waterway user charges paid by water carriers are primarily based on the amount of fuel used and, therefore, add to the variable costs. Water transportation is not labor intensive. Nationally in 1991, 5.24 million ton-miles of freight were transported for each water carrier employee.[29]

The low barge rates primarily result from economies of scale gained from shipping larger quantities from the same origin to the same destination consistently.

Pipelines, on the other hand, have high fixed costs with low capital turnover. This mode purchases or leases their own right-of-way and constructs their own pipelines, pumping stations, and terminals. The pipeline industry has significant economies of scale and low labor costs. "...Many experts estimate that variable costs are only 30-40 percent of the total costs...and may be as low as 25 percent."[30]

Railroads also own and maintain their own right-of-way, track, terminals, and rolling stock, although it should be noted that most were given their right-of-way rather than purchasing it. In addition, railroads frequently sell portions for highways, etc. They have a large proportion of indirect fixed costs—currently estimated to be approximately 30 percent.[31] In recent years, maintenance has accounted for more than 40 percent of railroad expenditures. Labor cost is the largest element of variable costs. Nationally in 1990, "the cost of labor was 39.9 cents of every revenue dollar."[32] An additional complication for this mode is the 28 different unions that represent their labor force. Railroads greatly benefit from economies of scale and increase their profits dramatically when there is volume to offset the large fixed costs.

Trucks have high levels of variable costs (70 to 90 percent) and low fixed costs (10 to 30 percent). The public financed highway system is a major contributor to low fixed costs. The majority of motor carriers' costs are fuel, wages, and maintenance. Trucks pay user fees for highway usage—these include gasoline, diesel and gasohol taxes, tires taxes, new vehicle taxes, and highway user taxes. A current debate centers on whether trucks should pay for added construction and maintenance costs caused by their heavier weight—currently trucks pay approximately 26 percent of all motor vehicle taxes.[33] The trucking industry is more labor intensive than other modes and has limited economies of scale.[34]

2.3.2 Costs Per Ton-Mile

For the few commodities that lend themselves to pipelines, the cost of transport is low. Cost

figures for pipelines are proprietary information, and no actual costs for pipelines were available for this study. For most bulk commodities, however, the mode that has the lowest costs is the barge industry, primarily because of the volume transferred for the amount of fuel used. Robert J. Blackwell, Assistant Secretary for Maritime Affairs, U.S. Department of Commerce, in personal correspondence to Philip Carroll, Director, Energy Conservation Division, U.S. Department of Commerce stated: "The energy cost per ton-mile for truck is at least four times greater than rail, and five times greater than water transport. While inland water transport requires 3.15 gallons of fuel per one thousand ton-miles of freight, rail freight requires 4.21 gallons, or 33 percent more than barges, and truck freight requires 8.33 gallons or 164 percent more than barges."[35]

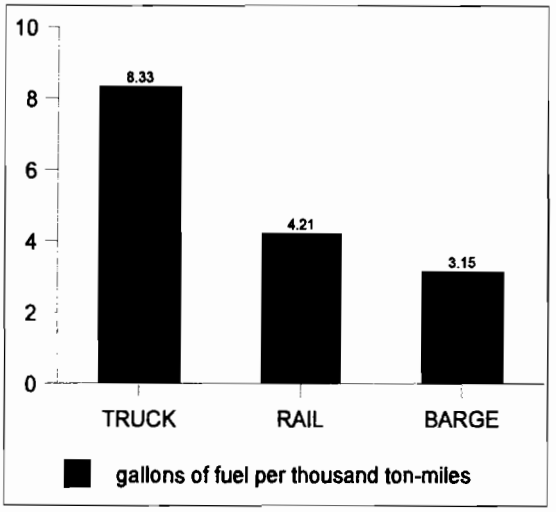


FIGURE 2.3 Energy Cost Per Thousand Ton-Miles

Where rail and truck compete with barges, the price charged for shipping is lower than where barges are not an option. It should be noted that while different studies at different times arrive at the same general conclusion, there are some slight differences possibly depending on the mix of "long" and "short" haul freight included in each study.

2.3.3 Revenue Per Ton-Mile

Below is a table showing revenue per ton-mile by mode. Barges have the lowest revenue per ton-mile followed by oil pipelines because of the large quantities transported at a time.

TABLE 2.2 Public Freight Carriers' Revenue and General Price Trends

	Rail (Class I)		Truck (LTL)		Oil Pipeline		Barge		Producer Prices	
	Revenue Per TM	Index 1980=100	Revenue Per TM	Index 1980=100	Revenue Per TM	Index 1980=100	Revenue Per TM	Index 1980=100	Index 1982=100	Index 1980=100
1986	2.92	102	21.63	120	1.504	114	0.760	57	103.2	117.3
1987	2.73	95	22.48	125	1.453	110	0.733	55	105.4	118.8
1988	2.72	95	23.17	129	1.364	103	0.754	57	108.0	122.7
1989	2.67	93	23.91	133	1.327	100	0.769	58	113.6	129.1
1990	2.66	93	24.38	135	1.436	108	0.757	57	119.2	135.5
1991	2.59	90	24.82	138	1.401	106	0.778	59	121.7	138.3
1992	2.58	90	23.08	128	1.492	113	0.757	57	123.2	140.0
1993	2.52	88	24.95	139	1.420	107	0.759	57	124.7	141.7
1994	2.49	87	25.01	139	1.400	106	0.736	56	125.5	142.8

Source: Eno Transportation Foundation, Inc.

2.4 ENVIRONMENTAL CONCERNS

All of the modes under discussion have potentially damaging environmental side effects, including fossil fuel use, exhaust emissions, spills, and endangerment of plants and wildlife.

The use of fossil fuels to create the energy to transport goods by truck, rail, or barge is one type of environmental concern both in terms of exhausting natural resources and in terms of emissions or air pollution contributing to damage to the ozone. Inland barges can transport one ton for 514 miles per gallon of fuel; rail can transport one ton for 202 miles per gallon, and trucks can transport one ton for 59 miles per gallon of fuel.[36] Pipelines can transport one ton for 492 miles.[37]

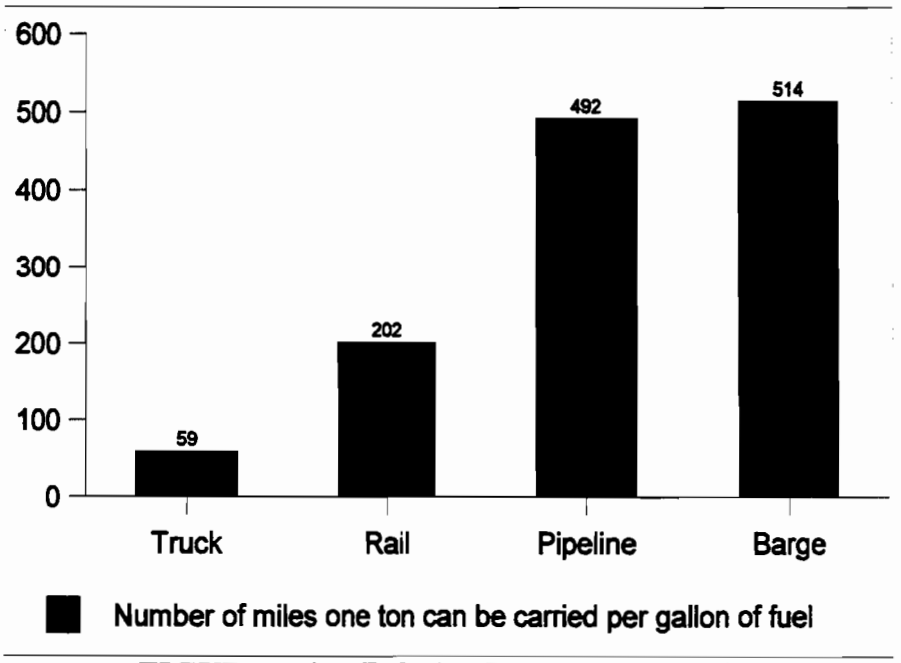


FIGURE 2.4 Relative Energy Efficiencies

A Congressional Budget Office report in February 1982 found that inland barges were the most efficient in terms of energy efficiency when compared to rail and truck.[38] "The Eastman study found 'barge transportation to be the most fuel efficient method of moving the raw materials and semi-finished products needed by the nation's economy.' Data for average barge energy intensiveness showed a range of between 270 BTUs and 350 BTUs per ton-mile, well below the range of 650 BTUs to 750 BTUs per ton-mile for rail."[39] "It is important to note that the energy efficiency of barge transportation results in other environmental benefits besides the obvious fuel savings. As a consequence of being less energy intensive than other modes, on a ton-mile basis, water transport also produces less air pollution--and is usually quieter. The less energy used, the less air pollution produced."[40]

Each physical location has its own environmental habitat and endangered species concerns to be addressed. The construction needed for new land-based transports (truck, pipeline, and rail) or for repairs and upgrades, affects endangered plants, birds, and animals depending on the location. For example, an environmental study conducted for a proposed pipeline near Roma, in Starr County, Texas, deals with protecting the following federally endangered or candidate endangered species: ashy dogweed, Johnston's frankenia, star cactus, Walker's manioc, ocelot, jaguarundi, interior least tern, cactus ferruginous, pygmy owl, Gulf Coast hog-nosed skunk, and Zapata bladderpod.[41] In addition, because pipelines can transport large volumes of liquid or gas at any one time, a ruptured pipeline would affect large sections of the habitat. "An independent modal safety study of transporting bulk hazardous substances prepared for the Maritime Administration, found that barge spills occur much less often than spills from either tank trucks or tank cars."[42] The report did not discuss pipelines.

The Texas portion of the GIWW poses special balancing concerns--the economic viability of Texas' and the U.S.'s valuable petrochemicals on one hand and the environmentally sensitive Laguna Madre, recognized as one of the world's most biologically productive ecosystems, on the other hand. The GIWW canal which threads its way through the Laguna Madre requires constant maintenance dredging. Many of the designated placement areas used in maintaining the waterway lie in the open waters of the Laguna Madre. Some of the placement areas are emergent, extending above the waterline; others are completely submerged. Environmental groups have expressed concerns about the impacts of open-water dredged material placement within the Laguna Madre. The concerns were so prominent that they led to legal recourse resulting in an agreement for the Corps to study the environmental impacts of dredging and dredged material placement in the Laguna Madre. Table 2.3 lists studies coordinated by the Interagency Coordination Team for the Corpus Christi Bay to Port Isabel Segment, GIWW.

In 1992-93, three studies in Canada and the northern United States concluded "...that ton for ton, vessels have fewer accidents, consume less energy, produce fewer harmful emissions, and are less disruptive to society in general. These studies' findings show that transporting bulk commodities by water is environmentally compatible, provides a means to sustainable development, and that the use of this environmentally-friendly mode should be encouraged."[43]

TABLE 2.3 Current Environmental Studies

CBI-L1	Environmental Monitoring of Dredging and Processes in the Lower Laguna Madre. Conrad Blucher Institute	$300,000
CBI-L2	Extension of the Monitoring in the Lower Laguna Madre. Conrad Blucher Institute	$165,000
CBI-L3	Relocation of Monitoring Platforms in Lower Laguna Madre. Conrad Blucher Institute	$219,690
WES-1	Hydrographic Characterization and Bottom Characterization, Laguna Madre. Waterways Experiment Station	$586,550
NMFS	Temporal and Spatial Effects of Open Water Dredge Material Disposal on Habitat Utilization by Fishery Species in Laguna Madre. National Marine Fisheries Service	$581,800
CBI-U1	Environmental Monitoring of Dredging and Processes in the Vicinity of Baffin Bay. Conrad Blucher Institute	$328,769
CBI-U2	Extension of the Monitoring in the Upper Laguna Madre. Conrad Blucher Institute	$249,414
EHA-1	Review of Available Water and Sediment Quality Data in the Laguna Madre. Espey, Huston, and Associates	$22,722
BEG	Sediment Characteristics, History, and Recent Transport, Laguna Madre. Univ. of Texas, Bureau of Economic Geology	$310,000
WES-2	Laguna Madre Fluid Mud Survey. U.S. Army Waterways Experiment Station	$125,000
TAMU	Predictive Model of Seagrass Impacts. Texas A&M University, University of Texas Marine Science Institute, and Texas Parks and Wildlife Department (TAMU/UTMSI/TPWD)	$530,349
EHA-2	Laguna Madre Open Water Dredged Material Disposal Study. Espey, Huston, and Associates	$157,862
EHA-3	Data Reduction and Trend Analysis. Espey, Huston and Associates	$26,939
?	Hydrodynamic Model of the Upper and Lower Laguna Madre.	?
	TOTAL	**$3,604,095**

Many phenomena affect the environment at the same time—some man-made and some natural. For example, while some entities express concern that dredging causes turbidity, a report from the Texas General Land Office cites Dunton et al. in pointing out that brown tide, which originated in the upper Laguna Madre in the late winter and early spring of 1991 and which has been present since, creates densities (by the brown tide organism)

> ...which reduces water clarity and inhibits the depth to which sunlight penetrates. This in turn reduces the photosynthetic capability of the seagrasses, which provide critical habitat for juvenile finfish....During the

> past few years the seagrasses have hyper-extended their stems in an effort to reach sunlight, and relied on energy stored in root mass to do so. However, shoot hyperextension makes them more susceptible to wave and wind damage, while smaller root masses makes them more susceptible to dislodgment.[44]

The General Land Office study also concluded that "there are insufficient data available to determine the extent of the human health risks posed by environmental concentrations of toxic chemicals and that insufficient information exists to determine the sources of toxic substances in the study area."[45] This study also indicates that no reports documenting decreases in abundance due to pollutants discharged (from river transports) in the Gulf of Mexico had been found.[46]

Most studies (e.g., Behrens,[47] Breuer,[48] and Hedgpeth[49]) conducted in the first twenty years after the dredging of the GIWW attributed the canal with reducing the salinity in the upper and lower Laguna Madre to levels that support fish and sea grasses.

Ernest Simmons, Marine Biologist, Rockport, Texas, reported:

> Prior to 1948, fish mortality of two types occurred in this bay, mortality caused by hypersalinity, and more serious kills caused by sudden drops in water temperature. Since the construction of the Intracoastal Waterway, kills from hypersalinity have been practically eliminated, primarily because fish are now able to leave the area. Kills from hypersalinity are known to have occurred in 1936, 1937, 1939, 1943, 1944, and 1945, and commercial fishermen speak of kills that occurred 20 and 30 years ago.
>
> ...Discolored water, often present in the upper Laguna Madre, is usually spoken of as "red water" or "bad water." Actually the water may be reddish or yellowish or even brown. It is not muddy and is not exceptionally turbid as light transmission is normally about 92 percent. This discolored water is commonly associated with high salinity but is not necessarily so. One form of discoloration, present in the Point of Rocks area, appears to originate in Baffin Bay. Pollution from the Celanese Corporation has often been suggested as the cause, but a similar discoloration was observed before the plant was installed. Several factors are known to contribute to red waters elsewhere, and there are probably others. The possibilities are:
>
> 1. Dissolved iron compounds are usually found with high salinity. As evaporation increases, water becomes more dense and sinks to the bottom causing iron compounds to mix with the water.
> 2. Decaying vegetation, not necessarily associated with hypersalinity, is abundant in areas of poor circulation. Reddish chromatophores in the vegetation break down, giving the water a brownish appearance.

3. Phytoplankton--Certain dinoflagellates are sometimes present in abundance. These give the water a yellowish cast.
4. Clay deposits in Baffin Bay may be a causative factor.[50]

Fishing Bulletin 89 reports that "When the salinity rises above a critical point (about 72°/00, Gunter, 1945b), fish start dying by the thousands."[51] A Texas Department of Water Resource study on the influence of freshwater inflows finds that not all fish have responded positively to the same factors and that "a management decision must be made to balance the divergent needs or to give preference to the needs of a particular fisheries component."[52]

As recent as September 1996, Richard Watson, Ph.D., Port Aransas reports that if the canal closes, "the circulation of all of Laguna Madre will be drastically reduced, salinities will soar again to values of over 100 ppt. [parts per thousand], and there will be fish kills and seagrass die-offs."[53]

2.5 SAFETY

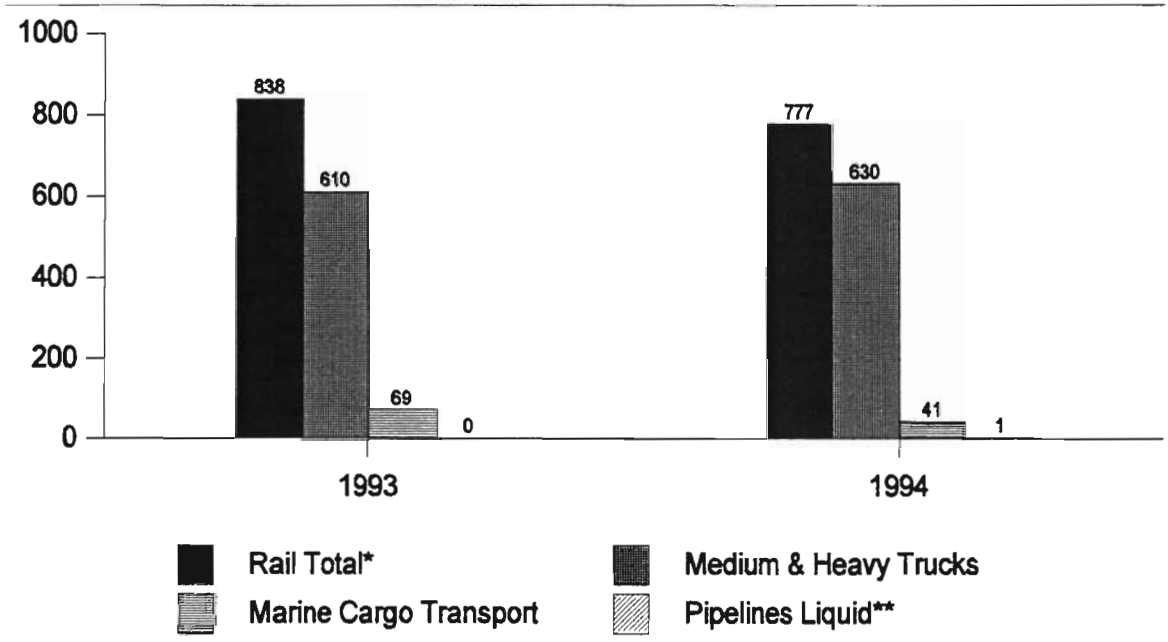
The transportation mode's speed appears to influence safety. Since pipelines are stationary, it follows that they have the fewest fatalities. Among the modes that physically move, inland water transportation with its slow transit speeds has fewer and less severe accidents than do truck or rail. Less than one gallon in 60,000 gallons transported is spilled by barges.[54] Trucks travel at high speed and share the road with automobiles and pedestrians. Because trucks are larger than the auto and pedestrian traffic, truck cargoes often survive crashes that smaller vehicles and people do not. Rail cars also travel at high speed, and if an accident occurs, it often involves a number of rail cars and causes severe damage. Barges share the canal with pleasure craft that primarily operate in good weather and during daylight hours. "Barge transportation operates in a waterway environment that has few crossing junctures and is relatively remote from population centers—all factors that tend to reduce both the number and severity of casualty incidents."[55] Table 2.4 and Figure 2.5 show U.S. transportation fatalities in each mode for 1993 and 1994.

All modes are sensitive to safety issues and are beginning to incorporate computer monitoring and tracking devices that aid operators in avoiding dangerous weather and other potentially hazardous conditions with the additional benefit of tracking shipments for improved communication with owners and users.

TABLE 2.4 1993-1994 U.S. Transportation Fatalities

MODE OF TRANSPORTATION	1993	1994
Rail		
Intercity		
Trespassers and nontrespassers	610	645
Employees and contractors	57	34
Passengers on trains	58	5
Rapid Transit	113	93
Rail Total	**838**	**777**
Medium and Heavy Trucks	**610**	**630**
Marine Cargo Transport	**69**	**41**
Pipeline		
Gas	17	21
Pipelines	0	1
Total Pipeline	**17**	**22**

Source: National Transportation Safety Board.



*The rail total includes intercity fatalities (725 in 1993; 684 in 1994) and rapid transit fatalities (113 in 1993; 93 in 1994)
**Gas pipeline fatalities: 17 in 1993; 21 in 1994.

FIGURE 2.5 1993-1994 U.S. Transportation Fatalities

2.6 PUBLIC AWARENESS/KNOWLEDGE BASE

Trucks share the roads with automobiles and pedestrians, and trains travel alongside many roads or cross them as well as having been a major source of public transportation in the early years of our country. The public sees both trucks and trains constantly. In addition, because of their speed, they are frequently found in exciting chase scenes in movies, books, etc.

Pipelines and barges are rarely seen or heard by the public. While barges have been around since the early days of this country, their traditions are more familiar to those in the Great Lakes and Mississippi Valley areas than in Texas.

2.7 NAFTA AND GLOBAL TRENDS

Most NAFTA trade is currently transported by truck, rail, and ship. However, Texas has one natural gas pipeline at Mission that crosses into Mexico. Another proposed pipeline near Roma, Texas, has passed most of the required environmental checks, and a refined gas pipeline has recently been licensed near El Paso, Texas.[56] While all transportation modes stand to benefit from expanding global and NAFTA trade expansion, among transportation modes that move, water transportation in particular offers many advantages.

A European community environmental study covering air pollution, noise pollution, land coverage, construction/maintenance, and accidents/casualties found that water transport was the least environmentally damaging. There is, therefore, a growing demand by the member countries to increase inland navigation.[57]

Phase I of the Maritime System of the Americas (MSA) looked into the potential for small river/ocean vessels on the waterways and rivers linking the central portions of the U.S. and Canada to Mexico. The study concluded "...that such vessels are viable in niche markets carrying general cargoes, containers, and some bulk commodities between the South Central United States and Eastern Mexico." Phase II and III of MSA suggest that "...the intermodal movement of domestic trailers using a roll-on/roll-off (ro/ro) ferry type vessel has cost and logistical advantages over other transport options in serving the eastern/central regions of both the U.S. and Mexico.[58]

The U.S. Department of Transportation, Maritime Administration, reports that "water transportation is low-cost, safe, and energy efficient and is ideally suited to carry products among Canada, Mexico, and the United States."[59]

A 1996 study by Arthur Andersen on the feasibility of an extension of the GIWW to Tampico, Mexico concluded that trade between Canada, the U.S. and Mexico would increase as a result; Texas would be a major beneficiary of the increased trade.

A 1996 study by Goff et. al. found that "Texas ports provide efficient access to Mexico and South America" and that the port system acts as an economic catalyst.[60]

An October 1996 study sponsored by the Louisiana Department of Transportation and Transportation Research Center entitled "Identification of NAFTA--Induced Opportunities for Louisiana's Ports and Waterways" found

> NAFTA-induced restructuring for north-south movements of cargo is already contributing to meaningful expansion of the levels of trade between Louisiana and Mexico. . . . Intermodal options utilizing a water transport component are likely to develop in the Gulf because of the lower costs for some segments of the trade as well as existing congestion and delays at key land border crossing points across the U.S.-Mexican border that will most likely not be resolved in the near future.[61]

The study also recommended utilization of River/Ocean (R/O) vessels (i.e., 3200 DWT, 250 TEU capacity) since they offer the greatest potential savings compared to rail service for direct cargo movements between the lower and middle Mississippi regions up to St. Louis and the central and southeastern regions of Mexico. "Previous analysis conducted by NPWI [National Ports and Waterways Institute] has indicated that R/O operations would require approximately 150,000 to 180,000 tons annually supplied from both northbound/southbound activity to sustain a weekly operating schedule/service."[62]

> The comparative advantages of water transportation are obvious for the movement of major bulk commodity shipments of grains, chemicals, petroleum products, and other traditional bulk cargoes to/from the U.S. and Mexico that typically involve 15,000 tons or more.[63]

> The mid-America inland waterway system has substantial cost advantages compared to unit train services for a relatively large portion of U.S. and Mexican hinterlands. Direct services by river barges across the Gulf of Mexico do not appear to be competitive with conventional barge transshipment to deep sea ocean. The sustained success of the major bulk sector for Louisiana's inland waterway system in trade with Mexico and other Latin American countries will be determined by the extent to which these emerging countries become long term consumers of U.S. midwest bulk commodities such as rice, wheat, corn, soybeans, chemicals, and ores.[64]

This same study compared the Port of Houston to the Port of New Orleans. The study estimated that Houston's total charges per ship call are about 5 percent lower than New Orleans for the large vessel, 7 percent lower for the medium size vessel, and 19 percent lower for the small vessel. Pilotage and tug hire costs are about 15 percent lower in Houston. However, stevedoring costs are higher for Houston because of lower overall cargo handling rates.[65]

The study that best summarizes the cause and effect relationships that help determine which modes of transportation U.S. industry and international trade ultimately use is U.S.-Mexico Trade and Transportation: Corridors, Logistics Practices and Multimodal Partnerships by Leigh B. Boske and Robert Harrison:

> Often, the efficiency and cost of a particular mode of transportation is greatly affected by a variety of factors, the most important of which appear to be the existence of transportation corridors and the infrastructure in place along these corridors which facilitates the movement of commodities from their origin to their destination. The development and maintenance of this physical infrastructure--whether it is infrastructure designed to facilitate overland trade, such as roadways and rail lines, or facilitate trade over sea and air, such as seaport facilities and aviation terminals--is of great importance to the continued smooth operation of trade, particularly trade which occurs over great distances or over international borders.
>
> The existence or absence of bilateral trade with Mexico is, then, a direct consequence of the interaction of the nature and quantity of the commodities that move across the border, the origin and destination of these commodities and the infrastructure presently in place to facilitate the movement of these commodities.[66]

CHAPTER 3: ECONOMIC IMPACT ANALYSIS

One of the purposes of this study is to update the study by Hillary Garrett and Dock Burke titled "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program in April 1989. This analysis follows the same basic methodology used in the 1989 study. The major exception is the use of the Texas Input/Output Model, 1986 Update, December 1989. The input-output model produces three types of multipliers—final demand, income, and employment. For each type of multiplier, there are two tables designated Type 1 and Type 2. This study uses Type 2 multipliers

> which include the economic impacts of household expenditures on the economy from changes in output caused by Final Demand changes. The Type 2 multiplier will always be larger and are considered to be the best estimate of total impacts upon the economy from sector output changes, since the full effect of consumer spending is taken into account.[67]

In order to determine the economic impact of the GIWW on Texas, this study calculated revenue values assigned to port cargo, capital expenditures invested in the Texas portion of the GIWW by the Corps, and the economic impact of the water transportation and related industries impact. See Table 3.19 for results. In addition, this report discusses tonnage and tonnage values of cargo traveling along the GIWW, industries that are heavily dependent on inland water transportation and the GIWW, and recreational impact of the GIWW.

3.1 TONNAGE STATISTICS

The U.S. Army Corps of Engineers Waterborne Commerce Statistics Center furnishes several types of cargo statistics for the GIWW and the Texas portion of the GIWW—(1) unduplicated cargo totals; (2) cargo listed by segment of the GIWW; and (3) cargo that enters each port by type of vessel.

3.1.1 Unduplicated Cargo Totals

The data in Table 3.1 and Table 3.2 show the volume of specific commodities that were shipped on the Texas portion of the GIWW in 1986 by SIC code and in 1994 by comparable Waterborne Commerce Commodity Code (WCUS). These tables represent the first type of cargo statistics, those totals without duplication. There was an increase of over a million short tons from 1986 to 1994.

In 1990 Waterborne Commerce of the United States switched from using SIC codes to using WCUS commodity codes. Therefore, both original SIC codes and currently used WCUS codes are shown in Tables 3.1 and 3.2 to enable the reader to better compare commodities. Values of commodities are available from the Bureau of Census Foreign

Trade Division and Resources. Based on their preliminary numbers the value of the unduplicated cargo shipped by barges in 1994 was $26,497,269,000. See Appendix M for methodology and calculations.

Of the over 66 million unduplicated short tons of cargo shipped in 1994, 83 percent are chemicals and allied products, petroleum and coal products, and crude petroleum. According to the State Comptroller's office, the petrochemical plants along the Texas Gulf Coast supply nearly two-thirds of the U.S.'s major petro-chemicals.[68] The Texas Gulf Coast refineries make up the largest such complex in the world and furnishes more than 20 percent of the total U.S. capacity of petro-chemicals.

Figure 3.1 shows the total tonnage that travels all portions of the GIWW. There is no duplication of numbers if cargo crosses more than one section. These figures show the percent representative of the Texas portion compared to the total GIWW. In 1986, the Texas portion of the GIWW represented 60.7 percent of the total traffic of the entire GIWW. In 1994, the Texas' portion was 56 percent.

3.1.2 Cargo Listed by Segment

Figure 3.2 and Table 3.3, on the other hand, represent the second type of statistics and count cargo by segment of the Texas GIWW—(1) Sabine River to Galveston; (2) Galveston to Corpus Christi; and (3) Corpus Christi to Brownsville. If a barge crosses more than one section, its cargo is counted each time it reaches a new section; therefore, a barge that travels from the Sabine River to Brownsville would have its cargo included in the totals three times.

Figure 3.2 and Table 3.3 show the tonnage handled on the Texas portion of the GIWW from 1984 to 1994, calculated by segment and, therefore, contain some duplication of cargo numbers. The statistics used in these tables represent the most commonly quoted in the literature.

3.1.3 Cargo Entering Each Port

The cargo on Table 3.9 represents the third type of cargo statistics by inland water transportation. The port cargo shown in Figure 3.4 includes not only barge cargo but also includes ship cargo tonnage handled at Texas ports as recorded by the Corps. These numbers do reflect some duplication. Goff et. al. report unduplicated cargo tonnage at Texas ports in 1994 at 378.9 million tons.[69] This study reports that:

> Almost one million Texans can attribute their jobs to the ports of Texas. Over 163,000 jobs are due to the direct activities of the Texas ports, while almost 780,000 jobs are due to indirect and induced expenditures. These Texan job holders earned over $30 billion dollars, or approximately $32,000 per year. This is approximately 20% higher earnings than the average Texan. The direct effects of the Texas ports on business sales exceeds $68 billion, while the indirect and induced effects added over $109 billion. In

terms of Gross State Product (GSP), Texas ports contributed, directly and indirectly, almost 19% to Texas GSP. Activities related to Texas ports contributed over $2 billion in local taxes, almost $3 billion in state taxes, and over $9 billion in federal taxes.[70]

TABLE 3.1 Goods Shipped on the Texas Portion of the GIWW, 1994

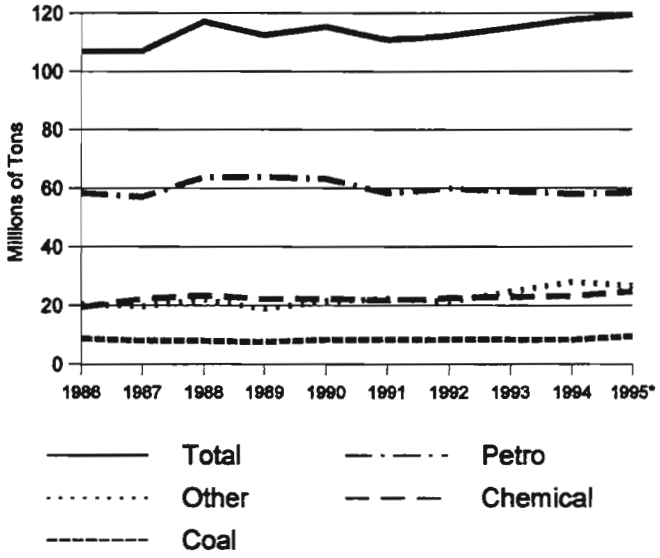
Goods Shipped on the GIWW (Texas Portion)							
1994							
1989 SIC	1994 WCUS	DESCRIPTION	SHORT TONS	1989 SIC	1994 WCUS	DESCRIPTION	SHORT TONS
2911	2211	GASOLINE	8,106,000	1479	3190	FERT. & MIXES NEC	116,000
1311	2100	CRUDE PETROLEUM	7,763,000	107	6241	WHEAT	115,000
2915	2340	RESIDUAL FUEL OIL	7,360,000	2095	6888	ICE	110,000
2914	2330	DISTILLATE FUEL OIL	5,099,000	3318	5315	FERROALLOYS	65,000
2811	3219	OTHER HYDROCARBONS	5,099,000	2819	3276	METALLIC SALTS	64,000
2813	3220	ALCOHOLS	2,486,000	111	6522	SOYBEANS	57,000
2917	2429	NAPTHA, PETRO SOLVENTS	2,287,000	3241	5220	BUILDING CEMENT	56,000
2917	3212	BENZENE AND TOLUENE	2,238,000	931	4515	MARINE SHELLS, UNMFG	54,000
1442	4331	SAND, GRAVEL, CRSHD ROCK	2,189,000	3314	5320	IRON & STEEL PRIMARY FORMS	49,000
2811	3211	ACYCLIC HYDROCARBONS	1,558,000	1494	4323	GYPSUM	44,000
2991	2990	PETROLEUM & COAL PRODUCTS	1,533,000	2991	2410	PETRO. JELLY AND WAXES	41,000
2916	2350	LUBRICATING OILS & GREASE	1,495,000	104	6445	OATS	40,000
2918	2430	ASPHALT, TAR & PITCHES	1,340,000	1061	4670	MANGANESE ORES, CONC	38,000
2819	3240	NITROGEN FUNC. COMP.	1,268,000	2042	6782	ANIMAL FEEDS	34,000
4029	8900	WASTE AND SCRAP, NEC	1,178,000	106	6447	SORGHUM GRAINS	30,000
2891	3297	CHEMICAL ADDITIVES	1,165,000	1451	4782	CLAY	29,000
1051	4650	ALUMINUM ORES, CONC	1,088,000	103	6344	CORN	23,000
2810	3274	SODIUM HYDROXIDE	1,034,000	2431	5540	PRIMARY WOOD PRODUCT	22,000
2819	3260	ORGANIC COMP. NEC	929,000	1499	4338	SOIL & FILL DIRT	19,000
2819	3273	AMMONIA	916,000	1121	1100	COAL AND LIGNITE	13,000
2920	2540	COKE, PETROLEUM COKE	873,000	2872	3130	POTASSIC CHEM FERT	13,000
2921	2640	LIQUIFIED GASES	846,000	2414	4170	WOOD IN THE ROUGH	12,000
2818	3272	SULPHURIC ACIDS	806,000	3321	5429	SMELTED PROD. NEC	8,000
2819	3230	CARBOXYLIC ACIDS	800,000	2711	7900	MANUFAC. PROD. NEC	8,000
2871	3110	NITROGENEOUS CHEM FERT	630,000	1091	4690	NONFERROUS ORES, CONC	7,000
3315	5330	IRON, STEEL SHAPES	484,000	2062	6865	MOLASSES	7,000
1411	4322	LIMESTONE	468,000	1471	4327	PHOSPHATE ROCK	7,000
4011	4420	IRON AND STEEL SCRAP	446,000	2091	6653	VEGETABLE OILS, MARGARINE	6,000
2891	3299	CHEM. PRODUCTS NEC	376,000	2416	4161	WOOD CHIPS	6,000
2913	2221	KEROSENE	356,000	2951	5290	MISC. MINERAL PROD	5,000
105	6442	RICE	337,000	2049	6747	GRAIN MILL PRODUCTS, NEC	3,000
3316	5360	IRON & STEEL SHAPES	233,000	2841	3285	PERFUMES & CLEANSERS	3,000
2819	3275	INORG. ELEM., OXIDES, HALOGE	229,000	841	4110	RUBBER & GUMS	3,000
1011	4410	IRON ORE AND CONCENTRATES	212,000	861	4190	FOREST PRODUCTS NEC	3,000
1493	3271	SULPHUR, LIQUID	211,000	3322	5421	COPPER	3,000
3411	5480	FABRICATED METAL PRODUCTS	194,000	2861	3298	WOOD & RESIN CHEM	2,000
2061	6861	SUGAR	188,000	2421	4189	LUMBER	2,000
3511	7110	MACHINERY (NOT ELEC)	188,000	3324	5422	ALUMINUM	2,000
3311	5312	PIG IRON	154,000	3011	7600	RUBBER & PLASTIC PR.	2,000
1499	4900	NONMETALLIC MINERALS, NEC	139,000	2014	6838	TALLOW, ANIMAL FATS, OIL	1,000
3317	5370	IRON & STEEL PIPE & TUBE	138,000	2041	6746	WHEAT FLOUR & SEMOLINA	1,000
3319	5390	PRIMARY I&S NEC	138,000	2212	7500	TEXTILE FIBERS, NEC	1,000
3312	4860	SLAG	126,000	2819	3279	INORGANIC CHEM. NEC	1,000
2873	3120	PHOSPHATIC CHEM FERT	125,000	1911	7300	ORDNANCE & ACCESS	1,000
2920	1200	COAL COKE	117,000	2491	7400	MANUFAC. WOOD PROD.	1,000
				TOTAL			66,072,000

TABLE 3.2 Goods Shipped on the Texas Portion of the GIWW, 1986

Goods Shipped on the GIWW (Texas Portion)							
1986							
1986 SIC	1994 WCUS	DESCRIPTION	SHORT TONS	1986 SIC	1994 WCUS	DESCRIPTION	SHORT TONS
1311	2100	CRUDE PETROLEUM	10,599,002	4112	9900	MISC SHIPMENTS NOT IDENTIF.	38,595
2915	2340	RESIDUAL FUEL OIL	9,841,899	2872	3130	POTASSIC CHEM. FERT.	38,003
2819	3230*	BASIC CHEM. & BASIC CHEM. PROD.	9,542,302	2041	6746	WHEAT FLOUR AND SEMOLINA	34,390
2911	2211	GASOLINE, INCL. ADDITIVES	7,092,101	107	6241	WHEAT	33,959
2914	2330	DISTILLATE FUEL OIL	4,184,620	1411	4322	LIMESTONE FLUX, CALCAREOUS STONE	32,957
2917	2429	NAPHTHA, MIN. SPIRITS, SOLVENT	3,751,450	2042	6782	ANIMAL FEEDS	31,138
2817	3212	BENZENE & TOLUENE	2,735,372	111	6522	SOYBEANS	28,828
2813	3220	ALCOHOLS	2,615,548	3511	7110	MACHINERY, EXCEPT ELEC.	26,448
1442	4331	SAND, GRAVEL, CRUSHED ROCK	1,811,401	2099	6889	MISC. FOOD PRODUCTS	25,387
2916	2350	LUBRICATING OIL & GREASES	1,687,198	1451	4782	CLAY, CERAMIC, REFRACTORY MATERIA	23,942
2912	2211	JET FUEL	1,585,560	1061	4670	MANGANESE ORES & CONC.	22,320
2810	3274	SODIUM HYDROXIDE	1,022,741	3319	5390	PRIM. I&S PRODS., NEC	21,006
4029	4333*	WASTE & SCRAP, NEC	953,913	2621	5110	STANDARD NEWSPRINT PAPER	19,159
4011	4420	IRON & STEEL SCRAP	882,426	2431	5540	VENEER, PLYWOOD, WORKED WOOD	18,898
2991	2410*	PETROLEUM & COAL PROD. NEC	825,152	2061	6861	SUGAR	18,694
2811	3211*	CRUDE PRODUCTS FROM COAL, PETR	736,722	1051	4650	BAUXITE, OTHER ALUMINUM ORES	14,487
931	4515	MARINE SHELLS, UNMANUF.	718,987	2014	6838	TALLOW, ANIMAL FATS, OILS	13,220
2818	3272	SULPHURIC ACID	678,920	2212	6894	BASIC TEXTILE PRODUCTS	12,700
3241	5220	BUILDING CEMENT	667,072	4118	4335	WATERWAY IMPROV. MAT.	12,039
2921	2640	LIQ. PETROLEUM GASES, COAL,	592,742	1491	4783	SALT	12,032
2920	1200*	COKE, INCL. PETROLEUM COKE	497,033	3271	5210	LIME	10,267
2918	2430	ASPHALT, TAR, & PITCHES	417,059	3411	5480	FABRICATED METAL PRODS	5,559
2871	3110	NITROGENOUS CHEM. FERT.	390,667	1091	4690	NONFERROUS METAL ORES, NEC	5,084
1493	3271	SULPHUR, LIQUID	336,910	3311	5312	PIG IRON	4,969
3315	5360	I&S BARS, RODS, ANGLES, SHAPES	328,418	101	6893	COTTON, RAW	4,115
2913	2221	KEROSENE	211,810	2091	6653	VEGETABLE OILS; MARG./SHORT	3,830
3317	5370	I&S PIPE AND TUBE	208,161	1492	4741	SULPHUR, DRY	3,011
2879	3190	FERTILIZERS, FERT. MAT. NEC	198,275	2095	6888	ICE	2,000
3316	5330	I&S PLATES & SHEETS	184,713	119	6521*	OILSEEDS, NEC	1,851
1499	4338*	NONMETALLIC MINERALS, NEC	138,131	103	6344	CORN	1,656
3314	5320	I&S INGOTS & OTHER PRIMARY FORM	115,628	1011	4410	IRON ORE AND CONCENTRATES	1,470
2891	3292*	MISC. CHEM. PRODUCTS	102,166	2039	6858	FRUIT, FRUIT/VEG. JUICES CANNED	1,417
105	6442	RICE	97,827	2821	3286	PLASTICS, CELLULOSE & RESINS	1,206
2049	6747	GRAIN MILL PRODUCTS, NEC	92,618	2631	5120	PAPER & PAPERBOARD	1,081
104	6445	OATS	89,413	912	6136	SHELLFISH	502
3312	4860	SLAG	77,341	3711	7210	MOTOR VEHICLES, PARTS, EQUIP	279
1121	1100	COAL AND LIGNITE	73,796	3611	7120	ELEC. MACHINERY, EQUIP, SUPPLIES	153
4111	6888	WATER	56,134	3322	5421	COPPER & COPPER ALLOYS	57
2873	3120	PHOSPHATIC CHEM. FERT.	54,989	2094	6887	GROCERIES	46
3318	5315	FERROALLOYS	47,280	2491	7400	WOOD MANUFACTURES, NEC	42
2062	6865	MOLASSES	45,329	4119	7800	EMPTY CONTAINERS	32
3911	7900	MISC. PROD. OF MANUFACTURING	43,360	2691	5190	PULP, PAPER, & PAPERBOARD PROD.,	10
106	6447	SORGHUM GRAINS	42,372	3731	7230	SHIPS & BOATS	7
						TOTAL	66,901,404
						ADJUSTED TOTAL**	64,901,404

*NOTE--These Old SIC Codes include more than one New SIC Code. ***119***--6521, 6590; ***1499***--4338, 4900; ***2811***--3211,3219; ***2819***--3230, 3240, 3250, 3260, 3273, 3275, 3276, 3279; ***2891***--3292, 3297, 3299; ***2920***--1200, 2540; ***2991***--2410, 2990; ***4029***--4333, 8900.

**NOTE--The Adjusted Total is 2 million below the total because of the counting of deep draft ships crossing a small portion of the GIWW. Source: Telephone interview with Ed Drinkert, October 10, 1996.



COMMODITY (millions of tons)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995*
Total	106.86	107.00	117.10	112.36	115.38	110.83	112.19	114.94	117.61	119.4
Petro	58.33	57.04	63.79	63.76	63.19	58.38	59.93	58.89	58.06	58.40
Other	20.36	19.72	21.87	18.87	21.41	22.39	21.26	24.8	28.02	26.70
Chemical	19.38	22.22	23.45	22.20	22.33	21.7	22.61	22.85	23.19	24.80
Coal	8.79	8.02	7.99	7.52	8.45	8.35	8.38	8.41	8.34	9.50

*Estimated

Source: Waterborne Commerce Statistics Center, http://www.wrc-ndc.usace.mil/ndc/wcsc.htm

FIGURE 3.1 GIWW Total Tonnage, 1986-1995, By Commodity

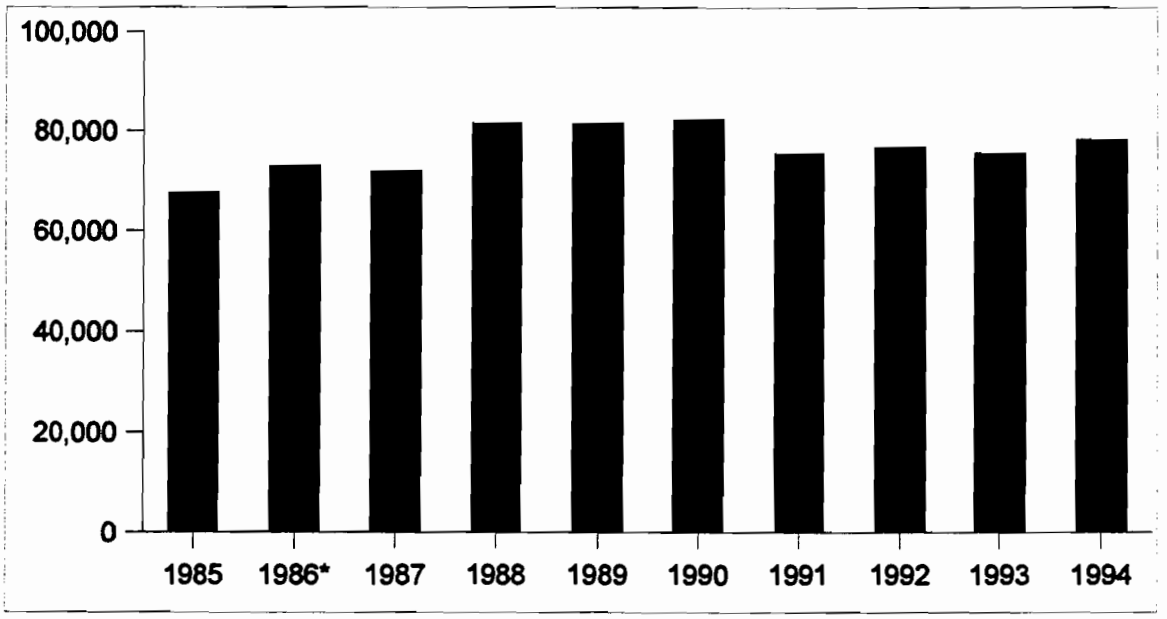


FIGURE 3.2 Tonnage Handled on the Texas Portion of the GIWW

* See Garrett and Burke study for a summary from 1946-1986.

Source: "Gulf Coast, Mississippi River System and Antilles." Waterborne Commerce Statistics Center, New Orleans.

TABLE 3.3 Total Tonnage Handled on the Texas Portion of the GIWW
Thousands of Tons

YEAR	TOTAL TEXAS GIWW (1000s of tons)
1985	67,615
1986	72,990
1987	71,892
1988	81,620
1989	81,489
1990	82,377
1991	75,549
1992	76,727
1993	75,624
1994	78,335

Source: "Gulf Coast, Mississippi River System and Antilles." U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans.

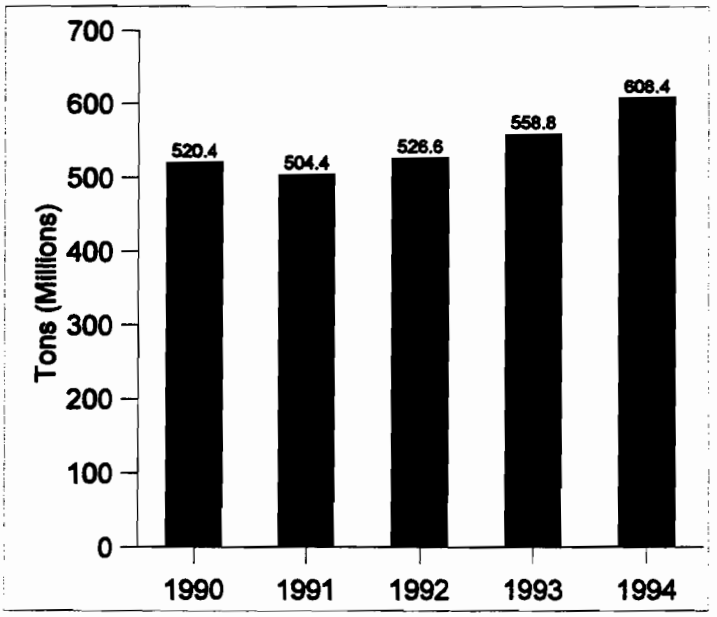


FIGURE 3.3 Total Tonnage Handled at Texas Ports, 1990-1994

Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center

3.2 COASTAL MANUFACTURING AND MINING--ECONOMIC IMPACT

It is difficult to show a direct cause and effect relationship between the GIWW and the concentration of certain manufacturing and mining sectors in the Gulf Coast region of Texas (see Appendix A for a listing of Texas counties directly impacted by the GIWW). Historically, however, ports and bodies of waters attract industry and eventually support large populations dependent on these industries. The lower barge transportation rates along the GIWW have been attractive to industries that have low profit margins and that can benefit from reduced transportation costs. Chemical and Allied Products (SIC code 2800) and Petroleum and Coal Products (SIC code 2900) are two major coastal manufacturing sectors that use barge transportation; Oil and Gas Extraction (SIC code 1300) and Non-Metallic Minerals (SIC code 1400) are two major mining sector industries that likewise utilize the GIWW.

3.2.1 Manufacturing Sectors

In 1994, the Gulf Coast petrochemical and refining industries (250 chemical plants, 30 refineries, and 74 gas processing plants) employed approximately 80,000 Texans.[71] In 11 counties along the coast, a 1992 study by Texas A&M's Center for Business and Economic Analysis reports that chemical manufacturing wages exceeded $700 million in 1992; and in 1994, the chemical industry was the fifth largest manufacturing employer in

Texas. In 1994, Texas Gulf Coast petro-chemical facilities employed approximately 55,800 workers.[72]

The relatively cheap transportation of the GIWW and a growing worldwide demand for petrochemicals have combined to encourage the following Gulf coast plant expansion: Exxon Chemical in Baytown, Phillips Petroleum in Pasadena, Solvay Polymers, and Rohm and Haas Texas Inc. in Deer Park, Bayer Corp. in Baytown, Chevron Chemical in Port Arthur, and Mobil Chemical in Beaumont.[73] In addition, two new plants opened in 1994—Formosa Plastics in Point Comfort and Dow Chemical's ethylene unit in Freeport.

Petrochemical companies and refineries operate under new environmental laws. Of the 73 chemical firms listed in the March 1995 Clean Industries 2000 directory, the Comptroller's office reports that 61 of these chemical firms and all 12 of the refineries are on the Gulf Coast. "Among the exemplary projects cited by the Texas Natural Resource Conservation Commission are Valero Refinery in Corpus Christi, which invested $30 million in pollution prevention and waste minimization projects, and Howell Hydrocarbons in Channelview, which installed a recovery unit for controlling vapors released when loading barges with chemicals. Also, ARCO Chemical in Bayport trimmed releases by 22 percent by using improved chemical processing methods."[74]

1995 Coastal Growth

The Gulf Coast is not the only source of chemical and petroleum activity in Texas. However, in 1995 approximately $2.05 billion, or over 94 percent of the capital improvements and expansion in the chemical industry, were along the coast. Of the 1,716 additional employees added in the chemical industry, 54 percent were along the coast. Over $600 million dollars, or 82 percent of the 1995 capital improvements and expansion in petroleum and coal products facilities in Texas, were along the coast. Forty-three percent of the employees added in 1995 were in the coastal region. See Appendix B for a breakdown of specific companies included in the figures below.

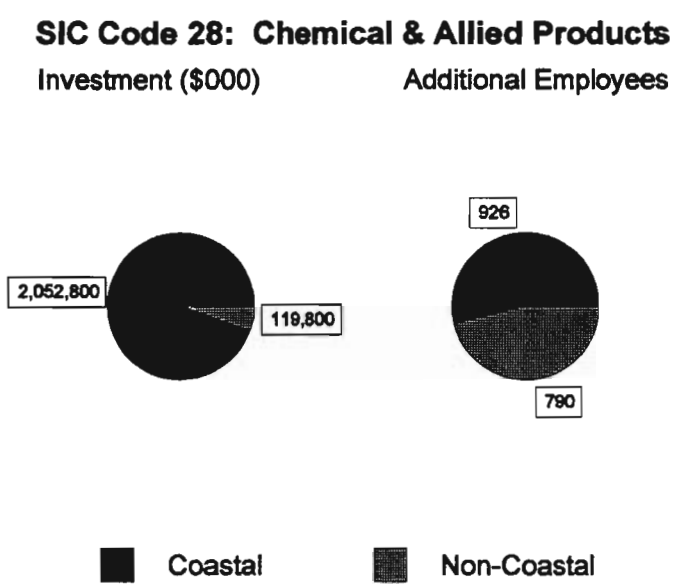


FIGURE 3.4 1995 Texas Business Growth, SIC Code 28

Source: "1995 Texas Business Growth," Office of Growth and Retention, Business Development Division, Texas Department of Commerce, February 1996.

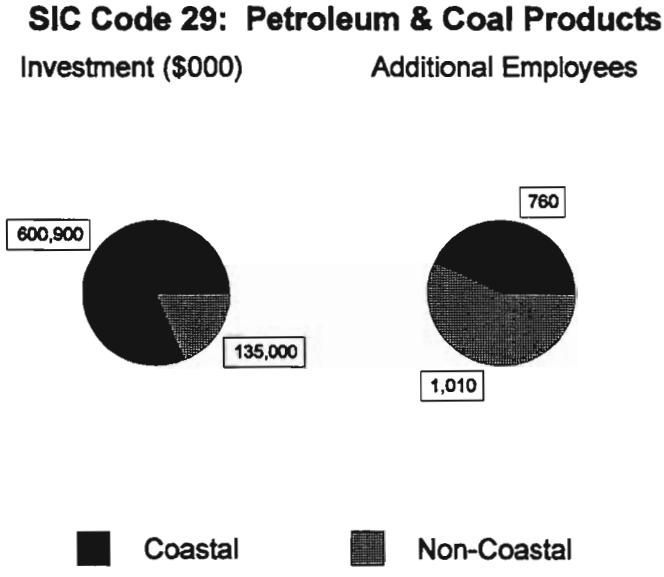


FIGURE 3.5 1995 Texas Business Growth, SIC Code 29

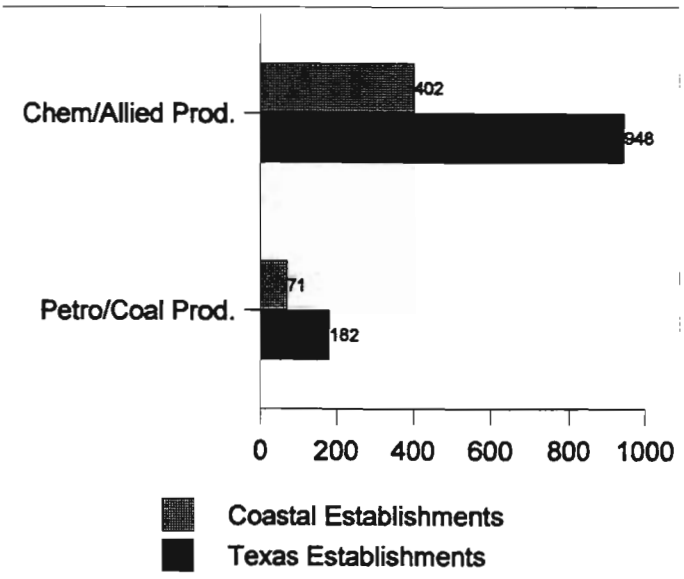
Source: "1995 Texas Business Growth," Office of Growth and Retention, Business Development Division, Texas Department of Commerce, February 1996.

1993 Texas Coast Characteristics

For Texas as a whole, there are 948 Chemicals and Allied Products establishments.[75] In 1993, the coast had 402 of these establishments, or 42 percent of all in Texas. Of the state's 78,300 Chemical and Allied Products employees, 53,900 were along the coast (69 percent). Payroll for the state was $3,498,400,000, with 77 percent along the coast.

Petroleum and Coal Products in Texas had 182 establishments, with 39 percent along the coast; statewide there were 24,300 employees with 71 percent of them in the 19 coastal counties. Payroll for the state was $1,156,700,000 with 76 percent from the coast.

In both manufacturing groups, less than 43 percent of the facilities are along the coast, but approximately 70 percent of these Texas employees are along the coast, and 76 percent of the payroll is along the coast.



Source: 1993 County Business Patterns, Bureau of the Census– http://www.census.gov/epcd/cbp/map/48

FIGURE 3.6 Texas and Coastal Counties Manufacturing Establishment Data, 1993

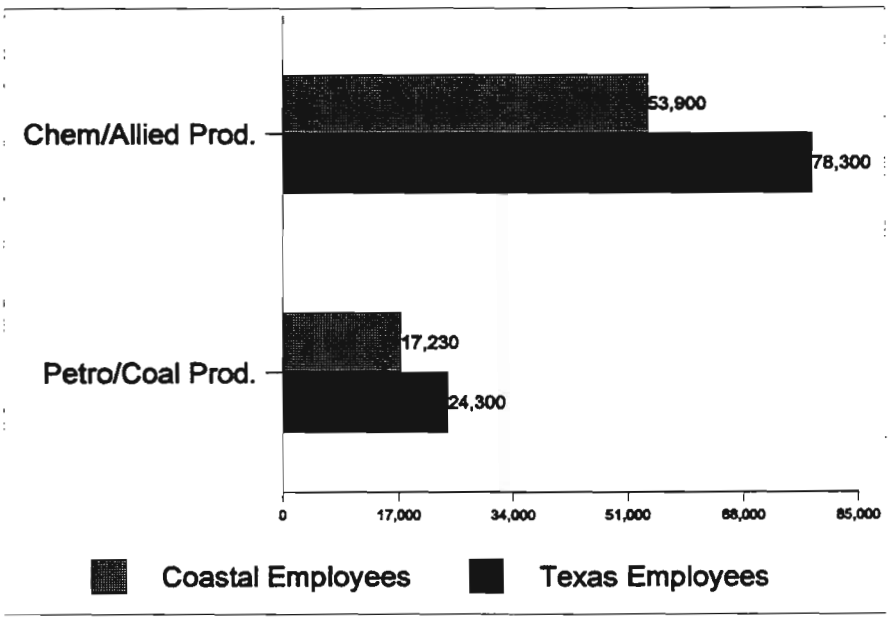


FIGURE 3.7 Texas and Coastal Counties Manufacturing Employee Data, 1993

Source: 1993 County Business Patterns, Bureau of the Census–
http://www.census.gov/epcd/cbp/map/48

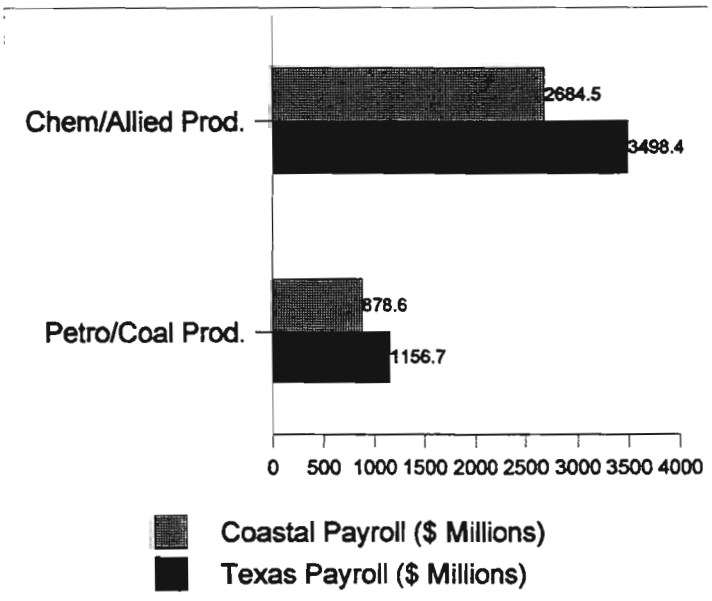


FIGURE 3.8 Texas and Coastal Counties Manufacturing Payroll Data, 1993

Source: 1993 County Business Patterns. Bureau of the Census–
http://www.census.gov/epcd/cbp/map/48

Chemical and Allied Products—1993 Economic Impact

To determine the economic impact that the Chemical and Allied Industry had in 1993 on Texas, income and employment were tallied from the County Business Patterns (see Appendix C). Demand was calculated as per the Texas Input/Output Model by dividing the number of employees reported by County Business Patterns and dividing it by the Direct Effect Coefficient in the table of employment multipliers of the input-output model, and by converting the results to current dollars using the GDP deflator for 1993 of 1.27. The results are listed in the Demand row and Direct Impact column of Table 3.4. Total Demand is estimated by multiplying the direct output estimates by the Final Demand Coefficient in the table of employment multipliers.

Employment can be estimated using the following Input/Output formulas:

- Change in sector output *converted to 1986 dollars* = Adjusted Output
- Adjusted Output (converted to a millions of dollars base) times the Direct Effect Coefficient of the employment multiplier table = Direct Employment
- Adjusted Output times the Total Effect Coefficient of the employment multiplier table = Total Number of Employees

The Employment rows of Table 3.4 reports the direct and total employment. In this case, they are exactly the same as those numbers found in the County Business Patterns.

Personal income can be calculated using the following formulas:

- Change in sector output times Direct Effect Coefficient in the table of income multipliers = Direct Personal Income impact of the sector.
- Change in sector output times Total Effect Coefficient = Total Personal Income impact of the sector.

The income derived by these formulas was lower than the payroll reported in County Business Patterns. Since the actual payroll was known in this case, the table incorporates this data.

The multipliers of Table 3.4 are "implied multipliers" that result from using the coefficient of the input-output model. The total impact was divided by its corresponding direct impact to calculate the multiplier.

TABLE 3.4 Summary of Chemical and Allied Products Impacts

CHEMICAL & ALLIED PRODUCTS Sector 47	Direct Impact	Multiplier	Total Impact
1993			
Demand	$26,429.7 mi	2.79	$73,664.86 mi
Income	$ 2,684.5 mi*	4.99	$13,395.66 mi
Employment	53,900	7.41	399,399

*taken from census--derived direct income impact = $2,436.81 million

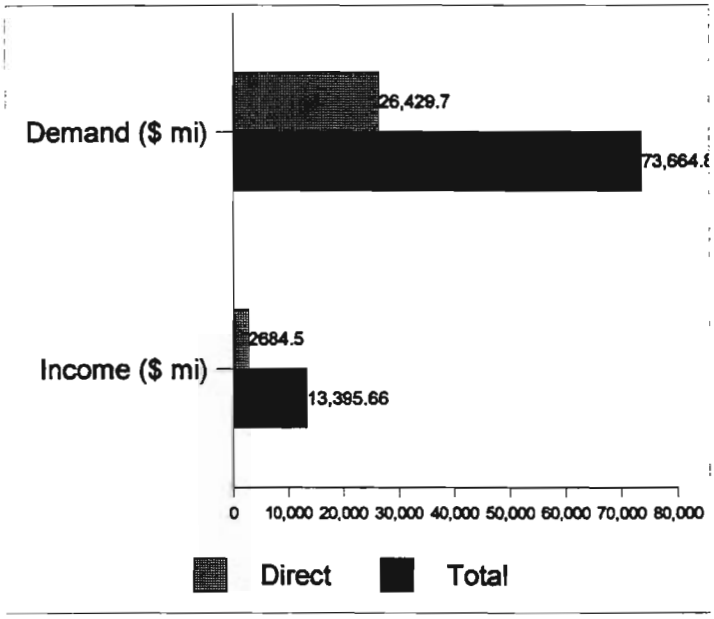


FIGURE 3.9 Chemical and Allied Products, Demand and Income Impacts

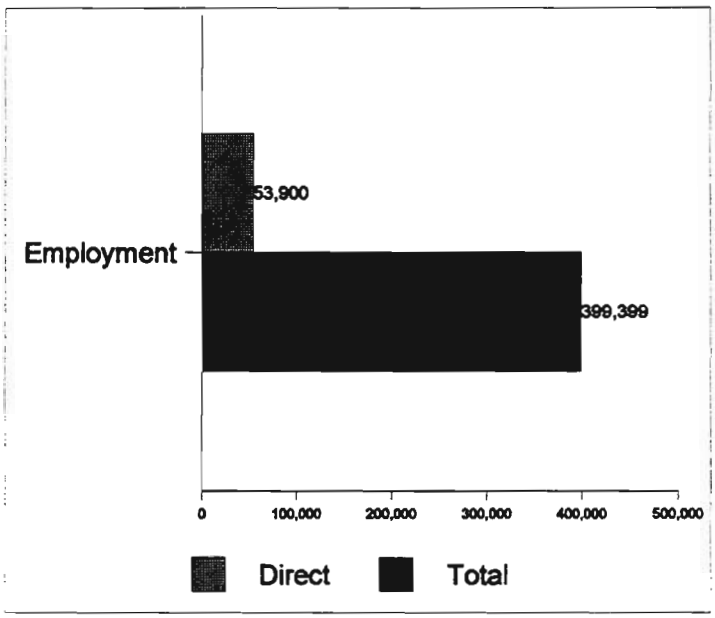


FIGURE 3.10 Chemical and Allied Products, Employment Impact

In summary, the chemical and allied sectors actually create a total of 399,399 jobs. Of these, 53,900 are direct jobs and 345,499 are indirect or induced jobs. The payroll or income received by these employees creates $13,395.66 million in income, and the demand or revenue of chemical and allied companies creates total revenue of $73,664.86 million.

Petroleum and Coal Products—1993 Economic Impact

The impact of Petroleum and Coal Products on Texas is calculated the same way. The Petroleum and Coal industry creates a total of 410,936 jobs in Texas. The payroll creates a total of $3,803.04 million in income and the demand or revenue creates $52,411.13 million in total revenue.

TABLE 3.5 Summary of Petroleum and Coal Products Impacts

PETROLEUM & COAL PRODUCTS Sector 52	Direct Impact	Multiplier	Total Impact
1993			
Demand	$16,599.99 mi	3.16	$52,411.13 mi
Income	$ 878.60 mi*	4.33	$ 3,803.04 mi
Employment	17,230**	23.85	410,936

* derived income equals $2,304.08; **derived employment equals 11,555

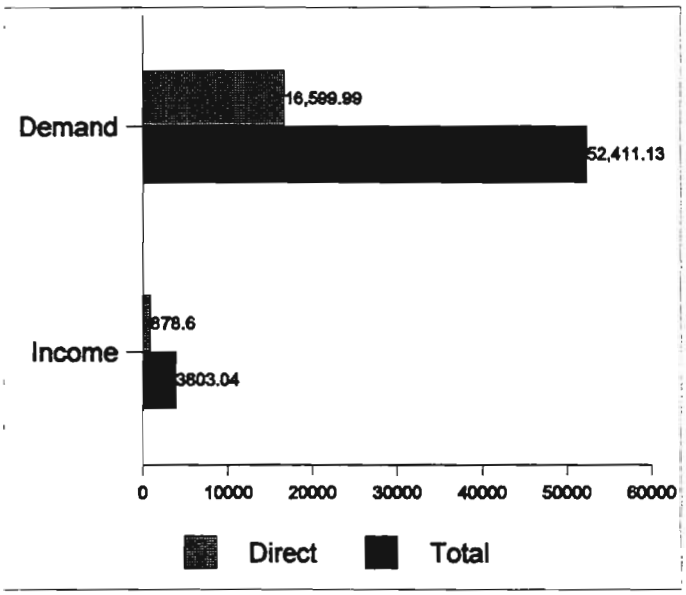


FIGURE 3.11 Petroleum and Coal Products Demand and Income Impacts

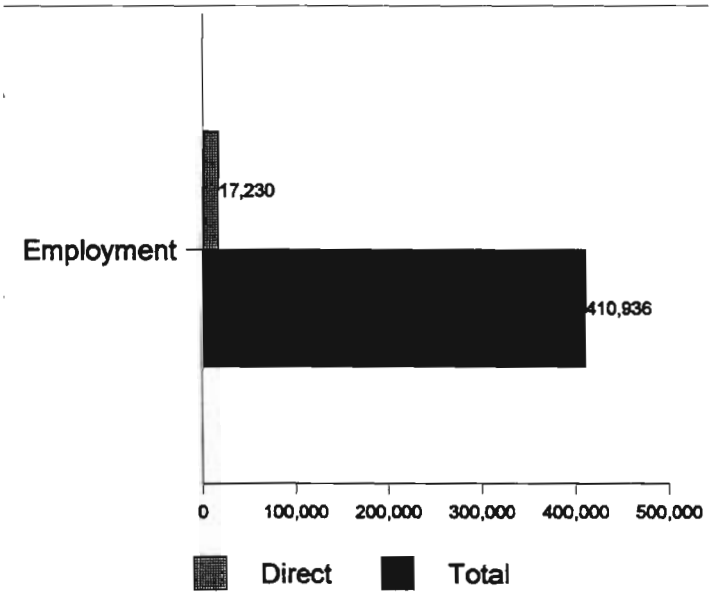


FIGURE 3.12 Petroleum and Coal Products Employment Impact

3.2.2 Mining Sectors

For Texas as a whole, there were 7,182 Oil and Gas Extraction establishments in 1993, with 20 percent of them located along the coast. These establishments employed 139,300 people of whom 19 percent were in coastal counties. The payroll in this sector was $5,598,800,000 with 22 percent of the payroll being earned along the coast.

There were 310 Nonmetallic Minerals (except fuels) establishments in Texas with 19 percent located in coastal counties; there were 5,500 employees statewide with 5 percent of the employees along the coast, and a total payroll of $154,200,000 with 7 percent earned along the coast.

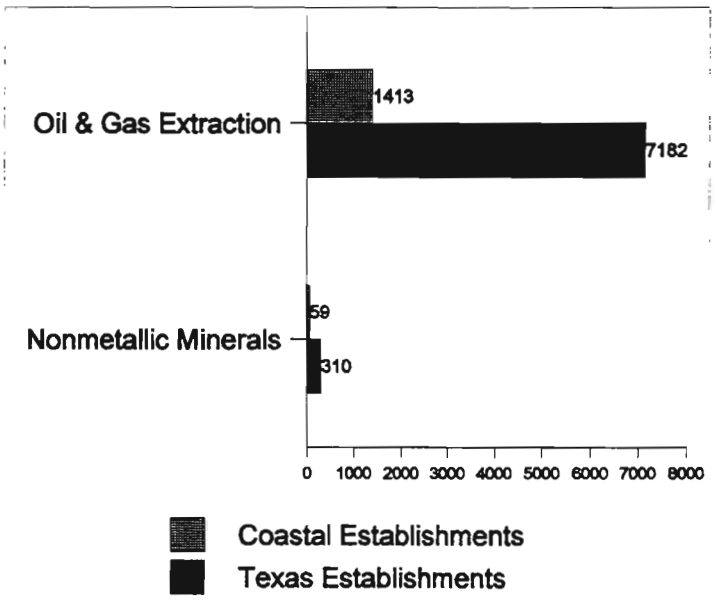


FIGURE 3.13 Texas and Coastal Counties Mining Establishment Data, 1993

Source: 1993 County Business Patterns, Bureau of the Census–
http://www.census.gov/epcd/cbp/map/48

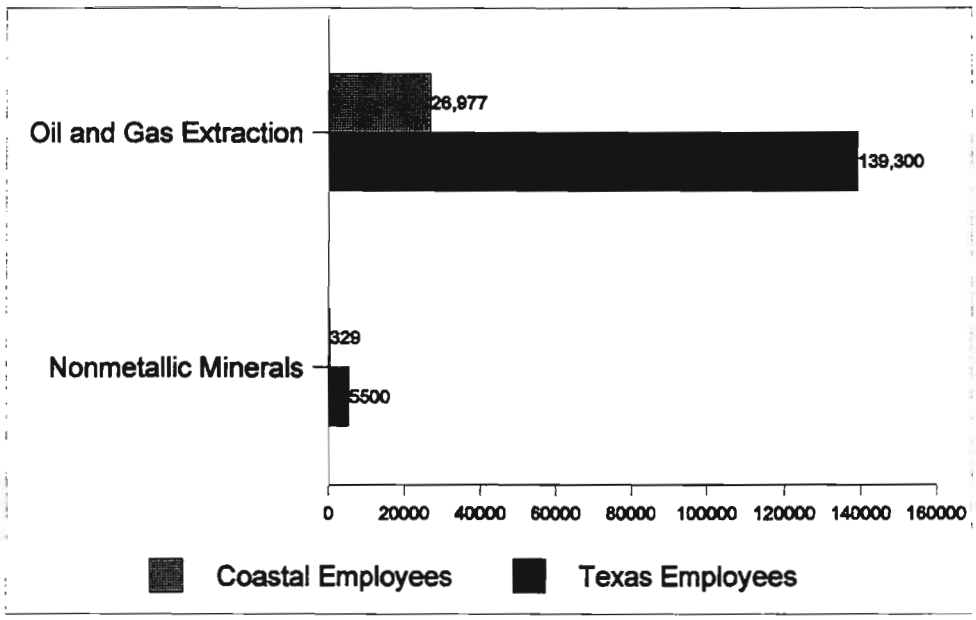


FIGURE 3.14 Texas and Coastal Counties Mining Employee Data, 1993

Source: 1993 County Business Patterns, Bureau of the Census--http://www.census.gov/epcd/cbp/map/48

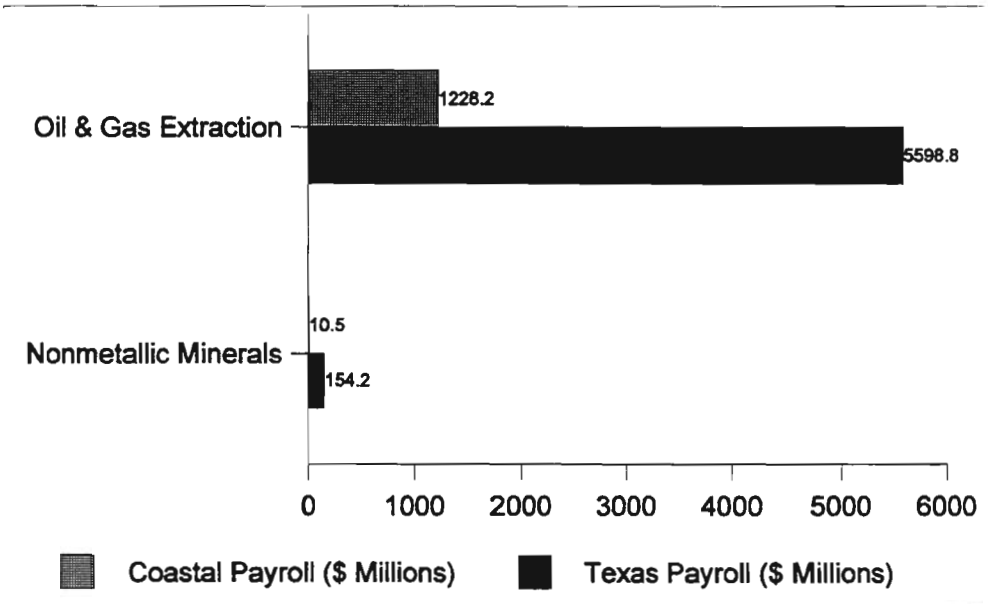


FIGURE 3.15 Texas and Coastal Counties Mining Payroll Data, 1993

Source: 1993 County Business Patterns, Bureau of the Census--http://www.census.gov/epcd/cpb/map/48

Oil and Gas Extraction—1993 Economic Impact

The Oil and Gas Extraction sector actually created a total of 91,487 jobs in Texas. The payroll or income received by the employees of $1,228.2 million creates $3,488.09 million in income. Demand or revenues received from Oil and Gas Extraction of $3,488.20 million creates $11,281.20 million in total revenues.

TABLE 3.6 Summary of Oil and Gas Extraction Impacts

OIL & GAS EXTRACTION Sector 13	Direct Impact	Multiplier	Total Impact
1993			
Demand	$3,488.20 mi	3.23	$11,281.20 mi
Income	$1,228.20 mi*	2.84	$3,488.09 mi
Employment	26,977	3.39	91,487

*Derived income as calculated by the model was $925.7 million, which is lower than the actual payroll.

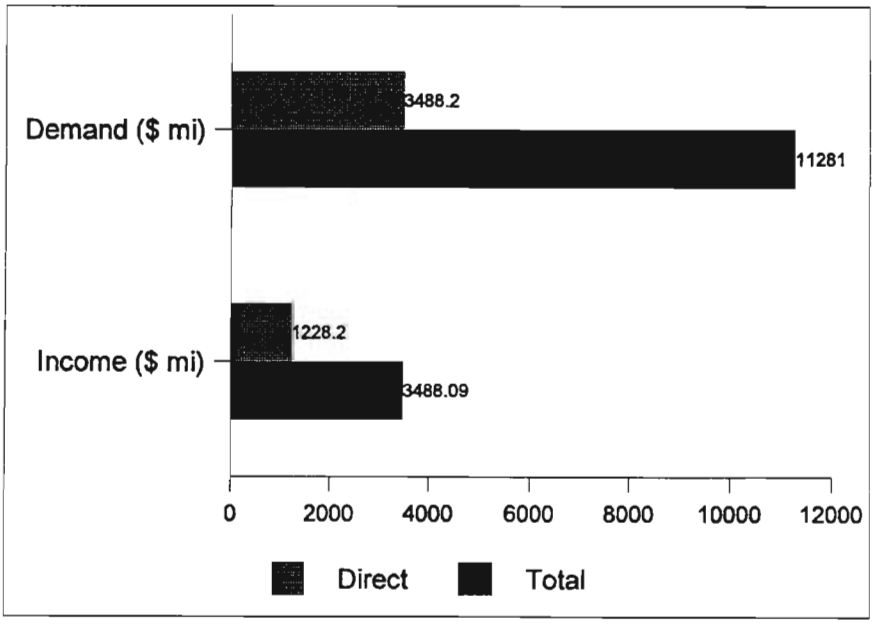


FIGURE 3.16 Oil and Gas Extraction Demand and Income Impacts

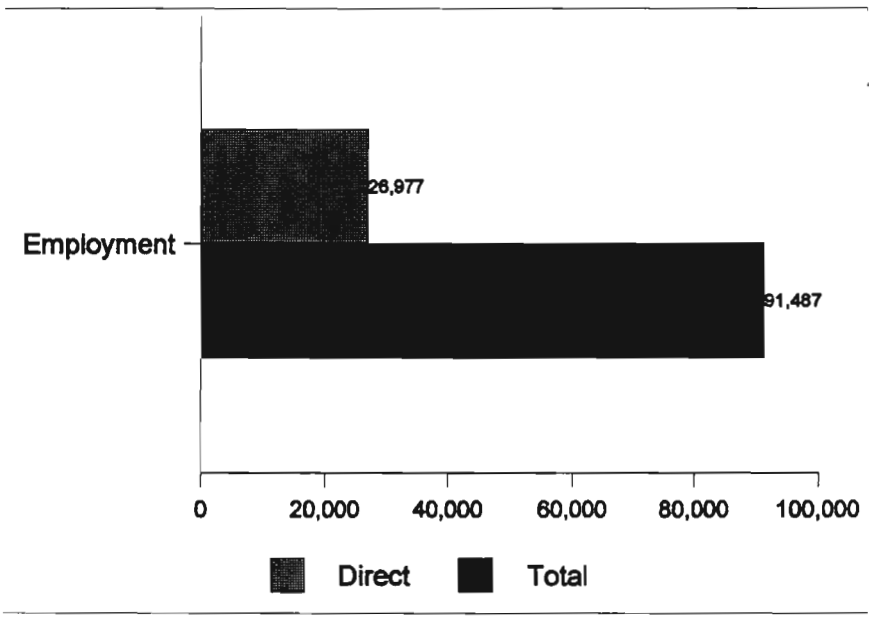


FIGURE 3.17 Oil and Gas Extraction Employment Impacts

Non-Metallic Minerals

The 329 employees in the Non-Metallic Minerals sector create a total of 858 jobs for Texans. The payroll or income of $10.5 million creates $31.40 million in income. The demand or revenue of $34.23 million creates a total of $102.53 million in revenue.

TABLE 3.7 Summary of Non-Metallic Minerals Impacts

NON-METALLIC MINERALS Sector 59	Direct Impact	Multiplier	Total Impact
1993			
Demand	$34.23 mi	3.00	$102.53 mi
Income	$10.50 mi*	2.99	$ 31.40 mi
Employment	329	2.61	858

*Derived income was $7.7360 million which is lower than the actual income reported.

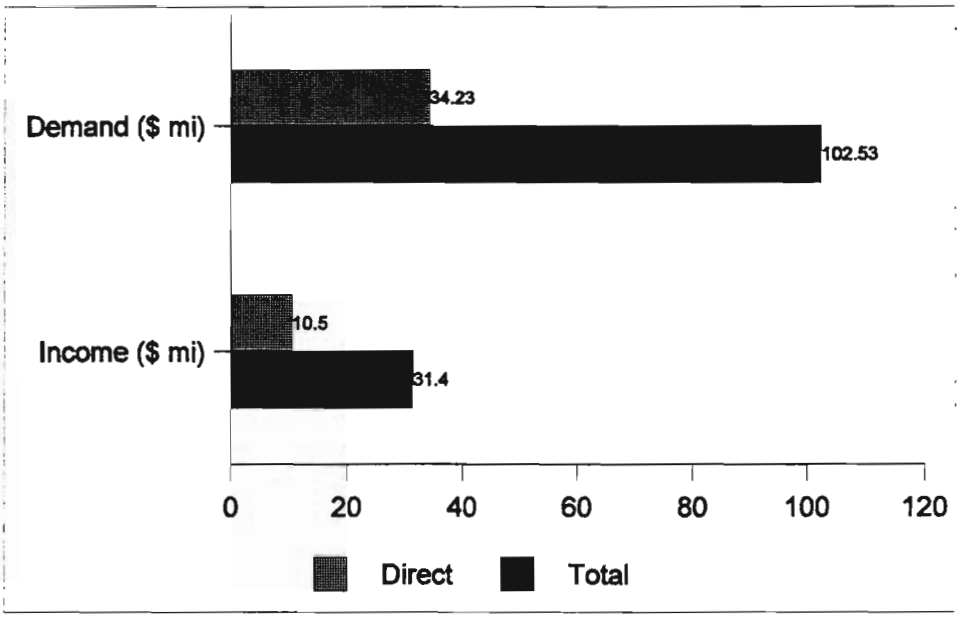


FIGURE 3.18 Non-Metallic Minerals Demand and Income Impacts

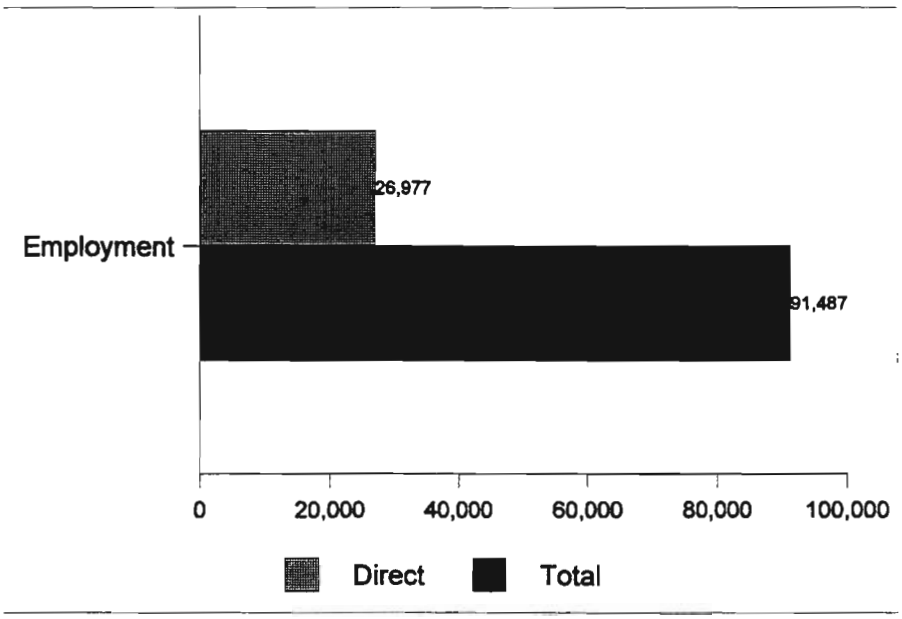


FIGURE 3.19 Non-Metallic Minerals Employment Impacts

Summary of Findings

In 1993, the two manufacturing and two mining industries discussed that are heavily dependent on water transportation furnished by barge companies, created :

- Total demand (revenues) of $137,459.72 million
- Total income (payroll) of $20,718.19 million
- Total employment of 902,680

In addition to payroll impact, these industries pay sales and property tax. The State Comptroller gathers sales tax data by quarter by SIC code.

TABLE 3.8 1993 Taxable Sales, Coastal Mining and Manufacturing

Chemical and Allied Products	$ 894,696,026
Petroleum and Coal Products	$1,651,350,940
Oil and Gas Extraction	$ 802,461,112
Non-Metallic Minerals, Except Fuels	$ 6,506,571
TOTAL	**$3,355,014,649**

(See Appendix D for a complete listing of reported gross sales and taxable sales for 1986 and 1993 for the Texas coastal counties.)

Using 0.0625 for the state tax rate, these coastal industries generated $209,688,415.60 in taxes. Please note that interstate commerce is not taxable.

3.3 PORT REVENUE AND JOB IMPACT

Barges transport cargo along the GIWW. They load cargo at one port or facility and transport it to another. In order to determine the revenue of internal traffic and isolate that portion of traffic that travels on the Texas portion of the GIWW, Part 2 of Waterways and Harbors Gulf Coast, Mississippi River System and Antilles, Waterborne Commerce of the United States, 1994, published by the Department of the Army Corps of Engineers was analyzed. Only "internal" cargo was counted. Cargo was broken into eight categories. See Table 3.9, Commodities Moved By Barges, on the following page. Gene Cockrill, Port of Brownsville, and Jack Beasley, Port of Houston provided the information on which the following cargo categories are based:

Liquid Bulk

- Chemicals and related products
- Crude materials, inedible except fuels

Dry Bulk

- Lime, cement and glass
- Primary non-ferrous metal products
- Soil, sand, gravel, rock, and stone
- Iron ore and scrap
- Non-ferrous ores and scrap
- Slag
- Other non-metal minerals

Breakbulk

- All manufactured equipment, machinery, and products
- Manufactured goods
- Forest products, wood, and chips
- Pulp and waste paper
- Oilseeds
- Vegetable products
- Agricultural products

Using the same procedure and assumptions used in the 1989 Garrett and Burke study, port cargo values attributable to barges almost doubled. This is consistent with the same cargo growth as the Port of Houston. The reader should note that the statistics reflect the cargo each time a barge enters a port. Therefore, some shipments may be included more than once.

This study assumes that revenue values found in the 1994 Martin Associates' study prepared for the Port of Houston are representative of the other ports in Texas. Therefore, this study uses these values to determine the revenue impact of barge traffic of all Texas ports. (Appendix E contains Martin Associates' terms and methodology and a summary of 1986 and 1994 data).

TABLE 3.9 Port Revenue by Commodity Type, 1994

PORT REVENUE BY COMMODITY TYPE
FOR COMMODITIES MOVED BY BARGES IN 1994
($ THOUSANDS)

	Petroleum	Grain	Breakbulk	Other Dry Bulk	Steel	Other Liquid Bulk	Autos	Rice	TOTAL OF INTERNAL
Anahuac, Aransas Pass, Clear Creek, Double Bayou, Port Isabel, Port Mansfield, Rockport	95	0	1,518	6,194	0	1,950	0	0	**9,757**
Beaumont	109,801	0	4,026	36,518	11,900	97,830	0	0	**260,075**
Brownsville	15,865	0	2,442	3,648	2,924	2,310	0	0	**27,189**
Cedar Bayou	19	0	0	3,990	34	6,420	0	0	**10,463**
Chocolate Bayou	51,585	0	0	0	0	31,260	0	0	**82,845**
Corpus Christi	184,756	483	3,366	10,982	34	102,390	0	0	**302,011**
Dickinson Bayou	0	0	0	21,128	0	0	0	0	**21,128**
Freeport	13,414	0	3,828	3,990	102	86,550	0	5,520	**113,404**
Galveston	26,828	63	15,444	6,118	34	12,990	0	0	**61,477**
Harbor Island	171	0	2,772	646	68	150	0	0	**3,807**
Houston	592,458	189	16,104	78,660	27,744	496,410	0	2,231	**1,213,796**
Matagorda	6,536	0	0	34,960	0	24,120	0	0	**65,616**
Orange	3,249	0	1,188	6,004	0	9,120	0	0	**19,561**
Port Arthur	76,969	0	1,716	23,940	102	22,020	0	0	**124,747**
Sabine Pass	1,482	0	6,666	684	238	180	0	0	**9,250**
San Bernard River	12,388	0	0	0	0	2,190	0	0	**14,578**
Texas City	175,921	0	330	76	0	150,450	0	0	**326,777**
Trib. Arroyo Colorado	14,478	0	10,032	3,876	0	0	0	0	**28,386**
Victoria	6,992	0	0	69,996	0	70,740	0	0	**147,728**
TOTALS	**1,293,007**	**735**	**69,432**	**311,410**	**43,180**	**1,117,080**	**0**	**7,751**	**2,842,595**

Source: Waterborne Commerce of the United States, Calendar Year 1994, Part II--Waterways and Harbors, Gulf Coast, Mississippi River System and Antilles.

TABLE 3.10 Revenue Impact for Texas Ports by Type of Cargo

Cargo	Total Tons	Impact per ton	Total Revenue Impact
Petroleum	68,053,000	$ 19	$1,293,007,000
Grain	35,000	21	735,000
Breakbulk	1,052,000	66	69,432,000
Other dry bulk	8,195,000	38	311,410,000
Steel	1,270,000	34	43,180,000
Other liquid bulk	37,236,000	30	1,117,080,000
Automobiles	0	211	0
Rice	337,000	23	7,751,000
TOTAL	**116,178,000**		**$2,842,595,000**

Note: Revenue per ton does not include an allocation of banking/insurance/law sector revenue, or the marine construction and ship repair revenue.

3.4 TRANSPORTATION INDUSTRIES

3.4.1 Introduction

Opening the Gulf Intracoastal Waterway (GIWW) in Texas created a demand for barge transportation to ship products such as petroleum and chemicals. In responding to that demand, a water transportation industry was born which has had an economic impact on Texas through creating sales, employment, and personal income.

The 1989 report, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," used a Texas input-output model to estimate that impact.[76] The purpose of this section is to update that analysis. The update follows the same general procedures used in the 1989 study. The main differences are that more recent data are collected, an updated version of the Texas input-output model is used, and a preliminary estimate of taxes paid is added.

3.4.2 Input-Output Analysis

GIWW water transportation has both a direct and an indirect impact upon the State's economy. In supplying water transportation, the industry has a direct impact through generating sales, hiring employees, and paying out personal income. Successive rounds of spending by the beneficiaries of the direct impact then cause an indirect impact on sales, employment, and payrolls.

Input-output analysis can be used to estimate the total (direct plus indirect) impact of an industry upon an economy. In December of 1989, after the Texas A&M report was written, the Texas Comptroller's office published an update of the Texas input-output model entitled The Texas Input-Output Model, 1986 Update. The updated model contains a description of the relationships between 174 sectors, and it is based on 1986 data, the

latest year for which data covering all the sectors was available. On the basis of these relationships, the model derives Final Demand, Income, and Employment coefficients. These coefficients allow estimations of the total impact of water transportation on Final Demand, Employment, and Income.

In this study, Final Demand refers to the demand for water transportation output; it equals sales or revenue received by establishments that supply water transportation. Income refers to personal income and includes wages, salaries, dividends, rents, and other forms of payments to persons by water transportation businesses. Employment refers to the number of jobs created by the industry.

Important limitations to the input-output model exist. First, the relationships between the sectors of the model are a snapshot of the relations that existed in 1986. One assumption is that the model's coefficients which describe the relationships between sectors remain constant over time. In fact, technological developments can change the relationships over time causing the model to generate inaccurate estimates of demand, employment, and payroll. The model is now more than ten years old. Presumably, some of the relationships have changed.

A second limitation is that the model's categories of industries are sometimes quite broad. The Standard Industrial Classification (SIC) code of the Office of Management and Budget defines the industrial sectors.[77] The SIC manual groups industries into two-, three-, and four-digit classifications. The Texas input-output model further aggregates the SIC classifications into 157 industrial classifications. One result of this aggregation is that no distinction is made between the coefficients of water transportation and those of water transportation services. Another is that the model's water transportation industries' coefficients are partly based on activities that have nothing to do with water transportation on the GIWW.

A third limitation is that the model does not take into account the costs of production. It measures revenue and personal income earned, but it does not measure the costs of earning that money, nor does it measure external costs such as environmental costs. What follows is a benefit analysis, not a Benefit-Cost analysis.

A fourth limitation is that the model estimates the benefits of a net change in activity. It assumes that GIWW water transportation is a net change in transportation services. If, for example, railroad, and truck transportation services decline as a result of the rise of water transportation on the GIWW, the revenue, employment, and income benefits for the State are exaggerated. The analysis that follows shows the GIWW water transportation industry's impact on the economy in isolation rather than the industry's net impact on the economy.

3.4.3 Basic Data

The Study Area

In order to estimate the economic impact of the GIWW on Texas, the Coastal Zone of Texas was selected for study. The assumption is that the direct impact of the GIWW's water transportation industries on revenue, employment, and income will take place in counties adjacent to the waterway, and that re-spending by economic agents in this region will lead to the indirect impact of the industry. Figure 3.20 provides a map of the Coastal Zone of Texas; and Table 3.11 lists the counties in the map. In order to capture the full direct effect of water transportation on Texas, this study includes counties not immediately adjacent to the waterway.

TABLE 3.11 Coastal Zone Counties In Texas

I.	**South East Texas Counties**		**IV.**	**Coastal Bend Counties**	
	1.	Orange		21.	Refugio
	2.	Jefferson		22.	Aransas
				23.	Bee
II.	**Gulf Coast Counties**			24.	Live Oak
	3.	Chambers		25.	McMullen
	4.	Liberty		26.	San Patricio
	5.	Walker		27.	Duval
	6.	Montgomery		28.	Jim Wells
	7.	Harris		29.	Nueces
	8.	Galveston		30.	Kleberg
	9.	Waller		31.	Brooks
	10.	Fort Bend		32.	Kenedy
	11.	Brazoria			
	12.	Austin	**V.**	**Lower Rio Grande Valley**	
	13.	Colorado		33.	Willacy
	14.	Wharton		34.	Hidalgo
	15.	Matagorda		35.	Cameron
III.	**Golden Crescent Counties**				
	16.	Jackson			
	17.	Calhoun			
	18.	Victoria			
	19.	Dewitt			
	20.	Goliad			

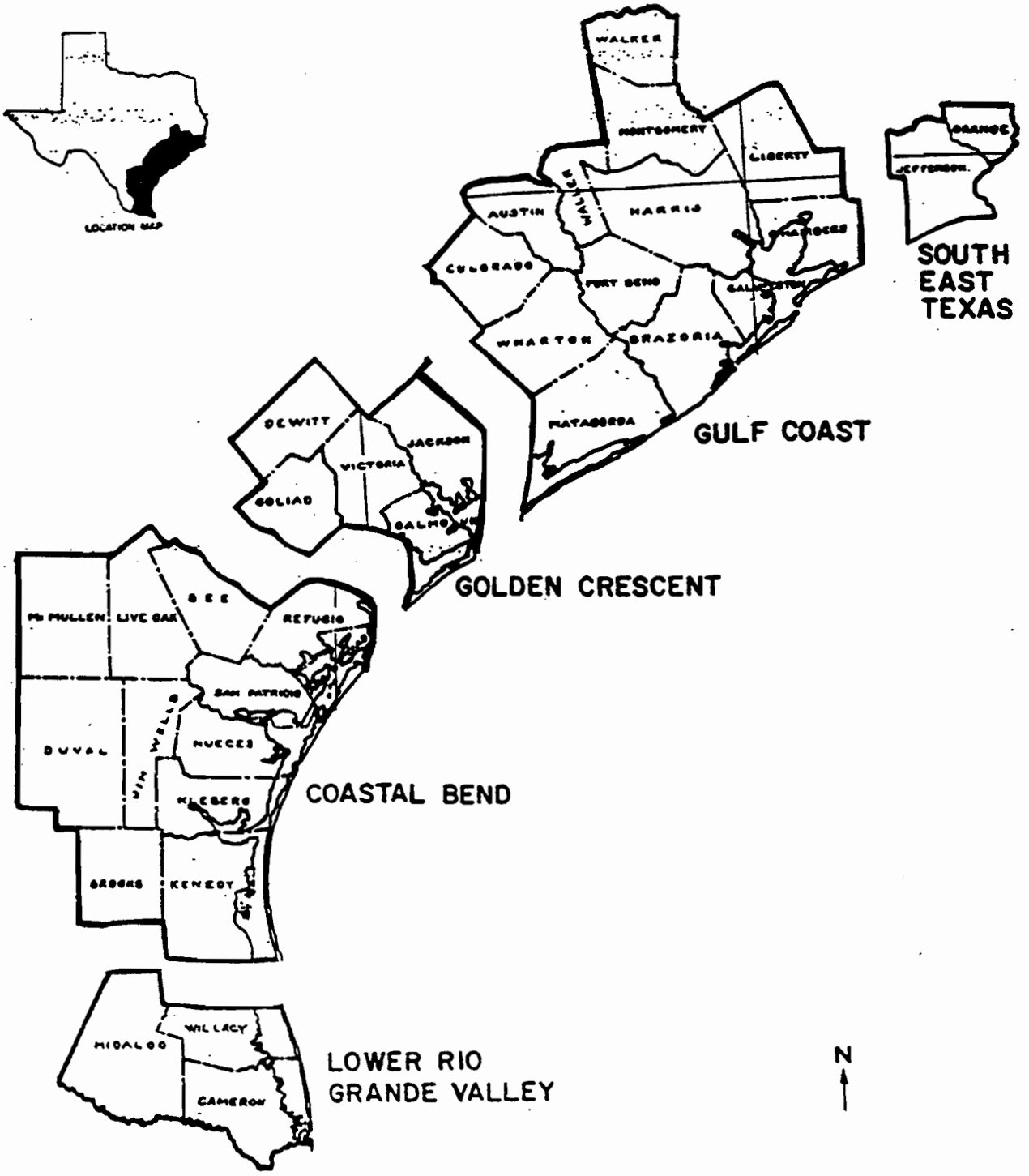


FIGURE 3.20 Map of Coastal Zone of Texas

Direct Impact of All Water Transportation

Table 3.12 lists the number of establishments, employment, and income data for water transportation industries in the Coastal Zone of Texas. The source of this data is the U.S. Census Bureau's Texas County Business Patterns, 1994. The 1994 data was taken from recently published computer readable data on the World Wide Web.[78] The table sums establishment, employment, and payroll data for the 35 counties of Table 3.11.

Definitions

The following provides an explanation of definitions of Water Transportation and Water Transportation Services in Table 3.12. Texas County Business Patterns provides data on a two-digit SIC code 44 named Water Transportation and a three-digit SIC code named Water Transportation Services. The data of the two-digit code includes that of the three-digit code. Consequently, in order to avoid double counting, the data for the Water Transportation of Table 3.12 was formed by subtracting SIC 449 from SIC 44. Hence, the first row of Table 3.12 shows Water Transportation (SIC 44) exclusive of Water Transportation Services (SIC 449). In the rest of this update, the term Water Transportation will refer to SIC 44 - SIC 449.

TABLE 3.12 All Water Transportation in Texas, 1994

	1994		
	No. Est.	**No. Emp.**	**Income ($ millions)**
Water Transportation (SIC 44 - SIC 449)	116	4,502	173.8
Water Transportation Services (SIC 449)	349	7,731	151.4
TOTAL	**465**	**12,233**	**325.2**

The Standard Industrial Classification Manual defines SIC 44 to include "establishments engaged in freight and passenger transportation on the open seas or inland waters, and establishments furnishing such incidental services as lighterage, towing, and canal operation. This major group also includes excursion boats, sightseeing boats, and water taxis." Water Transportation Services (SIC 449) include "marine cargo handling," "towing and tugboat services," "marinas," and "water transportation services not elsewhere classified".[79] These definitions indicate that the data of Table 3.12 includes activities that have nothing to do with water transportation on the GIWW in Texas. In order to quantify the impact of GIWW waterway transportation on Texas, this study will separate GIWW data from the broader data of Table 3.12.

Texas County Business Patterns defines an Establishment to be "a single physical location at which business is conducted or services or industrial operations are performed." Employees are "full- and part-time employees, including salaried officers and executives of corporations." The Income of Table 3.12 is the same as the figures listed as Payroll in the census data. It includes "all forms of compensation, such as salaries, wages, reported tips, commissions, bonuses, vacation allowances, sick-leave pay, employee contributions to qualified pension plans, and the value of taxable fringe benefits."

Impact of All Water Transportation

The last row of Table 3.12 shows that in absolute terms, the water transportation industry had a substantial impact on Texas in 1994. There were 465 establishments employing 12,233 workers and paying them more than $325 million.

Once again, these numbers refer to all water transportation in the Texas Coastal Region. The numbers are important because, in the analysis that follows, GIWW transportation is assumed to be a direct proportion of the estimates for all water transportation. If all water transportation declines, GIWW water transportation automatically declines.

3.4.4 Portion of All Water Transportation Attributable to the GIWW

As noted earlier, the data of Table 3.12 refer to activities that do not pertain to the GIWW. What portion of the data pertains to GIWW activities? In order to answer this question, Table 3.13 lists the major ports of Texas together with the total tonnage handled by the ports and the tonnage handled due to "internal traffic." Internal traffic refers to commodity movements that originate and terminate in Texas.[80] The last row of Table 3.13 shows that in 1994, the major ports handled a total of 370,030 thousand tons. Internal shipments amounted to 104,694 thousand tons. This study assumes that all inland water transportation is accomplished by barge on the GIWW. In addition, the Navigation Data Center of the Army Corps of Engineers estimates that in 1994, 17,684 thousand tons were shipped by GIWW barges of Texas-based companies to or from ports outside of Texas (external traffic). 17,684 thousand tons of external traffic plus 104,694 thousand tons of internal traffic form 33 percent of total port tonnage. Accordingly, 33 percent of the figures in Table 3.12 are attributed to water transportation on the GIWW.

Table 3.14 lists the economic activity directly attributable to the GIWW in Texas. The number in each cell of this table is simply 33 percent of the number in the corresponding cell of Table 3.12. The last row of the table shows that in 1994, 153 GIWW water transportation establishments directly generated 4,037 jobs and a personal income of $107.4 million. Input-output analysis will show that this sizable direct impact was multiplied by successive rounds of spending so that the total impact of the industries is substantially larger.

TABLE 3.13 Port Activity Attributable To Barge Transportation, 1994

PORTS	TOTAL PORT (Thousand Tons)	TOTAL INTERNAL (Thousand Tons)
BEAUMONT	21,201	10,412
BROWNSVILLE	3,396	1,131
FREEPORT	17,450	3,997
GALVESTON	10,257	2,244
HOUSTON	143,663	50,965
ORANGE	686	651
PORT ARTHUR	45,586	5,444
TEXAS CITY	44,351	14,281
MATAGORDA*	7,380	2,068
CORPUS CHRISTI	76,060	13,501
TOTAL	**370,030**	**104,694**

*Port Comfort/Port Lavaca

Source: U.S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, Part 2, New Orleans, 1994.

TABLE 3.14 GIWW Water Transportation In Texas, 1994

	1994		
	No. Est.	No. Emp.	Income ($ millions)
Water Transportation (SIC 44 - SIC 449)	38	1,486	57.4
Water Transportation Services (SIC 449)	115	2,551	50
TOTAL	**153**	**4,037**	**107.4**

3.4.5 Total Impact of GIWW Water Transportation

Table 3.14 lists the direct impact of GIWW water transportation on employment and payroll. Table 3.15 lists both the direct and total economic impacts of GIWW water transportation upon Final Demand, Employment, and Payroll for the year 1994.

Derivation of the Estimates

The derivation of Table 3.15 requires several steps, the understanding of which enables one to interpret the results correctly. The first step is to estimate the output (also referred to as final demand or sales or revenues) generated by the water transportation industries in the Coastal Zone of Texas. It is important to note that an independent estimate of the output of

GIWW water transportation establishments is not available, and so this study must generate it internally using the model. This analysis calculates a rough estimate of output by dividing the number of employees (given by Texas County Business Patterns) by the Direct Effect Coefficient in the table of employment multipliers of the input-output model, and by converting the results to current dollars using the GDP deflator for 1994 of 1.30. The Demand rows and Direct Effect column of Table 3.15 list the resulting estimates of output. The estimate of Total Demand derives from the multiplication of the direct output estimate by the Final Demand Coefficient in the table of employment multipliers of the input-output model.

TABLE 3.15 Economic Value of GIWW Water Transportation, 1994

WATER TRANSPORTATION (SIC 44 - SIC 449)	Direct Impact	Multiplier	Total Impact
Demand	$215.5 mi	3.25	$700.4 mi
Income	$ 88.7 mi ($ 49.2 mi)	2.06	$183.1 mi ($101.4 mi)
Employment	1,486 jobs	3.34	4,965 jobs
WATER TRANSPORTATION SERVICES (SIC 449)			
Demand	$370.1 mi	3.25	$1,202.8 mi
Income	$152.3 mi ($ 42.9 mi)	2.06	$ 314.4 mi ($ 88.4 mi)
Employment	2,551 jobs	3.34	8,525 jobs

The second step of the analysis is to estimate the impact of GIWW water transportation on employment using the following formulas:

- Change in sector output *converted to 1986 dollars* = Adjusted Output
- Adjusted Output (converted to a millions of dollars base) times the Direct Effect Coefficient of the employment multiplier table = Direct Employment
- Adjusted Output times the Total Effect Coefficient of the employment multiplier table = the Total Number of Employees

The Employment rows of Table 3.15 reports the direct and total employment effects of GIWW water transportation over time and by industry. The Direct Employment effects are the same numbers as those reported in Texas County Business Patterns and listed in Table 3.14.

The third step of the analysis is to estimate the impact of GIWW water transportation on

personal income by using the following formulas:

- Change in sector output times the Direct Effect Coefficient in the table of income multipliers = Direct Personal Income impact of the sector.
- Change in sector output of GIWW water transportation times the "Total Effect" coefficient = Total Personal Income impact of the sector.

The top numbers in the "Income" cells of Table 3.15 list the estimates that result from this process. The numbers in parentheses in the direct effect column are the data derived from Texas County Business Patterns. Comparing the numbers within each cell shows that the model substantially overestimates the income impact of GIWW transportation. This suggests that either the state-wide direct effect coefficient for employment is too low for GIWW water transportation or that the Direct Effect Coefficient for Income is too high. If the direct effect coefficient for employment is too low, Demand is also overestimated. This study assumes that the numbers in parentheses represent the true income impact of the water transportation industries. The corrected total income is calculated by multiplying the corrected direct income by the model's multiplier.

The multipliers of Table 3.15 are "implied multipliers" that result from using the coefficients of the input-output model as described in the preceding paragraphs. In other words, the direct and total impacts are calculated first. The multipliers of Table 3.15 are then calculated by dividing each total impact by the corresponding direct impact. The implied multipliers show that the total impact of GIWW water transportation on Texas is several times larger than the direct effect.

Total Demand, Employment and Income Impacts

Table 3.15 shows that in 1994, Water Transportation experienced $215.5 million of direct demand and that multiplier effects resulted in a total demand of $700.4 million. The corresponding figures for Water Transportation Services are $370.1 million and $1,202.8 million.

The corrected income estimates show that Water Transportation directly earned $49.2 million in 1994, while multiplier effects generated a total of $101.4 million. In Water Transportation Services, the corresponding figures were $42.9 million and $88.4 million.

In 1994, Water Transportation caused the direct creation of 1,486 jobs, while indirect job creation led to a total of 4,965 jobs. In Water Transportation Services, the figures were 2,551 and 8,525 jobs.

In 1994, both sectors together sold directly $585,600,000 worth of goods and services, and, in order to do so, they employed 4,037 workers. This activity directly generated a personal income of $92,100,000. Multiplier effects produced a total impact of $1,903,200,000 in sales, 13,490 jobs, and $189,800,000 in personal income.

Taxes

Table 3.15 can be used to generate an estimate of sales taxes paid to the State of Texas as a result of GIWW water transportation. The personal income earned both directly and indirectly due to the water transportation industry gives rise to taxable sales. The Office of the Texas Comptroller of Public Accounts estimates that 33 percent of personal income generates sales that are subject to State sales taxes.[81] This implies that in 1994, Water Transportation and Water Transportation Services together generated $62.63 million ($189.8 mi. X .33) in sales subject to the State sales tax. Applying the State sales tax rate of .0625 to this figure implies that GIWW water transportation generated $3,914,375 of sales tax revenue in 1994 for the State of Texas.

In addition, barge operators pay a federal fuel tax of 24.3 cents per gallon of diesel fuel. Twenty cents per gallon are placed in a U.S. Treasury fund and are used, in partnership with the federal government, to provide one half the cost of constructing and replacing navigational facilities on the inland waterway system. The tax is not a direct payment to the State of Texas, but it benefits the State indirectly by funding expenditures made within the State. Between 1986 and 1995, the tax doubled from 10 to 20 cents per gallon and another 4.3 cents per gallon tax was imposed for deficit reduction.

Data are available from the Corps on the total 20 cent fuel tax paid nationally, total ton miles of barge traffic nationally, and total ton miles of barge traffic in Texas.[82] The revenues coming from the 20 cent fuel tax were estimated by dividing the total tax paid nationally by the total ton miles nationally, and then multiplying by the total ton miles in Texas. This procedure yields an estimate of $2,676,971 paid by Texas operators during 1995. This figure seriously underestimates the fuel tax paid by Texas GIWW operators because barges operating on the Mississippi and Ohio river systems are much larger and much more fuel efficient. Operators on the Texas portion of the GIWW are undoubtedly above average in their use of fuel per ton mile and in fuel tax payment. David Greer of the Corps took a "wild guess" that the true payment would be close to $4,000,000. In order to derive an accurate estimate, empirical studies of the fuel efficiency of various types of barges would be necessary.

The 4.3 cent tax per gallon of fuel for deficit reduction was estimated in the following fashion. The total fuel tax paid nationally was divided by the $.20 tax per gallon of fuel to estimate the total gallons of fuel burned nationally. The total deficit reduction tax paid nationally was estimated by multiplying the total number of gallons by the $0.043 tax per gallon. The Texas share of this payment was estimated by multiplying the total national tax by the Texas share of total ton miles. Texas operators paid an estimated $575,806 in deficit reduction tax in 1995.

The conservatively estimated grand total of fuel tax paid during 1995 is $3,252,777. If Mr. Greer's "wild guess" is correct, the total 1995 would be $4,575,806. Calculations using 1994 data yield a total fuel tax payment of $2,920,534 for that year.

Other contributions may exist, but have not been measured. They may include property taxes, local sales taxes, fees, and contributions to civic organizations.

3.4.6 Conclusions

Input-output analysis reveals that in isolation the GIWW water transportation industry makes a large impact on Texas. The estimates indicate that in 1994, the GIWW water transportation industry generated a total of $1,903,200,000 in sales, 13,490 jobs and $189,800,000 in personal income.

TABLE 3.16 Summary of Water Transportation and Water Transportation Services, 1994

WATER TRANSPORTATION & WATER TRANSPORTATION SERVICES	Direct Impact	Multiplier	Total Impact
Demand	$585.6 mi	3.25	$1,903.2 mi
Income	$ 92.1 mi	2.06	$ 189.8 mi
Employment	4,037	3.34	13,490

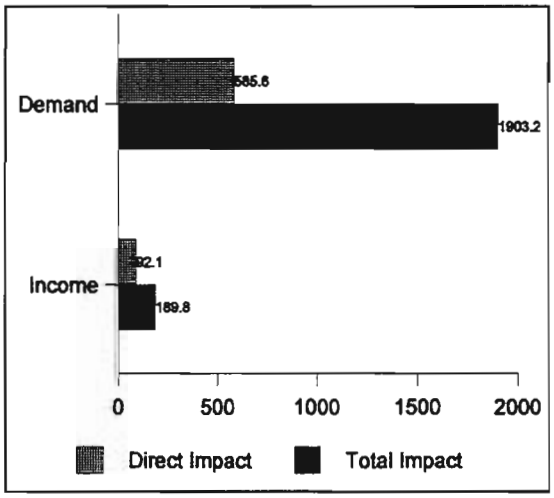


FIGURE 3.21 Water Transportation Industries Impacts—Demand and Income

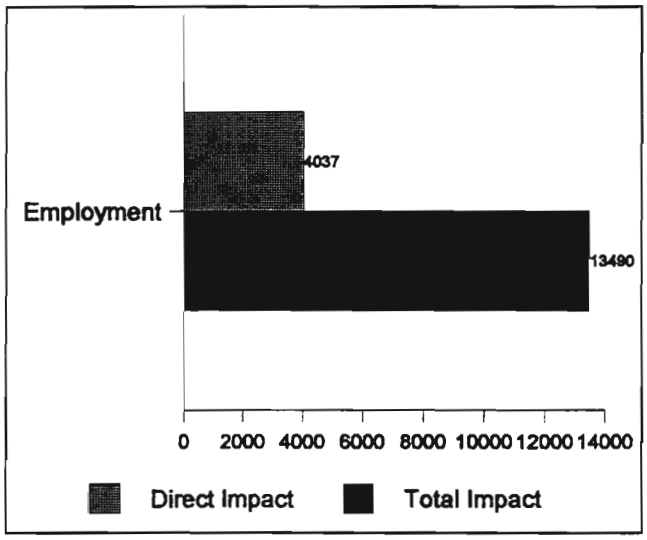


FIGURE 3.22 Water Transportation Industries Impact—Employment

This study indicates that the GIWW is generating significant tax revenues for the State of Texas, although the analysis of this source of benefits is in a rudimentary stage. The estimate is that the personal income generated by the GIWW water transportation industries during 1994 yielded the State of Texas $3,914,375 in sales tax revenue. At the same time, the industries paid approximately $2,090,000 in federal fuel taxes, at least some of which were spent in the state. Other payments such as property taxes and fees have not been recorded.

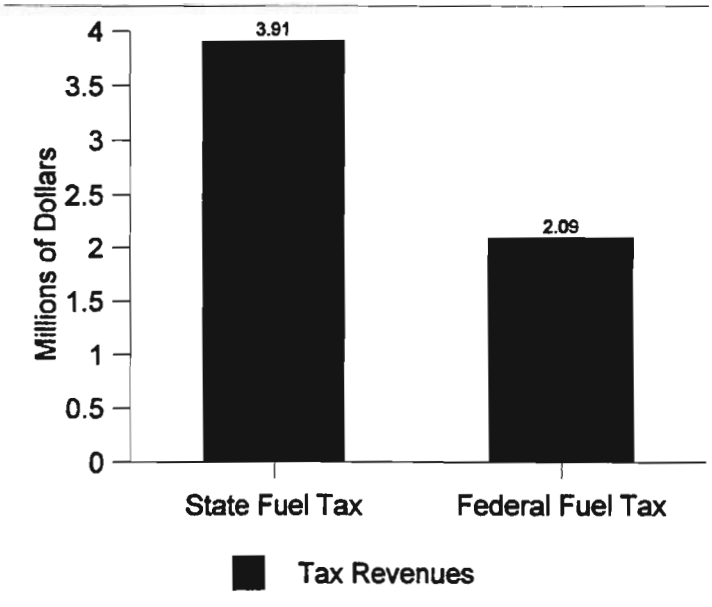


FIGURE 3.23 Water Transportation Industries Tax Revenues

From a methodological point of view, two weakness of the analysis reduce the accuracy of the estimates. The first is that the estimation of direct output (sales) of the GIWW water transportation industries must occur internally. All of the estimates of total effects depend upon this internally generated estimate of output. An independently generated estimate of output would greatly enhance the reliability of the total estimates for demand, employment, and personal income.

A second major methodological weakness is that the coefficients used in estimating the impact are now ten years old. Technological improvements may have changed the coefficients. Updating the Texas Input-output model would improve the accuracy of the estimates.

Readers who wish to compare the 1986 study results with those of 1994 using the same methodology employed in the 1986 Garrett and Burke study may refer to Appendix L for a complete comparison.

3.5 RECREATION AND COMMERCIAL FISHING INDUSTRIES

The Gulf Coast attracts many vacationers with its diverse leisure time water and eco-related activities. In 1993-1994, the Gulf Coast Region of Texas ranked second in the number of Person-Trips in the state with a 23 percent share of visitors (North Central Region, which includes the Dallas-Fort Worth area, had 24 percent). "Texans generated 61 percent of the total Person-Days to the Gulf Coast, while non-Texans accounted for 39 percent."[83] The average spent per day was $93.

Garrett and Burke reported that in 1987, visitor expenditures along the Texas Gulf Coast totaled $586 million, which created 24,095 man years of employment and income of $218.4 million. The state received $2.6 million and the local government received $7.4 million in taxes. "Output for the state was increased by $1.9 billion and almost all 21,000 jobs were created regionally. . . ."[84]

Commercial fishing along the coast in 1986 provided jobs for over 8,500 Texans and personal income of $55 million. The state received approximately $1 million and the local areas $1.3 million in tax revenue. The total business generated in the state as a result of commercial fishing was an estimated $650.6 million.[85]

As a result of the economic impact from sport and commercial fishing and recreation activity, "A total of over 48,000 Texans earning $675 million were employed by the business generated by these economic activities in the Gulf Coast region in 1986. State and local tax jurisdictions throughout Texas collected approximately $59 million."[86]

Texas A&M University is currently awaiting funding to update this economic impact analysis of sport fishing and other recreational activities. Their objectives will be:

1. To estimate the total economic impacts from recreational fishing, in terms of total value of output, personal income, employment, value added and tax revenues, on the local and state economies.
2. To estimate the total economic impacts generated by commercial fishing in Texas bays and estuaries.
3. To estimate the total economic impacts generated by nonconsumptive, resource based recreation and tourism in each bay and estuary system.
4. To compare and contrast the economic impacts from fishing and nonconsumptive uses with that of consumptive uses of Texas bays and estuaries.[87]

The Texas Department of Commerce, Tourism Division, currently publishes types of activities visitors participate in. Those most relevant to the GIWW are Beach/ Waterfront; Hunt/Fish; and Boat/Sail. For the Gulf Coast Region as a whole see Table 3.17 below for the amount of travel expenditures. For a specific break down of each of the seven counties MSA that the Department of Commerce publishes data, see Appendix F.

TABLE 3.17 Travel Expenditure Summary, Gulf Coast Region, 1993-1994

Average Spending		**$93**
Average Length of Stay		**2.3 days**
Average Party Size		**1.9 persons**
Person Days		**152,000,000**
Total Travel Expenditure		**$61,774,320,000**
Leisure	69%	$42,624,280,800
Beach/Waterfront	17%	$10,501,634,400
Hunt/Fish	8%	$ 4,941,945,600
Boat/Sail	4%	$ 2,470,972,800
Total B/W-H/F-B/S		*$17,914,552,800*
% of Leisure	*42%*	
% of Total	*29%*	

Source: Texas Destinations 1993-1994: Gulf Coast Region. DIRECTIONS Destination Index. Texas Department of Commerce and D.K. Shifflet & Associates Ltd. November 1995.

There are no current studies showing the direct relationship between the visitors to the coast and usage of the GIWW. A 1982 State Department of Highways and Public Transportation report, however, indicated that approximately 80 percent of all boaters visiting coastal water used the GIWW to some extent, and about 81 percent of the recreational boat trips in 1979 were fishing-related.[88]

The Texas Parks and Wildlife Department reported that in 1991 "there were over 847,000 saltwater sport anglers in Texas . . ." and that "direct expenditures by these anglers translate into over two billion dollars of economic impact annually."[89]

Parks and Wildlife collect data on both the number of fish caught (landed) by species and by the number of man-hours of fishing (pressure) by private boats and by party boat (those boats with a paid guide). Private-boat fishing . . . "Landings generally decreased from 1974-76 until 1991-92 when they increased and were 36% greater than during 1990-91."

Texas bays and passes offer a wide assortment of fish. Table 3.18 lists a sampling of three popular fish likely to be found in the GIWW and shows the number of fish caught by species and boat type for years 1984-85 to 1991-92.

TABLE 3.18 Estimated Annual Coastwide Landings*

	Private Boat Fishing			Party Boat Fishing		
Year	Red Drum	Southern Flounder	Spotted Seatrout	Red Drum	Southern Flounder	Spotted Seatrout
1984-85	95,600	138,200	316,600	13,700	1,200	50,000
1985-86	154,800	194,400	545,200	23,600	6,400	68,000
1986-87	266,800	178,100	883,900	22,400	6,300	94,900
1987-88	218,200	207,000	895,400	23,900	1,700	81,400
1988-89	164,000	155,100	816,100	28,100	2,600	118,100
1989-90	159,200	103,800	546,700	26,300	5,700	91,900
1990-91	97,700	116,500	231,900	22,000	2,800	39,100
1991-92	130,800	179,200	517,700	28,000	9,300	92,800

*Due to rounding, these totals may not exactly equal individual totals.

Source: Thomas A. Warren, Lee M. Green, and Kyle W. Spiller, Trends in Finfish Landings of Sport-Boat Anglers in Texas Marine Waters, May 1974-May 1992 , Management Data Series, No. 109, Texas Parks and Wildlife Department, 1994.

There is a large difference between the $586 million reported in 1986 and the $61.7 billion reported in 1993-94 by the Texas Department of Commerce. Some of the variation may be a function of the economic health of Texas. In 1986, most of the state was in a severe economic downturn which would depress numbers associated with luxury expenditures. The other possibility is a difference in data collection. The forthcoming update from Texas A&M should help clarify the economic impact of sport and commercial fishing and recreational activity uses of the bay and estuary system.

3.6 SUMMARY

The GIWW, Gulf Coast of Texas and all the industries, ports and infrastructure represent a vital yet delicately balanced economic system. All of the parts together produce a synergy that is stronger than any of the individual parts. In today's climate of accountability, all parts of the economy are under pressure to prove their specific impact and worth. Yet in an interrelated global economy, the isolation of the impact of any part of a whole is difficult.

For example, the portion of chemical, petroleum and other bulk material industries that are dependent on and enhanced by the availability and use of the Texas portion of the GIWW are not included. Yet, their taxes, employees and revenues are increased by the availability of the GIWW and the barge industry. Neither is the impact of global money from outside the USA that is spent on Gulf area industry construction; wages paid to American workers; taxes, etc.

Boating, fishing and vacation-related spending are enhanced and encouraged by the end results of the dredging of the GIWW. See pages 58-60 for the analysis. However, the impact of these GIWW activities are not included in the analysis below.

The economic impact of the GIWW, both direct impact and total impact including indirect and induced, are summarized below in Table 3.19.

Port Cargo Values
The monetary value of the cargo delivered to ports along the Texas portion of the GIWW by barges contribute $2.8 billion to the Texas economy. See pages 43-46 for the analysis.

Dredging
While $18 million was actually spent in 1994 on dredging the Texas portion of the GIWW, because of the indirect and induced spending associated with dredging, Texas actually received the benefit of $64.979 million of revenue.

Water and Water Transportation Services Revenue
Together Water Transportation and Water Transportation Services create revenues of over $585 million in direct impact and almost $2 billion if indirect and induced spending are included.

Income (Payroll)
Almost $190 million in income are added to the Texas economy as a result of Water Transportation and Water Transportation Services wages.

Employment
Water Transportation and Water Transportation Services create over 13,000 jobs in Texas. These numbers reflect employment attributed only to the GIWW.

Taxes

Almost $4 million in sales tax revenue is received as a result of Water Transportation and Water Transportation Services sales tax paid to Texas, and almost $3 million is paid by the barge industry to the federal government via fuel taxes.

TABLE 3.19 Impact Directly Attributable to the GIWW in Texas, 1994

SECTOR	DIRECT IMPACT	MULTIPLIER	TOTAL ECONOMIC IMPACT
DEMAND			
Total Port Cargo Value	*	*	$ 2,842,600,000
Intracoastal Waterway Maintenance Dredging	$18,100,000†	3.59‡	$ 64,980,000
Water Transportation Revenues	$215,500,000	3.25	$ 700,400,000
Water Transportation Services Revenues	$370,100,000	3.25	$ 1,202,800,000
TOTAL DEMAND	**$603,700,000**		**$ 4,810,780,000**
INCOME (PAYROLL)			
Water Transportation	$49,200,000	2.06	$ 101,400,000
Water Transportation Services	$42,900,000	2.06	$ 88,400,000
TOTAL INCOME	**$92,100,000**		**$ 189,800,000**
EMPLOYMENT			
Water Transportation	1,486	3.34	4,965
Water Transportation Services	2,551	3.34	8,525
TOTAL EMPLOYMENT	**4,037**		**13,490**
State Sales Tax	*	*	**$3,914,375**
Federal Fuel Tax	*	*	**$2,920,534**

*No entries were available as a different method was used to calculate port revenue and taxes.

† Two year average

‡ Sector 21 (SIC 1629) Input/Output

Source: U.S. Army Corps of Engineers; Bureau of the Census, Texas County Business Patterns, Washington DC, 1993; Texas Input/Output Model, 1986 Update.

CHAPTER 4: EXTENSION OF THE GIWW INTO MEXICO

Mexico has expressed interest in constructing a canal along its east coast since 1905. NAFTA and the increases in trade levels between the U.S. and Mexico have resulted in renewed enthusiasm for the project and the belief on the part of many that the project is now economically viable. In January 1996, the state of Tamaulipas took a giant step toward realizing this goal by awarding a 27 year concession contract to Grupo Protexa to build and operate a 273.25 mile (437 kilometer) canal from Tampico, Tamaulipas, on the south, to the U.S.-Mexico border.

In July 1996, Arthur Andersen completed a feasibility study that concluded that the project could be economically feasible. They also felt that the canal, which would not only allow access to the GIWW but ultimately to the Great Lakes and Canada, would reduce transportation costs which would increase the amount of trade between the U.S. and Mexico. As a result, Texas would be a major beneficiary as a trading partner, and the lower portion of the GIWW from Corpus Christi to Brownsville would increase in usage.

Before reaching their conclusion, they performed a demand analysis and looked at the following: U.S.-Mexico trade; U.S.-Mexico trade projections; latent demand based on lower transportation costs and increased development; and relative low transportation cost and market capture (based on extensive interviews). They based their forecasts on:

- Current (1995) U.S.-Mexico trade volume;
- Historic U.S.-Mexico trade growth (1991-1995);
- CIEMEX-WEFA Mexico trade balance projections (1996-2005);
- Dean International, Inc. U.S.-Mexico trade value projections (1996-2000);
- NAFTA tariff phase-out schedules;
- U.S. and Mexico economic growth and real exchange rate changes;
- Bulk commodity industry conditions; and
- Interviews with major U.S. and Mexican producers/consumers of bulk commodities.[90]

The summary below does not include propriety information (for example, names of companies and their estimated annual bulk trade or canal revenues/ expenses; strategic recommendations, etc.).

4.1 BACKGROUND

The rights to the coast area of Tamaulipas are owned by the federal government of Mexico, who granted a concession to the state of Tamaulipas who in turn granted a 27 year concession to Grupo Protexa. The Canal Intracostero Tamaulipeco as proposed will have compatible physical specifications to those of the GIWW. "The concession covers the construction, maintenance and operation of the canal, barge terminals, bridge crossings, pipeline crossings, the signalization system, and barrier works."[91] Under the concession agreement, Grupo Protexa would obtain revenues from canal tolls, port services fees, and infrastructure use charges. It would pay concession fees of an initial payment of $40 million pesos and annual payments of 3.5 percent of gross revenue to Canal Intracostero Tamaulipeco, S.A. de C.V. (CITSA) as well as certain additional payments during the construction period.[92]

Grupo Protexa has successfully addressed 90 environmental issues and received the appropriate permits from Mexico and the state of Tamaulipas that will allow construction. The two major hurdles still facing Grupo Protexa are: (1) the 6.25 mile (10-kilometer) extension from the Port of Brownsville ship channel to the Mexican border and (2) sufficient investor money to complete the project.[93]

On the U.S. side, the extension of the GIWW is facing strong opposition from the following groups:

1. U.S. environmental groups fear the increase in traffic between the border and Corpus Christi (Upper and Lower Laguna Madre). If the canal is constructed, environmentalists would loose their battle to close the GIWW through this area.
2. Stevedores at the Port of Brownsville who fear a loss of jobs to the Mexican ports of Tampico and Altamira are opposing the U.S. extension and the construction of the Mexican canal. The Port of Brownsville, also locally referred to as Mexico's northern-most port, has greatly benefited from having a reliable and efficient work force (which in the past could not be said of Tampico and Altamira).*
3. Many of the status quo proponents in Brownsville/Matamoros are fearful of increased competition and changing the tides of fortune.

On the Mexican side, neither the Mexican government nor Tamaulipas have guaranteed the canal investment, which reduces Grupo Protexa's financing options for financing the infrastructure. In addition, Matamoros truckers, who have already been heavily impacted by fierce competition since the 1989 Agreement for the Modernization and Restructuring of the Federal Motor Carrier Freight Industry which brought deregulation and fluctuation

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*The Canal Intracostero Tamaulipeco Feasibility Study, 1996, by Arthur Andersen reports that the "Port of Brownsville will benefit greatly from expanded trade between U.S. and Mexico."

of rates, oppose the construction of the Mexican canal. Lastly, environmental groups on both sides of the border have strong concerns about the construction of the Canal Intracostero Tamaulipeco through environmentally sensitive areas along the coast.

4.2 FEASIBILITY OF THE EXTENSION OF THE GIWW

Unless otherwise noted, all material from this section of the report came from Canal Intracostero Tamaulipeco Feasibility Study, Arthur Andersen, July 1996. Grupo Protexa and Great Lakes Dredge and Dock Company granted permission for the use of this material.

The four major assumptions made by Arthur Andersen related to the feasibility are:

1. The U.S. Gulf Intracoastal Waterway is assumed to be extended to the Mexican border and is assumed to connect with the Canal Intracostero Tamaulipeco.
2. The Canal Intracostero Tamaulipeco is assumed to operate without capacity-related delays.
3. NAFTA is assumed to remain intact.
4. Service on the Tampico-Mexico City/Central Mexico rail lines is assumed to be improved as part of the FNM privatization.

"The Canal Intracostero Tamaulipeco would provide a direct link for barge transportation between Mexico and the U.S. canal system, opening an important new corridor for the transportation of bulk commodities between the two countries...." Most likely, product characteristic on the GIWW extension and the Mexican Canal would initially be similar to those currently using the GIWW; namely, bulk products such as petroleum, chemicals (and related products), cement, steel, and ores. Construction of the Canal would greatly increase the traffic flows on the lower GIWW and the continuation of product flow to major market access points in Mexico. However--

> As a result of the opening of the Canal Intracostero Tamaulipeco, the composition of products on the Mississippi River system, the GIWW, and other canal systems in the U.S. can be expected to change. Certain exports to Mexico and imports from Mexico, which might have previously traveled on rail, truck, or ocean vessel, will switch to the canal system. More diverse and larger traffic volumes will travel on the GIWW and the Mississippi River, as well as other U.S. inland waterway segments such as the Arkansas River, the Missouri River, and the Ohio River.
>
> The U.S. experience in inland and intracoastal barge transportation demonstrates that canal construction promotes industrial development, which in turn can generate increased volumes of bulk commodity movement by barge. Many U.S. industries--such as the petroleum, steel and grain industries--strategically locate production and

distribution facilities on the canal system. These companies build private terminals which internalize loading and unloading costs and reduce overall transportation costs.

4.3 U.S.-MEXICO TRADE

U.S.-Mexico trade fluctuates yearly depending on economic conditions and peso values. As seen in Table 4.1, 1991 imports and exports totaled $64.5 billion with over half in southbound U.S. exports. In December 1994, the Mexican government devalued the peso*, which contributed to the total trade value rising in 1995 to $107.1 billion with $61.7 billion being imports from Mexico. The peso devaluation reduced the U.S. to Mexico traffic from levels that it would have been and increased the Mexico to U.S. traffic.

However, Arthur Andersen "forecasts a slight appreciation of the peso during 1996, a stabilization in its real value between 1997 and 2000, and a gradual appreciation (25 percent in 15 years) between 2001 and 2015...and a long-term average annual real GDP growth rate of 5 percent for Mexico and 2.5 percent for the United States." As the peso increases so will the amount of southbound U.S. traffic.

TABLE 4.1 U.S.-Mexico Trade Value, 1991-1995
(Thousands of U.S. Dollars)

	1991	1992	1993	1994	1995	1991-95 CAGR
Total Southbound Value	$33,275,781	$40,597,451	$41,635,495	$50,840,266	$45,400,604	
% change		*22.0%*	*2.56%*	*22.1%*	*-10.7%*	*8.1%*
Total Northbound Value	$31,194,293	$35,184,150	$39,929,656	$49,492,801	$61,704,999	
% change		*12.8%*	*13.5%*	*23.9%*	*24.7%*	*18.6%*
Total U.S.-Mexico Trade Volume	$64,470,074	$75,781,601	$81,565,151	$100,333,067	$107,105,603	
% change		*17.5%*	*7.6%*	*23.0%*	*6.8%*	*13.5%*

Source: U.S. Department of Commerce, 1996; Arthur Andersen, 1996.

*On December 16, 1994, the peso/dollar exchange rate was 3.4635; on December 22 it was devalued. On December 23 it was 4.7000, and on December 30 it was 5.0750. As of November 25, 1996, the peso is at 7.80.

4.4 U.S.-MEXICO TRADE ANALYSIS

The majority of tons of goods transported in 1995 was northbound (Mexico to U.S.) cargo with 104 million tons. U.S. to Mexico cargo totaled 51 million tons.

TABLE 4.2 U.S.-Mexico Trade, All Goods
All Land-Based and All Maritime Trade: 1995
(tons)

	Transport Mode [1]				
Direction	**Rail**	**Truck**	**Maritime**	**Other**	**Total**
Northbound	18,419,943	19,910,636	61,398,004	4,133,112	103,861,695
Southbound	16,810,364	24,520,746	7,819,174	2,150,408	51,300,692
TOTAL	**35,230,307**	**44,431,382**	**69,217,178**	**6,238,520**	***155,162,387***

[1]Mode of transportation at border crossing.
Source: Reebie Associates, 1995; U.S. Department of Transportation, MARAD Database, 1996, Arthur Andersen, 1996.

Bulk goods are the most likely user group for the canal. See Appendix G for a list of commodities included in each group. Total bulk commodities moving north and south in 1995 are shown below.

TABLE 4.3 U.S.-Mexico Trade, Bulk Commodities
All Land-Based and All Maritime Trade, 1995
(tons)

	Transport Mode [1]				
Direction	**Rail**	**Truck**	**Maritime**	**Other**	**Total**
Northbound	5,289,356	10,541,944	53,132,528	902,493	69,866,321
Southbound	10,903,666	19,115,276	5,486,526	1,376,086	36,881,554
TOTAL	**16,193,022**	**29,657,220**	**58,619,054**	**2,278,579**	***106,747,875***

[1]Mode of transportation at border crossing.
Source: Reebie Associates, 1995; U.S. Department of Transportation, MARAD Database, 1996, Arthur Andersen, 1996.

TABLE 4.4 U.S.-Mexico Trade, Bulk Commodities
All Land-Based and Gulf Maritime Trade
Northbound Trade Movement by Product and by Transport Mode, 1995
Tons

Product	Rail	Gulf Coast Truck	Maritime	Other	Total
Commodity Group A *Grain*	241,757	454,071	719	652,644	**1,349,191**
Commodity Group B *Mineral Fuels and Petroleum Products*	239,488	177,411	45,876,781	1,416	**46,295,096**
Commodity Group C *Salt, Sulfur, Earth and Stone*	17,713	1,468,290	6,021,223	2,677	**7,509,903**
Commodity Group D *Cement, Sand and Gravel*	381,841	167,378	--	37,831	**587,050**
Commodity Group E *Iron and Steel*	519,188	2,678,188	139,116	34,727	**3,371,219**
Commodity Group F *Chemicals*	610,663	759,310	1,029,225	75,407	**2,474,605**
Commodity Group G *Paper, Pulp and Pulpboard*	99,455	766,350	1,485	56,174	**923,464**
Commodity Group H *Ores, Slag, and Ash*	3,153,812	3,513,042	62,271	18,986	**6,748,111**
Commodity Group I *Lumber, Wood*	25,439	557,904	1,708	22,631	**607,682**
NORTHBOUND TOTALS	5,289,356	10,541,944	53,132,528	902,493	*69,866,321*

Source: Arthur Andersen, 1996.

Northbound, crude oil, and petroleum present the largest commodity group (46 million tons); followed by salt, sulfur, earth and stone (7.5 million tons); ores, slag, and ash (6.7 million tons) and iron and steel (3 million tons). Southbound, grain has over 12 million tons followed by refined petroleum products, chemicals, sand and gravel, and paper, pulp and pulpboard. Although total maritime northbound traffic exceeds total southbound traffic, southbound land-based trade is significantly greater than northbound land-based trade as is southbound dry bulk volume greater than northbound.

Presently the major petrochemical production/consumption areas in Mexico are Altamira/Ciudad Madero and Coatzacoalcos, and the major petrochemical production/consumption areas in the U.S. are Houston, New Orleans, and industrial east coast areas such as Charleston. The existing trade dynamics between petrochemical facilities on the Gulf coasts of Mexico and the United States make barge-based transport an attractive option for this sector.

TABLE 4.5 U.S.-Mexico Trade, Bulk Commodities
All Land-Based and Gulf Maritime Trade
Southbound Trade Movement by Product and by Transport Mode, 1995
Tons

Product	Rail	Gulf Coast Truck	Maritime	Other	Total
Commodity Group A *Grain*	5,928,793	3,577,671	2,337,542	386,177	**12,230,183**
Commodity Group B *Mineral Fuels and Petroleum Products*	680,734	2,202,003	2,092,047	137,302	**5,112,086**
Commodity Group C *Salt, Sulfur, Earth and Stone*	20,363	622,018	4,597	20,946	**667,924**
Commodity Group D *Cement, Sand and Gravel*	1,819,434	2,783,833	--	110,251	**4,713,568**
Commodity Group E *Iron and Steel*	295,469	1,162,717	95,778	125,254	**1,679,218**
Commodity Group F *Chemicals*	813,651	3,167,075	936,191	121,657	**5,038,574**
Commodity Group G *Paper, Pulp and Pulpboard*	1,103,417	1,978,269	13,979	438,872	**3,534,537**
Commodity Group H *Ores, Slag, and Ash*	3,153,812	3,513,042	62,271	18,986	**6,748,111**
Commodity Group I *Lumber, Wood*	83,493	1,498,756	6,392	6,924	**1,595,565**
SOUTHBOUND TOTALS	10,903,666	19,115,276	5,486,526	1,376,086	*36,881,554*

Source: Arthur Andersen, 1996.

4.5 EFFECT OF CANAL ON LATENT DEMAND

Latent demand would be trade flows that do not currently exist because they are not price competitive across the border due to high transport costs. Two examples would be Mexican limestone and U.S. coal.

> Texas has consistently ranked number one in exports to Mexico, with its share of total exports (measured in terms of value) increasing from 44.3 percent in 1987 to 46.9 percent in 1994. As hub-based transportation and distribution networks become the logistical system of choice, the State of Texas is developing into an increasingly important relocation center for companies involved in trade with Mexico. With major U.S. firms locating distribution centers in the Dallas-Fort Worth and Houston metropolitan areas, existing Texas-Mexico transportation infrastructure will eventually reach capacity limitations. The development of an inland water link between Texas and northeastern Mexico would not only absorb a share of existing trade volumes and alleviate trade route congestion, but the addition of transport capacity would encourage the development and future growth of latent demand volumes.

4.6 U.S.-MEXICO MODE ANALYSIS

Transportation and distribution of products affect price, profits, condition of the shipped goods, customer satisfaction, etc. When deciding how to transport its products, therefore, factors such as cost, speed, reliability, availability, and compatibility are important.

TABLE 4.6 Transportation Mode Comparison

Economic Characteristics	Rail	Truck	Ocean Vessel	Barge
Cost	moderate	high	low	low
Market Coverage	point to point, terminal to terminal	point to point	terminal to terminal	terminal to terminal
Predominant Traffic	low/mod value mod/high density	all	low value high density	low value high density
Equipment Capacity	70-100 tons	10-25 tons	5,000-70,000 tons	1,500 tons
Service Characteristics	**Rail**	**Truck**	**Ocean Vessel**	**Barge**
Speed	moderate	fast	slow	slow
Availability	moderate	high	low	moderate
Consistency	moderate	high	low	low
Loss and Damage	moderate/high	low	low-moderate	low-moderate
Flexibility	moderate	high	low	low

Source: Arthur Andersen, 1996.

Rail

The largest carrier of freight tonnage of bulk products is the railroad. Rail's most significant advantages include lower costs than trucking, consistency and wide market coverage, and ease of cargo transfer. The recent merger of Union Pacific/Southern Pacific will likely make it "a stronger U.S. competitor for the provision of rail service within Mexico as the privatization of FNM unfolds." (In 1995, legislation was passed in Mexico authorizing private sector investment in the national rail system, Ferrocarriles Nacionales de Mexico, FNM). The main disadvantage of transportation between the U.S. and Mexico has been the availability and reliability within Mexico.

Truck

The biggest advantages of trucking are speed and convenience. "Trucks average 95-105 kilometers per hour, and truck transport is the only mode of transportation which can deliver directly to any final destination, giving truck transportation the clear advantage in delivery time and convenience." With the deregulation of the trucking industry, it is increasingly competitive with rail, but it is still substantially higher than rail and other competitive modes.

Maritime

Ocean transport carries the largest sizes of cargo—normally between 5,000 and 70,000 tons. Cargo shipped by ocean is normally low-value, non-perishable bulk products. Currently, crude oil from Mexico to the U.S. dominates all competing modes of transportation. Large quantities of grain and refined petroleum products also use ocean transport. Ocean vessels are difficult to use for small lot sizes and typically are incapable of providing point-to-point service.

Additionally, "Mexican port conditions require the use of shallow draft medium sized line vessels with capacities of between 20,000 and 40,000 tons..." while most international carriers have converted to deep draft ships. "The privatization of Mexican ports can be expected to gradually change these conditions."

Barge transportation is versatile (bulk goods, dry good, liquids), can transport varying lot sizes, and has the lowest cost for smaller loads. However, barge is the slowest of the modes in terms of delivery time. In addition, outside of the immediate vicinity of the canal intermodal transport adds to the costs, decreases the safety, and possibly delays transport.

> Specific to the Canal Intracostero Tamaulipeco, it is anticipated that a final disadvantage will be inertia. Regardless of barge transportation's inherent cost advantages, many shippers will not immediately ship because of their unfamiliarity with water-based modes of transportation, their established relationships with operators of alternative modes of transportation, and because of substantial investment in distribution facilities strategically located along land-based transport routes.

TABLE 4.7 U.S. Barge Transportation Representative Rates (U.S. Dollars)

	Per ton	Per ton-mile
Covered Hopper (50% backhaul)		
Carrier: ACBL		
Dry Bulk	$6.00	$.0148
Tank Barge (50% backhaul)		
Carrier: (deleted on request of carrier)		
Crude Oil	$4.23	$.0104
Petroleum	$4.00	$.0099
Chemicals	$7.60	$.0187

Source: Arthur Anderson, 1996.

TABLE 4.8 Canal Intracostero Tamaulipeco Estimated Barge Transportation Rates (U.S. Dollars)

Brownsville-Tampico	Distance	Per ton-mile	Rate Estimate
Dry Bulk (Hopper Barge)	272	$.0148	$4.02
Liquid Bulk (Crude Oil)	272	$.0104	$2.83
Liquid Bulk (Petroleum)	272	$.0099	$2.68
Liquid Bulk (Chemicals)	272	$.0187	$5.09

Source: Arthur Andersen, 1996.

4.7 COMPETITIVE MODE RATES

Arthur Andersen presented the following survey results showing that barge transportation is the lowest cost mode of transportation on a per ton-mile basis.

TABLE 4.9 Average Unit Transport Cost by Mode, Dry Bulk[1], U.S. Dollars

Mode	Average Rate per Ton-Mile
U.S. Barge	$0.0148
U.S. Rail	$0.0390
U.S. Trucking	$0.0830
U.S.-Mexico Ocean Shipping	$0.0250
Mexico Trucking	$0.0350
Mexico Rail	$0.0190

[1]Transport costs reflect normalized rates charged to users for direct transport only, for an average route and commodity. Figures presented in the table reflect Arthur Andersen's interviews with numerous U.S. and Mexican carriers and shippers.
Source: Arthur Andersen, 1996.

Arthur Andersen also presented the following table for projected northbound traffic (from Mexico to the U.S.) and southbound traffic (from the U.S. to Mexico): sand and gravel, grain, and chemicals comprise the largest commodity groups for southbound traffic, while limestone, mineral fuels/petroleum products, chemicals and iron/steel are the largest northbound commodity groups.

TABLE 4.10 Projected Northbound Traffic Volume (1998-2020)
Canal Intracostero Tamaulipeco
(Thousands of tons)

Product	1998	1999	2000	2005	2010	2015	2020
Commodity Group A *Grain*	266	306	369	444	503	563	604
Commodity Group B *Mineral Fuels and Petroleum Products*	2,010	2,169	2,450	2,795	3,516	4,048	4,489
Commodity Group C *Salt, Sulfur, Earth and Stone*	693	761	875	1,186	1,374	1,630	1,891
Commodity Group D *Cement, Sand and Gravel*	112	112	118	446	486	517	527
Commodity Group E *Iron and Steel*	849	928	1,061	1,433	1,662	1,916	2,170
Commodity Group F *Chemicals*	881	951	1,075	1,390	1,792	2,084	2,415
Commodity Group G *Paper, Pulp & Pulpboard*	320	363	432	566	665	783	918
Commodity Group H *Ores, Slag, and Ash*	541	589	670	803	894	989	1,070
Commodity Group I *Lumber, Wood*	108	117	133	164	188	216	247
Other Captured Demand *Limestone*	2,930	3,164	3,417	5,021	6,408	8,256	9,116
NORTHBOUND TOTALS	**8,710**	**9,461**	**10,599**	**14,491**	**17,488**	**21,002**	**23,447**

Source: Arthur Andersen, 1996.

TABLE 4.11 Projected Southbound Traffic Volume (1998-2020)
Canal Intracostero Tamaulipeco
(Thousands of tons)

Product	1998	1999	2000	2005	2010	2015	2020
Commodity Group A *Grain*	2,206	2,446	2,697	2,737	2,960	3,201	3,444
Commodity Group B *Mineral Fuels and Petroleum Products*	120	133	147	167	179	190	201
Commodity Group C *Salt, Sulfur, Earth and Stone*	153	166	180	230	234	248	257
Commodity Group D *Cement, Sand and Gravel*	2,305	2,595	2,653	3,250	3,506	3,783	4,066
Commodity Group E *Iron and Steel*	320	355	392	435	466	497	525
Commodity Group F *Chemicals*	1,605	1,793	1,992	2,261	2,576	2,790	3,008
Commodity Group G *Paper, Pulp & Pulpboard*	938	1,031	1,127	1,337	1,445	1,561	1,680
Commodity Group H *Ores, Slag, and Ash*	152	176	203	245	282	328	379
Commodity Group I *Lumber, Wood*	157	183	199	289	356	447	564
Other Captured Demand *Coal*	--	--	--	2,297	2,297	2,297	2,297
SOUTHBOUND TOTALS	**7,956**	**8,877**	**9,590**	**13,248**	**14,301**	**15,342**	**16,421**

Source: Arthur Andersen, 1996.

4.8 SUMMARY AND NEED FOR FURTHER STUDY

In the scenario presented by Arthur Andersen, the opening of the Canal Intracostero Tamaulipeco would be a win-win event for both Mexico and the U.S. and would increase trade in bulk goods which are not currently economically feasible.

Resources were not available to check the validity of information that the Arthur Andersen

study used in making their conclusion, nor the letters of intent submitted by prospective users. The authors therefore suggest further study of the issue. In particular, the following need to be addressed:

1. The probability of a 50 percent backhaul on the Canal Intracostero Tamaulipeco.
2. The probability that rates charged would be those quoted given the tolls that would be charged by canal operators.
3. The level of canal usage in the early years after completion.
4. The adequacy of the proposed environmental procedures.

Without the extension from the Port of Brownsville to the Mexican border, the Canal Intracostero Tamaulipeco would not be feasible. Until a formal request is made for the U.S. extension and attorneys have time to review the documents, Paul Storing, Special Assistant, International Boundary and Water Commission, reports that the exact requirements for the border extension are not known. Preliminary review indicates that a Presidential Permit would probably be required but until the formal request is made and reviewed, no determination can be made.[94] Appendix K has a copy of a March 1995 memo giving procedures for a Presidential Permit if it is determined that it is needed.

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APPENDICES

Appendix A--Texas Counties Directly Impacted by the GIWW

Aransas
Brazoria
Calhoun
Cameron
Chambers
Galveston
Harris
Jackson
Jefferson
Kenedy
Kleberg
Liberty
Matagorda
Nueces
Orange
Refugio
San Patricio
Victoria
Willacy

Appendix B--1995 Texas Business Growth
SIC Codes 28 and 29

1995 Expansions, SIC Code 28						
Company	Location	Inves (000)	Emps	Foreign Inv	Type	Activity
COASTAL:						
Georgia Gulf Co.	Pasadena	$ 20,000			E	Cumene
Chevron Chemical Co.	Baytown				E	Polyethylene
Mobile Chemical Co.	Beaumont	$ 20,000			E	Synthetic Base Lube Stock
Oxymar	Ingleside				E	Vinyl Chloride
Huntsman Corp.	Port Arthur				E	Ethylene
Hoechst Celanese Corp.	Clear Lake				E	Acrylic Acid
ICI Americas Inc./Acrylics Division	Beaumont	$ 50,000			E	Methyl Methacrylate
Dow Chemical Corp.	Freeport				E	Metallocene
BASF Corp.	Freeport				E	Nylon-6 Polymers
Sterling Chemicals, Inc.	Texas City				E	Methanol
Bayer Corp.	Baytown	$ 93,000	20		E	Maleic Anhydride
Goodyear Tire & Rubber Co.	Beaumont	$ 16,000			E	Chemicals
BASF Corp.	Freeport	$ 200,000	50		E	Acrylic Acid
Huntsman Corp.	Port Neches	$ 10,800			E	Butadiene
Hoechst Celanese & Molten Metals	Bay City	$ 25,000			N	Recycling
Air Products and Chemicals, Inc.	Pasadena	$ 40,000			N	Hydrogen
Advanced Aromatics, Inc.	Baytown	$ 3,000			E	Naphthalene
Exxon Corp.	Baytown		170		E	Ethylene
Formosa Plastics	Texas City	$ 500,000			N	Ethylene
FMC Corp.	Bayport	$ 65,000			E	Hydrogen Peroxide
Chevron Chemical Co.	Port Arthur	$ 300,000			E	Ethylene
Sterling Chemicals	Houston	$ 40,000			N	Oxidation Plant
Exxon Chemical America	Baytown		50		E	Polypropylene
Mobile Corp.	Beaumont	$ 200,000	600		N	Paraxylene
Koch Chemical	Corpus Christi				E	Mixed Xylenes
Huntsman Corp.	Port Arthur	$ 5,000			E	Aromatics Extraction
Ishihara Sangyo	Houston	$ 40,000			N	Magnetic Iron Oxides
Rohm and Haas Co.	Houston	$ 20,000			N	Acrylic
BP Chemicals, Inc.	Port Lavaca	$ 50,000			E	Acrylonitrile
Praxair Hydrogen Supply	Texas City	$ 40,000			N	Natural Gas Conversion
Solvay Interox	Deer Park	$ 80,000			N	Hydrogen Peroxide
Hoechst Celeanese Chemical	Bay City				E	Palargonic Acids
Alabaster Corp.	Pasadena		6		N	Microbes
American Clean Fuels Co.	Texas City	$ 100,000	30		N	Fuel Additive
Chevron Chemical	Orange	$ 50,000			E	Polyethylene
Dow Chemical	Freeport	$ 60,000			E	Tolulen diisocyanate
Schenectady International	Freeport	$ 17,200			E	Paranonyl Phenol
Arco Chemical Co.	Channelview	$ 1,000			N	Chemicals
Tanox Biosystems	Houston	$ 5,300			E	Pharmaceuticals
Akzo Nobel Chemicals	Pasadena	$ 1,500			E	Catalysts
Kaneka Texas Corp.	Pasadena				E	Gum and Wood Chemicals
SUBTOTAL (COASTAL)		$ 2,052,800	926			

1995 Expansions, SIC Code 28 (Continued)						
Company	Location	Inves (000)	Emps	Foreign Inv	Type	Activity
NON-COASTAL						
Rexene Corp.	Odessa	$ 60,000	30		N	Flex Polyolefins
Circle MG Products, Inc.	Snyder		3		E	Calcium Chloride
Phillips Petroleum Co.	Sweeny				E	Ethylene
Kittrich Corp.	Dallas				E	Mouse Pellets
K-Klean, Inc.	McKinney				E	Detergents
McCoy Defalco Electrochemicals, Inc.	Pearland		3		N	Engine Treatment
Eastman Chemical Co./Texas	Longview	$ 500			E	Ethylene
Reichhold Chemicals	Houston				E	Polyester
Eurostar Perfumes, Inc.	Pleasanton		25		E	Perfumes
Natera	Carrollton				E	Cosmetics
Jones Blair Paint	Dallas	$ 1,200			E	Paint
Carrington Laboratories	Irving				E	Ointments
Carolina Color Corp.	Lancaster				E	Color Concentrates
Diamond Shamrock, Inc.	Three Rivers				E	Natural Liquid Gas
Nont Americas	Marshall	$ 6,000			N	Carbon Reactivation
Rx America	Fort Worth		400		N	Pharmaceuticals Distr.
Fleming Companies	Dallas	$ 5,600	250		E	Health & Beauty Items
Mary Kay Cosmetics	Carrollton				N	Cosmetics
Mary Kay Cosmetics	Dallas				E	Cosmetics
Mission Pharmacal	San Antonio				N	Pharmaceuticals
Air Liquide America	Grand Prarie	$ 1,200			E	Industrial Gases
Diamond Shamrock	Mont Belvieu				E	Propylene
Phillips Petroleum	Borger				E	Methyl Mercaptan
Conoco	Bryan		15		N	"Liquid Power"
Teknor Color Co.	Kilgore	$ 1,000	14		N	Color Concentrates
Agricultural Warehouse	Ennis	$ 1,500			E	Warehouse
Benjamin Moore	Mesquite	$ 4,800			E	Paints
Tecnol Medical Products	Fort Worth	$ 4,000	50		N	Pharmaceuticals
Clarke Products	Grand Prarie				E	Acrylic
Air Liquide	Nederland	$ 34,000			E	Industrial Gas
SUBTOTAL		**$ 119,800**	**790**			
TOTAL (Coastal & Non-Coastal)		**$ 2,172,600**	**1716**			

1995 Expansions, SIC Code 29						
Company	Location	Inves (000)	Emps	Foreign Inv	Type	Activity
COASTAL:						
Mobley Co., Inc.	Baytown	$ 4,000	35		N	Oil Filter Recycling
Tenneco Business Services	Houston		225		N	Business Center
Unocal Corp.	Sugar Land		250		E	Oil & Gas
Clark Refining and Marketing	Port Arthur	$ 195,000			E	Oil Refining
Deer Park Refining Ltd.	Houston	$ 200,000	95		N	Refining
Deer Park Refining	Houston	$ 200,000	95		N	Refining
Transamerican Natural Gas	Houston	$ 1,900			E	Oil & Gas Exploration
Occidental Petroleum Corp.	Houston		60		E	Engineering
Subtotal		**$ 600,900**	**760**			
NON-COASTAL:						
Walthall Ready Mix	Nederland		10		N	Concrete
Diamond Shamrock, Inc.	Three Rivers				E	Refinery
Exxon	Irving	$ 85,000	400		N	Oil
Quaker State Corp.	Dallas		330		N	Corp. HQ
James Hardie Building Products	Cleburne	$ 50,000	165		N	Fiber Cement
Longview Asphalt Co.	Longview		45		N	Asphalt
Bentley-Harris Mfg. Co.	El Paso		60		N	Woven Coverings for Wires
Subtotal		**$ 135,000**	**1010**			

Source: "1995 Texas Business Growth," Office of Growth and Retention, Business Development Division, Texas Department of Commerce, February 1996.

Appendix C--1993 County Business Patterns, U.S. Census Bureau

CHEMICAL AND ALLIED PRODUCTS			
COUNTY	NUMBER OF ESTABLISHMENTS	NUMBER OF EMPLOYEES	ANNUAL PAYROLL
			$ 1,000
Aransas	1	0-19	W
Brazoria	24	9,893	539,828
Calhoun	7	2,964	141,611
Cameron	13	325	3,993
Chambers	3	1000-2499	W
Galveston	13	3,274	168,415
Harris	280	24,922	1,219,732
Jackson	•	•	•
Jefferson	26	6,150	295,428
Kenedy	•	•	•
Kleberg	1	0-19	W
Liberty	2	20-99	W
Matagorda	3	500-999	W
Nueces	9	1,688	83,055
Orange	9	3,331	166,887
Refugio	•	•	•
San Patricio	7	1,356	64,507
Victoria	4	1000-2499	W
Willacy	•	•	•
TOTALS	402	53,903	2,683,456
(W = Withheld)		(+2620 to 6134)	(+ ?)

PETROLEUM AND COAL PRODUCTS			
COUNTY	NUMBER OF ESTABLISHMENTS	NUMBER OF EMPLOYEES	ANNUAL PAYROLL
			$ 1,000
Aransas	1	0-19	W
Brazoria	1	1000-2499	W
Calhoun	2	100-249	W
Cameron	2	20-99	W
Chambers	•	•	•
Galveston	6	2,934	146,552
Harris	35	5,940	312,170
Jackson	•	•	•
Jefferson	9	5,359	271,348
Kenedy	•	•	•
Kleberg	•	•	•
Liberty	•	•	•
Matagorda	•	•	•
Nueces	12	2,997	147,593
Orange	1	0-19	W
Refugio	•	•	•
San Patricio	1	0-19	W
Victoria	1	0-19	W
Willacy	•	•	•
TOTALS	71	17,230	877,663
(W=Withheld)		(+1120 to 2923)	(+ ?)

OIL AND GAS EXTRACTION			
COUNTY	NUMBER OF ESTABLISHMENTS	NUMBER OF EMPLOYEES	ANNUAL PAYROLL
			$ 1,000
Aransas	5	*100-249*	*W*
Brazoria	31	412	13,755
Calhoun	4	*20-99*	*W*
Cameron	5	*0-19*	*W*
Chambers	16	*500-999*	*W*
Galveston	24	*250-499*	*W*
Harris	942	23,565	1,122,224
Jackson	13	150	3,022
Jefferson	26	628	22,790
Kenedy	*	*	*
Kleberg	9	*100-249*	*W*
Liberty	26	142	2,860
Matagorda	7	53	1,088
Nueces	197	1,578	48,447
Orange	8	*20-99*	*W*
Refugio	21	350	11,160
San Patricio	21	89	1,655
Victoria	55	*500-999*	*W*
Willacy	3	10	166
TOTALS	1,413	26,977	1,227,167
(W = Withheld)		*(+ 1490 to 3212)*	*(+ ?)*

NON-METALLIC MINERALS			
COUNTY	NUMBER OF ESTABLISHMENTS	NUMBER OF EMPLOYEES	ANNUAL PAYROLL
			$ 1,000
Aransas	*	*	*
Brazoria	6	*20-99*	*W*
Calhoun	*	*	*
Cameron	1	*0-19*	*W*
Chambers	1	*0-19*	*W*
Galveston	2	*0-19*	*W*
Harris	27	254	8,088
Jackson	*	*	*
Jefferson	4	*20-99*	*W*
Kenedy	*	*	*
Kleberg	1	*0-19*	*W*
Liberty	8	67	1,159
Matagorda	*	*	*
Nueces	1	*20-99*	*W*
Orange	3	*20-99*	*W*
Refugio	*	*	*
San Patricio	3	8	229
Victoria	2	*100-249*	*W*
Willacy	*	*	*
TOTALS	59	329	9,476
(W = Withheld)		*(+180 to 721)*	*(+ ?)*

Appendix D--Reported Gross Sales and Taxable Sales, 1986 and 1993

CHEMICAL AND ALLIED PRODUCTS REPORTED GROSS SALES AND TAXABLE SALES				
	1986		1993	
County	Gross Sales	Taxable Sales	Gross Sales	Taxable Sales
Aransas	*	*	*	*
Brazoria	134,961,820	45,931,602	228,721,905	104,497,044
Calhoun	-	2,884,479	15,365,579	114,298,247
Cameron	6,526,308	650,332	24,612,077	2,384,613
Chambers	*	*	*	*
Galveston	334,987,371	48,036,885	386,656,359	168,159,194
Harris	2,894,840,784	177,720,837	4,717,763,268	404,223,904
Jackson	*	*	*	*
Jefferson	311,253,874	17,048,752	275,570,078	28,514,816
Kenedy	-	-	-	-
Kleberg	*	*	*	*
Liberty	14,404,758	1,188,785	3,815,992	1,534,626
Matagorda	*	*	5,584,593	48,019
Nueces	432,584,105	27,827,060	96,619,522	50,523,533
Orange	146,134,953	9,814,470	54,802,624	9,213,668
Refugio	*	*	*	*
San Patricio	4,589,823	524,120	2,068,893	8,059,984
Victoria	14,130,887	2,622,416	23,041,041	3,238,378
Willacy	*	*	*	*
TOTAL	4,294,414,683	334,249,738	5,834,621,931	894,696,026
* Indicates data not available or omitted to avoid disclosure.				
Source: Comptroller of Public Accounts, Research Division				

PETROLEUM AND COAL PRODUCTS REPORTED GROSS SALES AND TAXABLE SALES				
	1986		1993	
County	Gross Sales	Taxable Sales	Gross Sales	Taxable Sales
Aransas	-	-	-	-
Brazoria	3,302,442	5,561,662	*	*
Calhoun	-	-	-	-
Cameron	*	*	*	*
Chambers	*	*	-	88,697,806
Galveston	371,045,219	155,825,556	2,156,690,713	117,181,868
Harris	3,180,215,624	1,080,314,970	4,323,710,358	1,378,986,356
Jackson	*	*	*	*
Jefferson	1,586,599,373	9,186,379	582,434,310	1,476,734
Kenedy	-	-	-	-
Kleberg	-	-	-	-
Liberty	*	*	*	*
Matagorda	*	*	*	*
Nueces	1,130,213,587	15,576,828	77,426,066	65,008,176
Orange	*	*	*	*
Refugio	-	-	-	-
San Patricio	*	*	*	*
Victoria	*	*	*	*
Willacy	*	*	*	*
TOTAL	6,271,376,245	1,266,465,395	7,140,261,447	1,651,350,940
* Indicates data not available or omitted to avoid disclosure.				
Source: Comptroller of Public Accounts, Research Division				

OIL AND GAS EXTRACTION				
REPORTED GROSS SALES AND TAXABLE SALES				
	1986		1993	
County	Gross Sales	Taxable Sales	Gross Sales	Taxable Sales
Aransas	*	*	*	*
Brazoria	12,765,716	1,163,514	22,015,043	2,054,392
Calhoun	5,466,417	2,822,622	72,392,249	235,106
Cameron	*	*	*	*
Chambers	1,599,754	152,213	945,600	349,921
Galveston	599,857,407	2,239,689	20,620,696	7,532,317
Harris	275,320,153	647,366,697	2,734,533,527	744,507,074
Jackson	14,107,576	314,334	9,714,683	2,197,227
Jefferson	9,783,463	2,839,130	25,849,798	7,677,039
Kenedy	-	-	-	-
Kleberg	4,543,825	367,574	5,413,348	573,892
Liberty	20,462,736	4,758,253	20,942,801	7,125,952
Matagorda	6,344,098	4,431,732	*	*
Nueces	36,749,741	13,528,454	72,632,531	20,685,622
Orange	*	*	*	*
Refugio	9,412,270	4,777,099	9,156,449	3,359,409
San Patricio	3,484,285	1,107,760	2,998,905	1,017,362
Victoria	29,760,210	7,740,034	20,465,990	5,145,799
Willacy	*	*	*	*
TOTAL	1,029,657,651	693,609,105	3,017,681,620	802,461,112

* Indicates data not available or omitted to avoid disclosure.

Source: Comptroller of Public Accounts, Research Division

NONMETALLIC MINERALS, EXCEPT FUELS REPORTED GROSS SALES AND TAXABLE SALES					
	1986			1993	
County	Gross Sales	Taxable Sales		Gross Sales	Taxable Sales
Aransas	*	*		*	*
Brazoria	*	*		*	*
Calhoun	-	-		-	-
Cameron	9,740	7,393		*	*
Chambers	-	-		-	-
Galveston	*	*		*	*
Harris	13,513,020	815,750		10,037,077	6,455,428
Jackson	-	-		-	-
Jefferson	*	*		*	*
Kenedy	-	-		-	-
Kleberg	-	-		-	-
Liberty	6,552,306	832,802		*	*
Matagorda	*	*		*	*
Nueces	*	*		*	*
Orange	1,086,909	463,461		1,072,389	51,143
Refugio	-	-		-	-
San Patricio	*	*		*	*
Victoria	*	*		*	*
Willacy	-	-		-	-
TOTAL	21,161,975	2,119,406		11,109,466	6,506,571
* Indicates data not available or omitted to avoid disclosure.					
Source: Comptroller of Public Accounts, Research Division					

Appendix E--Terms, Methodology, and Summary of Martin Associates Study

TERMS

Direct jobs -- "Those jobs with local firms providing support services to the seaport. These jobs are dependent upon this activity and would suffer immediate dislocation if the seaport activity were to cease. Seaport direct jobs include jobs with railroads and trucking companies moving cargo to and from the port's marine terminals and private terminals, members of the International Longshoremen's Association (ILA) and non-ILA dockworkers, steamship agents, freight forwarders, ship chandlers, warehouse operators, bankers, lawyers, terminal operators, stevedores, etc."

Induced jobs -- "Jobs created locally and throughout the regional economy due to purchases of goods and services by those directly employed. These jobs are with grocery stores, the local construction industry, retail stores, health care providers, local transportation services, etc., and would also be discontinued if seaport activity were to cease."

Indirect jobs -- "Those jobs generated in the local economy as the result of local purchases by the firms directly dependent upon seaport activity. These jobs include jobs in local office supply firms, equipment and parts suppliers, maintenance and repair services, etc."

Related jobs -- "Jobs with manufacturing and distribution firms such as steel fabrication firms using the steel imported through the marine terminals. Related jobs are not dependent upon the seaport marine terminals to the same extent as are the direct, induced and indirect jobs. For example, these firms can and do use other ports. It is the demand for the final product, i.e. steel products, that creates the demand for the employment with these shippers/consignees, not the use of a particular seaport or marine terminal."

Employee earnings -- "Consist of wages and salaries and include a re-spending effect (local purchases of goods and services by those directly employed)."

Business revenue -- "Total business receipts by firms providing services in support of the marine activity."

State and local taxes -- "Includes taxes paid by individuals as well as firms dependent upon the seaport activity."

METHODOLOGY

The Martin Associates "study is based on interviews with 840 firms providing services to the cargo and vessels handled at The Port of Houston Authority's (PHA's) marine terminals and the private terminals along the Houston Ship Channel. These 840 firms represent more than 95 percent of the firms in the Houston seaport community, underscoring the defensibility of the study. Furthermore, the impacts can be traced back to the individual firm. The data collected from the interviews were then used to develop

an operational model of the PHA public and private marine terminals."

"No input-output models were used in this study to estimate employment multiplier impacts, but instead, re-spending models were developed using actual consumption patterns of Houston area residents. The use of input-output models assumes that the geographical spending patterns of firms throughout the product supply chain (from the retail level to the raw material level) can be determined with certainty, and impacts are estimated at each level of purchases. As a result, the level of defensibility of the input-output approach is reduced, as the size of the region for which impacts are to be estimated at becomes smaller. The input-output approach is more defensible for use in measuring national impacts for large, well-defined, industries such as the automobile industry or steel industry. Instead of using the input-output method to estimate the impacts at the various levels of purchases by individuals, the approach used in this study only estimated the impacts at the first level (retail) and the second level (wholesale) of purchases. For purchases by firms, this study only estimates the indirect impacts associated with the first round of purchases, and these local purchases are based on interview results, not input-output models. As a result, in order to ensure defensibility, the impacts estimated in this report are conservative by design."

Source: The Local and Regional Economic Impacts of the Port of Houston, prepared for the Port of Houston Authority by Martin Associates, May 1995.

SUMMARY OF STUDY

Background

The Port of Houston Authority (PHA) retained Martin Associates to estimate the economic impacts generated in 1994 by the cargo activities at their public and private terminals. Martin Associates utilized the same methodology as was used in the 1986 study with which this research will be compared.

The following exhibit prepared by Martin Associates is a visual representation of how seaport activity creates four types of economic impacts in the economy: (1) jobs; (2) employee earnings; (3) business revenue; and (4) state and local taxes.

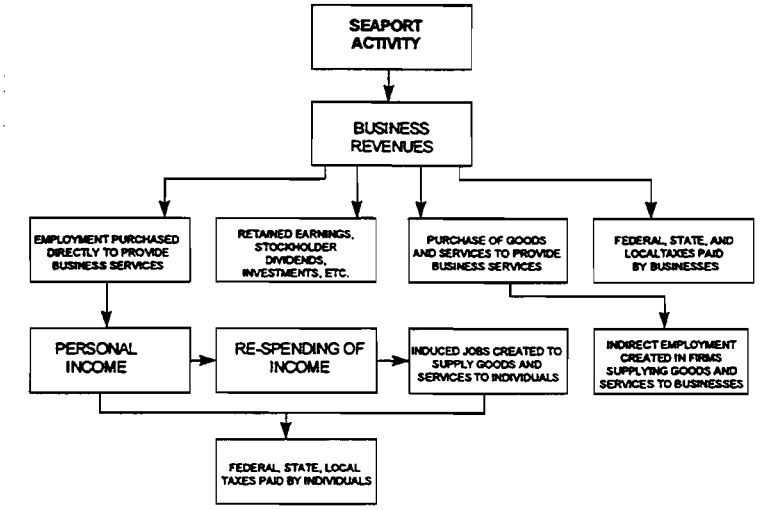

FIGURE E.1 Flows of Economic Impacts Through the Economy

Source: The Local and Economic Impacts of the Port of Houston, prepared for the Port of Houston Authority by Martin Associates, May 1995, p. E-2.

Conclusion

The Port of Houston significantly contributes to employment, personal income, revenue and taxes. In 1994, Martin Associates estimated that the Port of Houston generated a total of 195,898 jobs. Of this amount, 33,237 were direct jobs; 19,243 were induced jobs; and 4,018 were indirect jobs. An additional 139,400 were related jobs. Of the total jobs generated, about 140,000 were held by Texas residents.* The 8,263 direct jobs generated by the marine cargo activity at the public portion of the Port of Houston would disappear if Port activity ceased, as would the 3,817 induced jobs generated by the local purchases

*Martin Associates, The Local and Regional Economic Impacts of the Port of Houston, prepared for the Port of Houston Authority, May 1995, E-6, II-1.

of these individuals and the 1,127 indirect jobs created by the purchases of the firms providing services to the PHA marine terminal.

A total of over $2.7 billion was created in personal income, with approximately $1.3 billion in direct personal income and about $1.5 billion in re-spending. The 33,237 direct employees actually earned the $1.3 billion which translates into an average salary of $38,653, which is 22 percent higher than the average earnings in the Houston area.

Business revenue created was over $5.5 billion. This means that business services at the marine terminals created this revenue. The value of the cargo moved is not included in this figure.

Port activity also generates tax revenue. State and local taxes generated were $213 million, and U.S. Customs receipts totaled almost $300 million.*

TABLE E.1 Summary of the Economic Impacts Generated by the Port of Houston

JOBS	
Direct	33,237
Induced	19,243
Indirect	4,018
TOTAL	***56,498***
RELATED JOBS	***139,400***
PERSONAL INCOME ($1,000)	
Direct	$1,284,723
Re-spending	$1,446,598
TOTAL	***$2,731,321***
BUSINESS REVENUE ($1,000)	***$5,532,373***
STATE AND LOCAL TAXES ($1,000)	***$213,371***
U.S. CUSTOMS RECEIPTS ($1,000)	***$295,500***

Source: The Local and Regional Economic Impacts of the Port of Houston, prepared for the Port of Houston Authority by Martin Associates, May 1995.

Comparison of 1986 and 1994 Economic Impacts of Public and Private Marine Facilities

* Ibid., E-5, E-6.

- *Jobs*

Direct jobs increased by about 4,500, mostly in the shippers/consignee related to liquid bulk cargoes. There was an increase of 24 million tons in liquid bulk cargo. Terminal employees and warehouse operators working with containerized cargo and trucks also grew. Jobs reduced were the following: railroad, steamship, independent container repair, and leasing firm jobs. Jobs created by general cargo commodities (container, steel, breakbulk, and bagged grain) also fell primarily because of increased efficiency in loading and off loading. Related jobs grew by 63,000 because of the growth of containerized cargo, iron and steel products, breakbulk cargo, and grain exports.*

- *Personal Income*

The wages and salaries (excluding benefits) received by employees directly employed in seaport activity grew by about $500 million in nominal dollars (current dollar value). Martin Associates reports that "Annual salaries per direct job increased from about $32,312 in 1986 (expressed in 1994 dollars) to $38,653 per direct employee, reflecting growth in the higher paying jobs with port dependent shippers/consignees."**

Business Revenue

Business revenue grew by about 53 percent from 1986 to 1994, generating $5.5 billion in business revenue in 1994. Analysis of business revenue impact by commodity reveals large growths in liquid and dry bulk. Liquid bulk doubled in impact per ton from $15 to $30, and dry bulk increased from $18 to $38. More modest gains were found in containerized cargo and automobiles. Reduction in revenue impact per ton occurred in petroleum, breakbulk, grain, steel, and bagged grain. Of particular note is the reduction in breakbulk impact per ton from $133.50 to $66 and in bagged grain from $94 to $44.

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* Ibid., V-4, V-5.

** Ibid., E-10.

TABLE E.2 Comparison of Total Revenue Generated by Activity at the Port of Houston, 1986 and 1994

SECTOR	PORT OF HOUSTON REVENUE ($ Millions)		PERCENT OF TOTAL REVENUE	
	1986	1994	1986	1994
Surface Transportation	1400.0	3500.0	47.0	64.0
Maritime Service	730.0	1400.0	24.0	25.0
Banking and Insurance	550.0	535.7	19.0	9.8
Port of Houston Authority	33.0	66.0	1.0	1.2
Federal Government*	270.0	---	9.0	---
TOTAL	**2983.0**	**5501.7**	**100.0**	**100.0**

*Omitted from the 1994 study because Custom fees collected specifically related to port activities could not be determined.
Source: The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority by Martin Associates. November 1987; The Local and Regional Economic Impacts of the Port of Houston Prepared for the Port of Houston Authority by Martin O'Connell Associates. May 1995; Garrett, Hillary and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

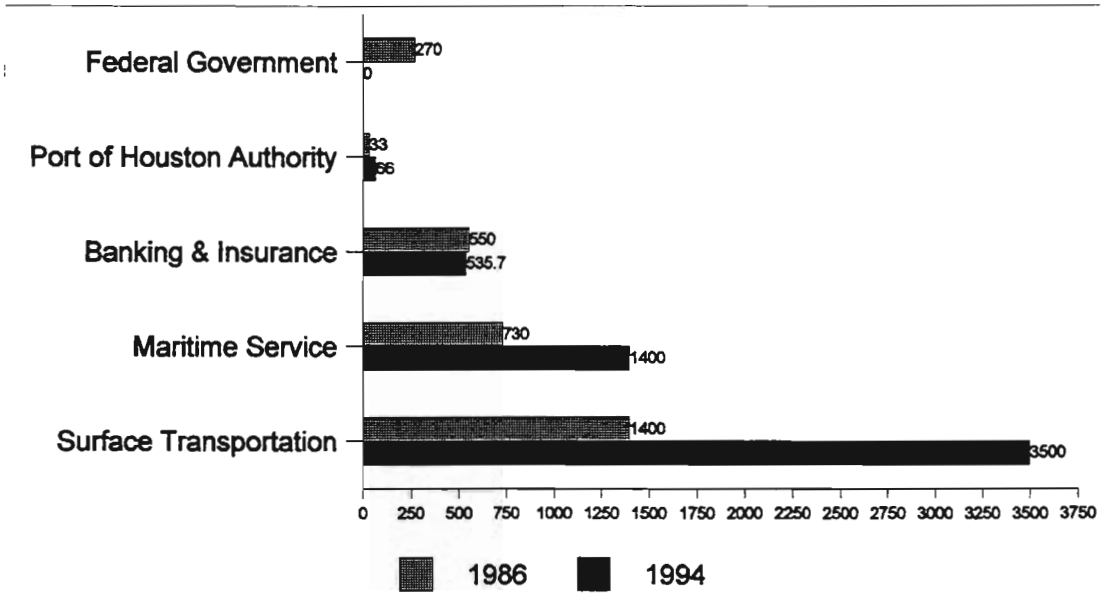

FIGURE E.2 Comparison of Total Revenue Generated by Activity at the Port of Houston, 1986 and 1994

Source: Martin Associates, The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority. November 1987; Martin O'Connell Associates, The Local and Regional Economic Impacts of the Port of Houston. Prepared for the Port of Houston Authority, May 1995; Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

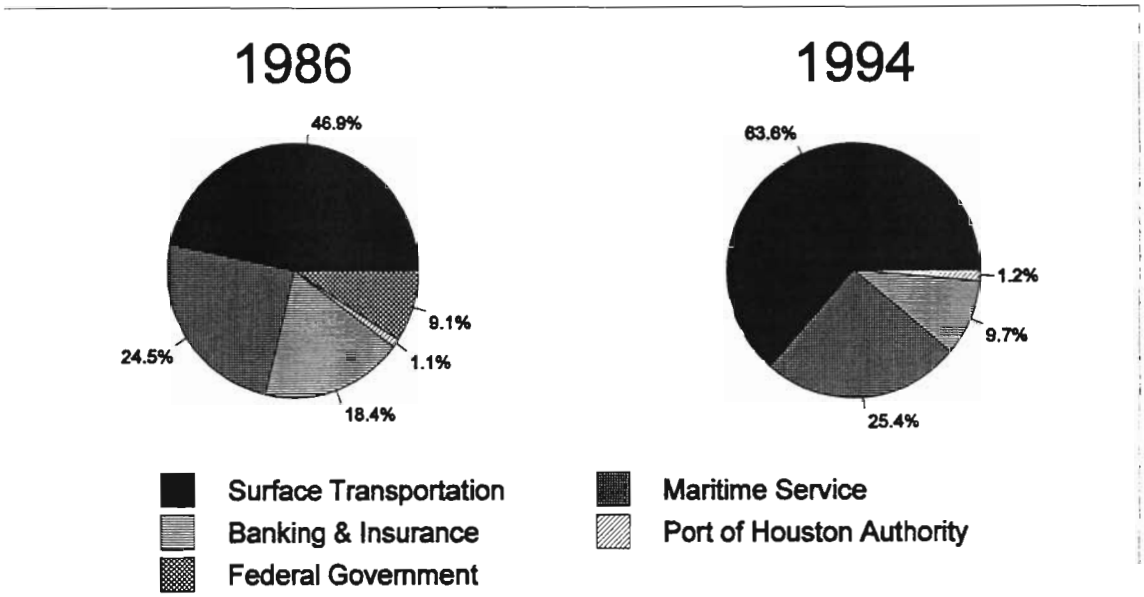

FIGURE E.3 Comparison of Percent of Total Revenue Generated by Activity at the Port of Houston, 1986 and 1994

Source: Martin Associates, The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority. November 1987; Martin O'Connell Associates, The Local and Regional Economic Impacts of the Port of Houston. Prepared for the Port of Houston Authority, May 1995; Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

TABLE E.3 Comparison of Revenue Impacts by Commodity Generated by Activity at the Port of Houston, 1986 and 1994

COMMODITY	PORT OF HOUSTON TOTAL REVENUE IMPACT ($ Millions)		REVENUE IMPACT PER TON (Dollars)	
	1986	1994	1986	1994
Liquid Bulk	425.7	1576.48	15.30	30
Other Dry Bulk	304.3	1004.89	18.40	38
Petroleum	1224.5	947.65	25.60	19
Containerized Cargo	328.0	663.62	96.40	120
Breakbulk	140.2	197.02	133.50	66
Grain	66.6	107.20	25.30	21
Steel	100.0	105.72	56.10	34
Bagged Grain	42.6	26.93	94.20	41
Automobiles	62.8	24.75	151.30	211
Rice	8.7	4.7	86.50	23
TOTAL	**2703.4**	**4631.91**	**N/A**	**N/A**

Source: Martin Associates, The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority. November 1987; Martin O'Connell Associates, The Local and Regional Economic Impacts of the Port of Houston. Prepared for the Port of Houston Authority, May 1995; Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

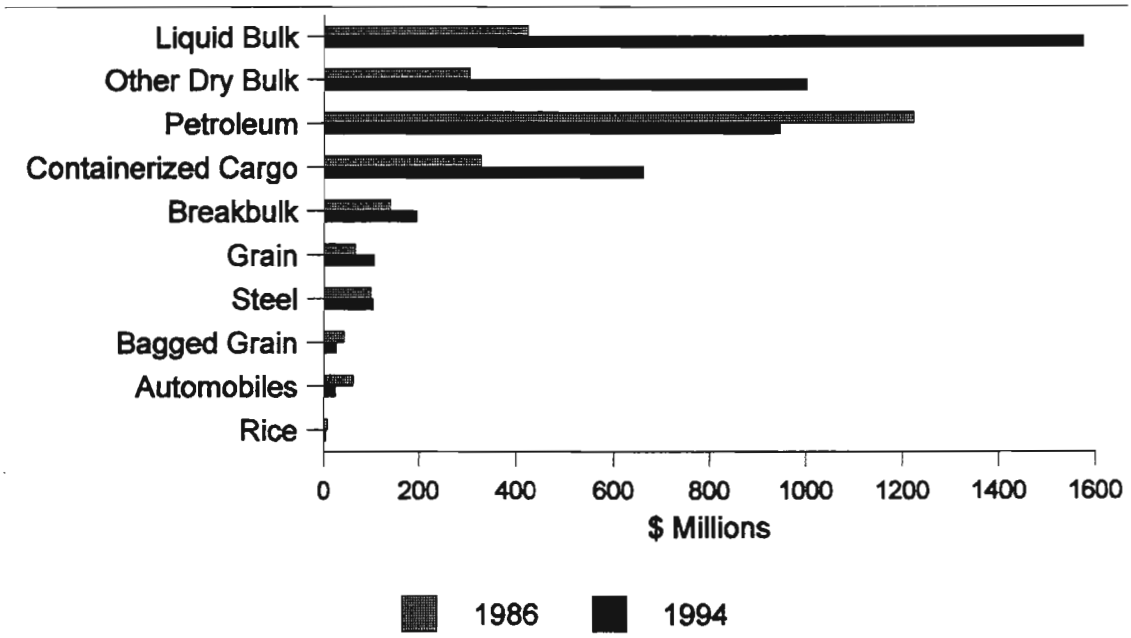

FIGURE E.4 Comparison of Total Revenue Generated by Activity at the Port of Houston, 1986 and 1994

Source: Martin Associates, The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority. November 1987; Martin O'Connell Associates, The Local and Regional Economic Impacts of the Port of Houston. Prepared for the Port of Houston Authority, May 1995; Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

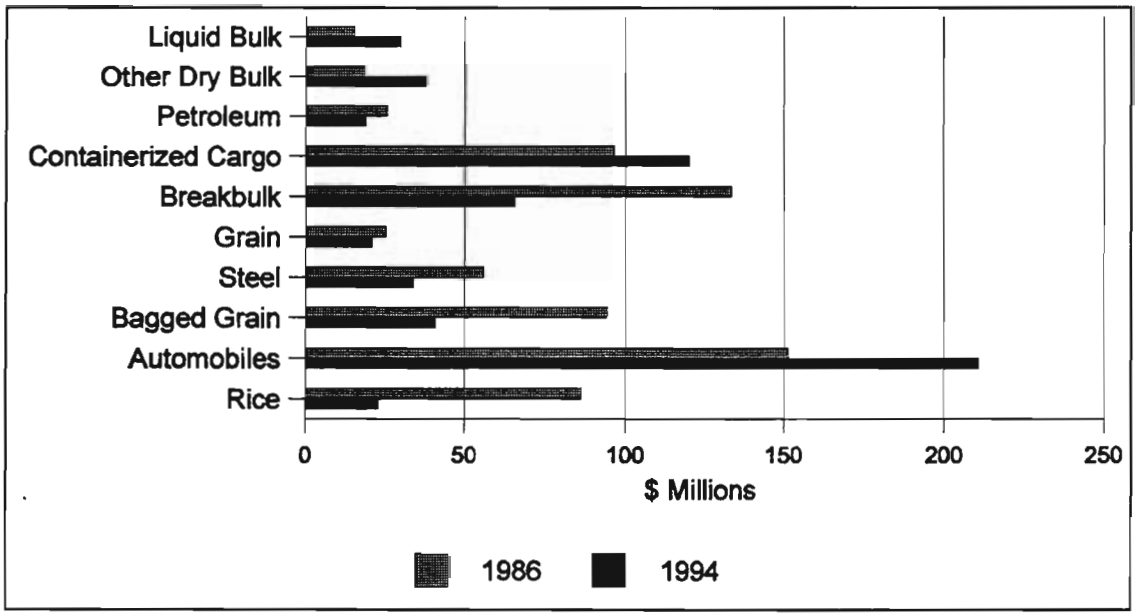

FIGURE E.5 Comparison of Revenue Impact Per Ton by Commodity Generated by Activity at the Port of Houston, 1986 and 1994

Source: Martin Associates, The Economic Impact of the Port of Houston. Prepared for the Port of Houston Authority. November 1987; Martin O'Connell Associates, The Local and Regional Economic Impacts of the Port of Houston. Prepared for the Port of Houston Authority, May 1995; Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989.

Appendix F--Travel Expenditure Summary

	GULF COAST REGION		HOUSTON		GALVESTON TEXAS-CITY		BRAZORIA	
AVERAGE SPENDING		$93.00		$102.00		$76.00		$76.00
AVERAGE LENGTH OF STAY		2.3		2.2		1.8		1.7
AVERAGE PARTY SIZE		1.9		1.7		2.7		2
PERSON DAYS		152,000,000		85,000,000		14,000,000		1,000,000
TOTAL		$61,774,320,000.00		$32,425,800,000.00		$5,171,040,000.00		$258,400,000.00
LEISURE	69%	$42,624,280,800	63%	$20,428,254,000	84%	$4,343,673,600	75%	$193,800,000
BEACH/WATERFRONT	17%	$10,501,634,400	5%	$1,621,290,000	45%	$2,326,968,000	14%	$36,176,000
HUNT/FISH	8%	$4,941,945,600	2%	$648,516,000	19%	$982,497,600	19%	$49,096,000
BOAT/SAIL	4%	$2,470,972,800	1%	$324,258,000	<.05%	NA	<.05%	NA
BCH/WTRFRNT-HNT/FSH-BTSL		$17,914,552,800		$2,594,064,000		$3,309,465,600		$85,272,000
% OF LEISURE	42%		13%		76%		44%	
% OF TOTAL	29%		8%		64%		33%	
	BEAUMONT PORT ARTHUR		BROWNSVILLE HARLINGEN SAN BENITO		CORPUS CHRISTI		VICTORIA	
AVERAGE SPENDING		$102.00		$93.00		$88.00		$34.00
AVERAGE LENGTH OF STAY		1.8		4.1		2.5		2.5
AVERAGE PARTY SIZE		1.6		2.2		2.1		2.9
PERSON DAYS		10,000,000		11,000,000		21,000,000		6,000,000
TOTAL		$2,937,600,000.00		$9,227,460,000.00		$9,702,000,000.00		$1,479,000,000.00
LEISURE	54%	$1,586,304,000	75%	$6,920,595,000	74%	$7,179,480,000	86%	$1,271,940,000
BEACH/WATERFRONT	<.05%	NA	45%	$4,152,357,000	54%	$5,239,080,000	0.14	$207,060,000
HUNT/FISH	4%	$117,504,000	27%	$2,491,414,200	15%	$1,455,300,000	0.14	$207,060,000
BOAT/SAILING	3%	$88,128,000	3%	$276,823,800	8%	$776,160,000	<.05%	NA
BCH/WTRFRNT-HNT/FSH-BTSL		$205,632,000		$6,920,595,000		$7,470,540,000		$414,120,000
% OF LEISURE	13%		100%		104%		33%	
% OF TOTAL	7%		75%		77%		28%	
*DUE TO ROUNDING OF NUMBERS, THESE TOTALS MAY NOT EQUAL INDIVIDUAL TOTALS.								

Source: Texas Destinations 1993-1994: Gulf Coast Region. DIRECTIONS Destination Index. Texas Department of Commerce and D.K. Shifflet & Associates Ltd. November 1995.

Appendix G--Bulk Commodities and General Goods, U.S.-Mexico Trade

Bulk Commodities:

Commodity Group A - Grain

- Field crops
- Grain mill

Commodity Group B - Mineral Fuel and Petroleum Products

- Products of petroleum refining
- Crude oil
- Natural gas
- Petrochemicals
- Coal

Commodity Group C - Salt, Sulfur, Earth and Stone

- Structural clay products
- Concrete, gypsum, or plaster
- Crushed and dimension stone

Commodity Group D - Cement, Sand, and Gravel

- Cement
- Sand and gravel

Commodity Group E - Iron & Steel

- Steel mill products
- Nonferrous primary smelter products
- Fabricated metal products

Commodity Group F - Chemicals

- Industrial chemicals
- Soap or other detergents
- Paints
- Gum or wood chemicals
- Agricultural chemicals
- Misc. chemical products
- Misc. plastic products

Commodity Group G - Paper & Glassware

- Pulp or pulp mill products
- Fiber, paper & pulpboard
- Misc. printed matter
- Glassware

Commodity Group H - Ores, Slag & Ash

- Metallic ores
- Nonferrous metal basic shapes
- Misc. primary metals

Commodity Group I - Lumber, Wood

- Primary forest materials
- Misc. wood products

General Goods:

Fresh fruits	Fresh vegetables	Sugar	Leather footwear
Fresh fish	Clothing	Floor coverings	Electrical equipment
Preserved food	Drugs	Tires and inner tubes	Railroad equipment
Beverages	Livestock	Industrial machinery	Aircraft
Furniture	Leather goods	Motor vehicles	Photo equipment
Textiles	Meat or poultry	Misc. manufactured products	

Source: Arthur Andersen, 1996.

Appendix H--Project Cost, Galveston District (ACE)

PROJECTS		FY 94	FY 95	AVG COST/YEAR
GIWW between Apalachee Bay, FL and the Mexican border				
Sargeant Beach		$ 2,375,460	$ 6,609,610	$ 4,492,535
Brazos River Floodgates		$ 120,151	$ 2,707,774	$ 1,413,963
TOTAL		$ 2,495,611	$ 9,317,384	$ 5,906,498
DREDGING OPERATIONS	Period	FY 94	FY 95	AVG COST/YEAR
Emergency Dredging Freeport Harbor to Brazos River Crossing	10/1/93 to 12/2/93	$ 1,023,959		
Dredging Port Mansfield Entrance Channel and Channel to Port Mansfield	2/3/94 to 4/6/94	$ 1,554,681		
Dredging Main Channel to Matagorda Bay	1/24/94 to 3/25/94	$ 716,714		
Dredging Main Channel across Aransas Bay	1/13/94 to 2/16/94	$ 411,308		
Dredging Colorado River and Turning Basin	3/24/94 to 6/1/94	$ 801,029		
Dredging Mile 302 to High Island	5/13/94 to 9/2/94	$ 1,779,301		
Dredging Channel to Victoria and Channel to Sea Drift	6/23/94 to 8/20/94	$ 1,204,394		
Dredging Chocolate Bayou Channel	10/1/93 to 1/4/94	$ 732,529		
Dredging Navigation Channel and Impounding Basin at Mouth of Colorado River	12/21/93 to 2/15/94	$ 1,689,849		
Dredging High Island to Port Bolivar	1/2/95 to 9/30/95		$ 3,477,162	
Dredging Port Isabel to Arroyo Colorado	10/1/94 to 11/19/94		$ 569,521	
Dredging Channel to Harlingen	10/1/94 to 11/19/94		$ 320,700	
Dredging Tributary Channel to Aransas Pass & Aransas Pass	10/12/94 to 1/11/95		$ 1,246,363	
Dredging Colorado River to Matagorda Bay	11/27/94 to 2/14/95		$ 1,435,494	
Dredging Corpus Christi Bay to Mud Flats	11/16/94 to 3/4/95		$ 1,416,977	
Dredging Arroyo Colorado to Mud Flats	1/17/95 to 4/22/95		$ 2,015,766	
Dredging Channel to Harlingen and Turning Basin	1/17/95 to 4/22/95		$ 268,122	
Dredging Channel to Palacios	4/20/95 to 6/18/95		$ 780,954	
Dredging Turnstake Island to Live Oak Point	5/8/95 to 7/18/95		$ 1,067,763	
Dredging Main Channel across Aransas Bay	6/14/95 to 8/28/95		$ 476,204	
Dredging Main Channel to Matagorda Bay	7/24/95 to 8/8/95		$ 179,341	
Dredging Navigation Channel and Impoundment Basin at Mouth of Colorado River	12/18/94 to 2/10/95		$ 1,212,564	
TOTAL (Projects and Dredging Operations)		$ 12,409,375	$ 23,784,315	$ 18,096,845

Source: Army Corps of Engineers, Galveston District.

Appendix I--IWTF Receipts and Disbursements (1990-95)

INLAND WATERWAYS TRUST FUND SUMMARY OF RECEIPTS AND DISBURSEMENTS (1990-95)						
REPORT PERIOD	TAX RECEIPTS	INTEREST RECEIVED	ACCRUED INTEREST	TOTAL REVENUE	TRANSFERS TO CORPS	IWTF BALANCE
1990	$ 64,820,000	$ 21,726,827	$ 3,447,834	$ 89,994,661	$ 128,736,975	$ 278,600,351
	tax rate = 11 cents			$ 89,994,661		
1991	$ 60,683,000	$ 24,523,419	$ (4,958,153)	$ 80,248,266	$ 142,838,030	$ 216,010,487
	tax rate = 13 cents			$ 80,248,266		
1992	$ 73,265,500	$ 13,167,685	$ (1,769,565)	$ 84,663,620	$ 114,444,875	$ 186,229,332
	tax rate = 15 cents			$ 84,663,620		
1993	$ 82,975,700	$ 10,465,452	$ (2,909,278)	$ 90,531,874	$ 68,596,565	$ 208,164,641
	tax rate = 17 cents			$ 90,531,874		
1994	$ 91,039,600	$ 11,450,865	$ (1,002,077)	$ 101,488,388	$ 81,306,836	$ 228,346,193
	tax rate = 19 cents			$ 101,488,388		$ 228,346,193
1995	$ 106,172,030	$ 15,494,430	$ (1,623,698)	$ 120,043,762	$ 90,624,085	$ 257,764,870
	tax rate = 20 cents			$ 120,043,762		$ 257,764,871

Appendix J--Internet Addresses

Navigation Data Center (USACE)	http://www.wrc-ndc.usace.army.mil/
Bureau of Transportation Studies	http://www.bts.gov/
National Institutes for Water Resources	http://wrri.eng.clemson.edu/
Texas Water Resources Institute	http://twri.tamu.edu/
National Sea Grant College Program	http://www.mdsg.umd.edu/
U.S. Geological Survey, Water Resources	http://h2o.usgs.gov/
National Water Research Institute (Canada)	http://www.cciw.ca/env/nwri/intro.html
Universities Water Information Network	http://www.uwin.siu.edu/
U.S. Water News	http://www.mother.com/uswaternews/welcome.html
Water Resources Publications, LLC	http://www.infohiway.com/way/wrp/
WaterWeb: Links to Water Info	http://www.waterweb.com/
Waterborne Commerce Statistics Center	http://www.wrc-ndc.usace.mil/ndc/wcsc.htm
Texas Department of Transportation	http://www.dot.state.tx.us
Center for Transportation Research	http://www.utexas.edu/depts/ctr
Instituto Mexican del Transporte	http://www.imt.mx
Texas Transportation Institute	http://tti.tamu.edu
International Boundary and Water Commission	http://www.ibwc.state.gov
Energy Information Administration	http://www.eia.doe.gov
Cargo Port Links	Http://www.hal-pc.org/~nugent/port.html

Appendix K--Presidential Permit Process

The following is the text of a memorandum dated March 1995 provided by Paul Storing, Special Assistant, International Boundary and Water Commission.

SUBJECT: The Process By Which A Presidential Permit is Obtained Allowing Construction of a Project Between the United States and Mexico.

Introduction

The information contained in this Memorandum is a summary explanation of the legal basis for and procedures to be followed with respect to obtaining a Presidential Permit for construction, operation and maintenance of a facility on the U.S.-Mexico border. Completion of any U.S.-Mexico project will also require close coordination and planning with Mexican sponsors and authorities. The legal requirements discussed herein are in addition to other requirements imposed by federal and state law. This document should not be relied upon as an exhaustive review of all steps that must be taken from concept development through construction. It is intended only as a road map to help the applicants identify major issues they are likely to confront.

The State Department's Legal Authority

The legal authority for the State Department's role in approving the issuance of Presidential Permits by making a determination as to their necessity and whether construction would be in the national interest, is found in Executive Order 11423 of August 16, 1968 (33 FR 11741), as amended by Executive Order 12847 of May 17, 1993 (58 FR 29511) and, to the extent applicable, the International Bridge Act of 1972 (33 U.S.C. Section 535 et. seq. The Department of State is also responsible for coordinating compliance with any requirements of the National Environmental Policy Act (42 U.S.C. Section 4321 et. seq.)

Early Consultations are Desirable

The applicant should consult, as early as possible in the planning process, with all of the U.S. Government agencies involved including the General Services Administration, the Federal Inspection Service agencies, the Environmental Protection Agency, the Department of the Interior (Fish and Wildlife Service), the U.S. Coast Guard (if the project is an international bridge), and the U.S. Section of the International Boundary and Water Commission. At the state level, the applicant should also consult with the appropriate state agencies, including those responsible for the environment, parks, wildlife, highways, historic preservation and any other state agency known to be involved so that questions or concerns that may be raised by these agencies are made known to the applicant as soon as possible.

How to Apply and What to Include in the Application

Applications for Presidential Permits for cross-border facilities on the Mexican border should be made to the Secretary of State, Attention: Coordinator, U.S.-Mexican Affairs, Office of Mexican Affairs, Room 4258, Department of State, Washington, D.C. 20520. Thirty copies of each application and of any supporting documents, drawings, etc. should be submitted. Applications should include the following:

1. Each application should precisely identify the person or entity applying for the permit. If the applicant is a county, municipality or other public body, the applicant should state its legal authority to make the application. The application should reveal any intention on the part of the applicant at any time to transfer, sell or assign to any other entity the facility for which approval is sought.

2. The application should describe in detail the proposed facility, including its location, design, the safety standards to be applied, access routes and detail of the proposed construction methods. The application should also include photographs of the construction site, maps which identify, inter allia, the parcel of land intended to be provided by the sponsor as a site for the border crossing, engineering drawings including the anticipated cross-section, technical specifications and such other explanatory materials as are available.

3. The application should explain how, in the view of the applicant, the national interest would be served by construction of the proposed facility. This explanation may be supported by any reports, correspondence, and other material indicating the desirability and feasibility of the proposed facility. Similar facilities in the area should be described and the names and addresses of their owners included. Existing and projected levels of international road traffic should be set forth and the type of road system that would serve the facility on each side of the border described. In the case of bridges, the application should indicate the projection of such traffic to be carried by the proposed bridge for the construction year and the design year (presumably 20 years), as well as the effect that traffic would have on and its compatibility with, the existing road. Maps showing the location of similar existing facilities, U.S. and Mexican roads with traffic counts, weight restricted routes and of any new roads needed to make the project feasible would be very helpful. These maps and other application materials should show where the projected traffic is expected to come from and the likely impact, in terms of numbers of vehicles, of any traffic diversion caused by the bridge on other border area crossings. This last information would help establish the required size of any inspection facility at the bridge site.

4. The application should set forth the applicant's plan of action for construction of the facility. Such a plan would include an expected schedule for securing the necessary permits and approvals, arranging financing, and performing construction.

If any specific problems can be expected in this connection, they should be outlined with an indication of how they might be resolved.

5. The application should describe the planned financing of the proposed facility, including estimated costs, details of financing and proposed toll structure. If the facilities, including access roads, will involve funding from state or federal sources, the application should so specify and should set forth any steps taken to arrange for such funding.

6. The application should indicate all steps taken, or that will be taken to secure the approval of local, state and federal officials in Mexico. The Government of Mexico has expressed its desire that applications for construction permits for facilities be made at more or less the same time in the two countries. The application should indicate the views of Mexican officials toward the facility, so far as these are known. The application should describe planned arrangements for construction of the Mexican portion of the facility, including ownership of the Mexican facilities and plans for financing the Mexican portion. Copies of any agreements concerning these matters should be attached. According to the 1972 Act, all required authorizations from the Government of Mexico must be obtained before an international facility may be constructed.

7. Satisfaction of all Mexican requirements is not necessary before a person may apply to the Department of State for a Presidential Permit. However, the applicant should affirm and present evidence that the Mexican authorities have been consulted and will at least consider construction at the location proposed. In this way, the unnecessary expenditure of resources by both the applicant and the U.S. Government may be avoided.

8. The National Historic Preservation Act of 1966 requires federal agencies to consider the effects of their actions on historic properties and to seek comments from the Advisory Council on Historic Preservation. Before a Presidential Permit can be issued, it must be determined that the proposed project will not adversely affect any property included on or eligible for inclusion in the National Register. Information that would facilitate such a determination should be included by the applicant.

9. The application should describe any other permits or approvals from U.S. federal, state and local agencies that are understood by the applicant to be required in connection with the proposed facility, and should describe steps being taken to secure them.

10. In furtherance of the recommendations contained in the August 8, 1994 NEC Whitepaper, "Staff Recommendations of the Task Force on Border Infrastructure and Facilitation for Improved U.S. Border Operations," the application should (1)

show that there are the commitments necessary to ensure an adequate support infrastructure, including access roads, consistent with state and regional plans; (2) take into account Mexican development plans and priorities; and (3) propose a viable financing plan for inspection facilities and inspection agency staffing, as well as for the crossing itself.

Environmental Review

1. Pursuant to the National Environmental Policy Act (NEPA), the Department of State must take into account, in considering any application for a Presidential Permit, significant environmental impacts, if any, whether direct, indirect or cumulative, of the proposed facilities and directly related construction. Depending upon those impacts, the Department of State may be required to prepare, circulate for comment and file environmental documentation prior to deciding whether to grant the Presidentail Permit application. To facilitate this process, each application should be accompanied by any environmental documentation it believes to be required under NEPA and the Regulations found in 40 CFR Parts 1500-1508, whether that is an environmental assessment (EA) or an environmental impact statement (EIS). It should be noted that if an EA is produced, it may be necessary, depending upon the finding of the Department of State to produce an EIS.

2. Upon receipt of the application including the environmental documentation considered appropriate by the applicant, the Department of State will circulate that documentation to other federal agencies and to state authorities for comment. The Department publishes a notice in the Federal Register inviting public comment. If the proposed project is located within or near an area under the Clean Air Act (CAA), there is additional consultation in which the Department of State must engage concerning the level of environmental documentation required. Should questions from the agencies arise, they will be referred to the applicant. The Department of State will work with the applicant to ensure these are satisfactorily addressed. The applicant may be required to prepare an amended application reflecting any agreements and commitments made in the course of addressing agency concerns. The Department of State would then circulate any amended application for final agency review. If, following the review, the Department of State determines there will be no significant environmental impact, the Department will issue a Finding of No Significant Impact (FONSI). If a significant impact is found, an EIS must be prepared before the Presidential Permit may be issued.

   Further detail on the environmental review process is attached. Guidance related to Eas, EISs and NEPA is contained within 40 CFR Parts 1500-1508.

National Interest Criteria

Once all of the consultation and findings referred to above have been made, the Secretary of State makes a decision as to above have been made, the Secretary of State makes a decision as to whether or not construction of the facility in question would be in the national interest. If construction is found to be in the national interest, federal agencies are so informed. Unless any objection is expressed, the Presidential Permit is issued 15 days thereafter.

Other Necessary Approvals Prior to Construction Authorization

1. Under the provisions of the International Bridge Act of 1972 (22 U.S.C. 535, 535c - 535h), the Coast Guard has jurisdiction pertaining to the construction, modification, operation and maintenance of any bridge connecting the United States with a foreign country. Applicants should consult with the U.S. Coast Guard regarding that agency's permit process.

2. Plans for construction of the facility in question must be submitted for approval by the International Boundary and Water Commission located at El Paso, Texas and Ciudad Juarez, Mexico. The Commission must determine that the effects of the facility will not be contrary to existing bilateral arrangements between the U.S. and Mexico.

3. Receipt of a Presidential Permit does not guarantee the availability of sufficient U.S. personnel to provide essential availability of sufficient U.S. personnel to provide essential inspection services. Applicants should periodically coordinate with the Federal Inspection Service (FIS) agencies to keep abreast of staffing decisions that could impact the opening of the facility they are proposing.

More Information

Any questions regarding the contents of this Memorandum should be addressed to the Coordinator, U.S.-Mexico Border Affairs, Office of Mexican Affairs, Room 4258, Department of State, Washington, D.C. 20520 (tel: 202-647-8529).

Appendix L–Comparison of 1986 and 1994 Water Transportation

Appendix L presents a trend analysis of the economic impact of the Water Transportation industries over the period 1986-1994. This is an early version of the analysis included in Section 3.4 Transportation Industries, page 46. The trend analysis was discarded primarily because knowledgeable experts in the field found that the trends did not mirror reality. Potential sources of error are described in the appendix. The appendix estimates for 1994 are lower than the estimates of Section 3.4 because the appendix does not take into account the participation of GIWW barge traffic in "external" transportation.

Introduction

Opening the Gulf Intracoastal Waterway (GIWW) in Texas created a demand for barge transportation to ship products such as petroleum and chemicals. In responding to that demand, a water transportation industry was born which has had an economic impact on Texas through creating sales, employment, and personal income.

The 1989 report, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," used a Texas input-output model to estimate that impact.* The purpose of this section is to update that analysis. The update follows the same general procedures used in the 1989 study. This update collects recent data, uses an up-dated version of the Texas input-output model, and identifies trends in the impact over time. The section ends with some conclusions and policy recommendations.

Input-Output Analysis

GIWW water transportation has both a direct and an indirect impact upon the State's economy. In supplying water transportation, the industry has a direct impact through generating sales, hiring employees, and paying out personal income. Successive rounds of spending by the beneficiaries of the direct impact then cause an indirect impact on sales, employment, and payrolls.

Input-output analysis can be used to estimate the total (direct plus indirect) impact of an industry upon an economy. In December of 1989, after the Texas A&M report was written, the Texas Comptroller's office published an update of the Texas input-output model entitled The Texas Input-Output Model, 1986 Update. The updated model contains a description of the relationships between 174 sectors, and its basis is 1986 data, the latest year for which data covering all the sectors was available. On the basis of these relationships, the model derives Final Demand, Income, and Employment coefficients. These coefficients allow estimations of the total impact of water transportation on Final Demand, Employment, and Income.

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*Hillary Garrett and Dock Burke, "Economic Impact of the Gulf Intracoastal Waterway System in Texas," prepared for the Texas Sea Grant College Program, April 1989, Chapter 5, Section D.

In this study, Final Demand refers to the demand for water transportation output; it equals sales or revenue received by establishments that supply water transportation. Income refers to personal income and includes wages, salaries, dividends, rents, and other forms of payments to persons by water transportation businesses. Employment refers to the number of jobs created by the industry.

Important limitations to the input-output model exist. First, the relationships between the sectors of the model are a snapshot of the relations that existed in 1986. One assumption is that the model's coefficients which describe the relationships between sectors remain constant over time. In fact, technological developments can change the relationships over time causing the model to generate inaccurate estimates of demand, employment, and payroll. The model is now ten years old. Presumably, some of the relationships have changed.

A second limitation is that the model's categories of industries are sometimes quite broad. The Standard Industrial Classification (SIC) code of the Office of Management and Budget defines the industrial sectors.* The SIC manual groups industries into two-, three-, and four-digit classifications. The Texas input-output model further aggregates the SIC classifications into 157 industrial classifications. One result of this aggregation is that no distinction is made between the coefficients of water transportation and those of water transportation services. Another is that the model's water transportation industries' coefficients are partly based on activities that have nothing to do with water transportation on the GIWW.

A third limitation is that the model does not take into account the costs of production. It measures revenue and personal income earned, but it does not measure the costs of earning that money, nor does it measure external costs such as environmental costs. What follows is a benefit analysis, not a Benefit-Cost analysis.

A fourth limitation is that the model estimates the benefits of a net change in activity. It assumes that GIWW water transportation is a net change in transportation services. If, for example, railroad, and truck transportation services decline as a result of the rise of water transportation on the GIWW, the revenue, employment, and income benefits for the State are exaggerated. The analysis that follows shows the GIWW water transportation industry's impact on the economy in isolation rather than the industry's net impact on the economy.

Basic Data

The Study Area

In order to estimate the economic impact of the GIWW on Texas, the Coastal Zone of

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*Office of Management and Budget, Standard Industrial Classification Manual (Washington, DC: GPO, 1987).

Texas was selected for study. The assumption is that the direct impact of the GIWW's water transportation industries on revenue, employment, and income will take place in counties adjacent to the waterway, and that re-spending by economic agents in this region will lead to the indirect impact of the industry. A map of the Coastal Zone of Texas is found on page 49, Figure 3.20; Table L.1 lists the counties in the map. In order to capture the full direct effect of water transportation on Texas, this study includes counties not immediately adjacent to the waterway.

TABLE L.1 Coastal Zone Counties In Texas

I. South East Texas Counties

1. Orange
2. Jefferson

II. Gulf Coast Counties

3. Chambers
4. Liberty
5. Walker
6. Montgomery
7. Harris
8. Galveston
9. Waller
10. Fort Bend
11. Brazoria
12. Austin
13. Colorado
14. Wharton
15. Matagorda

III. Golden Crescent Counties

16. Jackson
17. Calhoun
18. Victoria
19. Dewitt
20. Goliad

IV. Coastal Bend Counties

21. Refugio
22. Aransas
23. Bee
24. Live Oak
25. McMullen
26. San Patricio
27. Duval
28. Jim Wells
29. Nueces
30. Kleberg
31. Brooks
32. Kenedy

V. Lower Rio Grande Valley

33. Willacy
34. Hidalgo
35. Cameron

Direct Impact of All Water Transportation

Table L.2 lists the number of establishments, employment, and income data for water transportation industries in the Coastal Zone of Texas. The source of this data is the U.S. Census Bureau's County Business Patterns, 1986 and 1994. The 1994 data was taken from recently published computer readable data on the World Wide Web.* The table sums establishment, employment, and payroll data for the 35 counties of Table L.1.

Definitions

The following provides an explanation of definitions of Water Transportation and Water Transportation Services in Table L.2. County Business Patterns provides data on a two-digit SIC code 44 named Water Transportation and a three-digit SIC code named Water Transportation Services. The data of the two-digit code includes that of the three-digit code. Consequently, in order to avoid double counting, the data for the Water Transportation of Table L.2 was formed by subtracting SIC 449 from SIC 44. Hence, the first row of Table L.2 shows Water Transportation (SIC 44) exclusive of Water Transportation Services (SIC 449). In the rest of this update, the term Water Transportation will refer to SIC 44 - SIC 449.

TABLE L.2 All Water Transportation in Texas, 1986 and 1994

	1986			1994		
	No. Est.	**No. Emp.**	**Income ($ millions)**	**No. Est.**	**No. Emp.**	**Income ($ millions)**
Water Transportation (SIC 44 - SIC 449)	190	7,166	198.8	116	4,502	173.8
Water Transportation Services (SIC 449)	294	7,955	167.7	349	7,731	151.4
TOTAL	**484**	**15,121**	**366.5**	**465**	**12,233**	**325.2**

The Standard Industrial Classification Manual defines SIC 44 to include "establishments engaged in freight and passenger transportation on the open seas or inland waters, and establishments furnishing such incidental services as lighterage, towing, and canal operation. This major group also includes excursion boats, sightseeing boats, and water taxis." Water Transportation Services (SIC 449) include "marine cargo handling," "towing and tugboat services," "marinas," and "water transportation services not elsewhere

*Computer Readable Data, Texas County Business Patterns, 1994. Http://www.census.gov/

classified".* These definitions indicate that the data of L.2 includes activities that have nothing to do with water transportation on the GIWW in Texas. In order to quantify the impact of GIWW waterway transportation on Texas, this study will separate GIWW data from the broader data of Table L.2.

County Business Patterns defines an Establishment to be "a single physical location at which business is conducted or services or industrial operations are performed." Employees are "full- and part-time employees, including salaried officers and executives of corporations." The Income of Table L.2 is the same as the figures listed as Payroll in the census data. It includes "all forms of compensation, such as salaries, wages, reported tips, commissions, bonuses, vacation allowances, sick-leave pay, employee contributions to qualified pension plans, and the value of taxable fringe benefits."

Impact of All Water Transportation

The last row of Table L.2 shows that in absolute terms, the water transportation industry had a substantial impact on Texas in 1994. There were 465 establishments employing 12,233 workers and paying them more than $325 million.

Comparing the data of 1986 with that of 1994 shows a downturn in the industry. The last row of Table L.2 indicates that the total number of establishments in the coastal zone declined by 4 percent from 484 to 465. The total number of employees fell by 19 percent from 15,121 to 12,233. Personal income fell by 11 percent from $366.5 million to $325.2 million. Furthermore, the Census reports personal income in nominal terms. If the Gross Domestic Product (GDP) deflator 1.30 deflated 1994 income in order to account for inflation, it follows that real income for 1994 was $250.2 million, and that real income fell by 32 percent over the time period.

The first row of Table L.2 singles out the "Water Transportation" industry (SIC 44 - SIC 449) and shows that its number of establishments declined by 39 percent from 190 to 116. The number of employees fell by 37 percent from 7,166 to 4,502. Personal Income fell by 12.6 percent from $198.8 million to $173.8 million. Real income fell by 33 percent from $198.8 million to $133.6 million.

The second row of the table indicates that Water Transportation Services have enjoyed more stability than the non-service portion of Water Transportation. The number of establishments increased by 19 percent from 294 to 349, but, despite this increase, the number of employees fell by almost 3 percent from 7,955 to 7,731, and nominal income fell by almost 10 percent from $167.7 million to $151.4 million. Real income fell by 31 percent from $167.7 million to $116.5 million.

Once again, these numbers refer to all water transportation in the Texas Coastal Region.

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*Office of Management and Budget, 274-76.

The numbers and their trends are important because the analysis which follows assumes that GIWW transportation is a direct proportion of the estimates for all water transportation. If all water transportation declines, GIWW water transportation automatically declines.

Portion of All Water Transportation Attributable to the GIWW

As noted earlier, the data of Table L.2 refer to activities that do not pertain to the GIWW. What portion of the data pertains to GIWW activities? In order to answer this question, Table L.3 lists the major ports of Texas together with the total tonnage handled by the ports and the tonnage handled due to "internal traffic." Internal traffic refers to commodity movements that originate and terminate in Texas.* The last row of Table L.3 shows that in 1994, the major ports handled a total of 370,030 thousand tons. Internal shipments amounted to 104,694 thousand tons which is 28.3 percent of the total tonnage handled. This study assumes that all inland water transportation is accomplished by barge on the GIWW. Accordingly, Table L.3 attributes 28.3 percent of the figures to water transportation on the GIWW.

TABLE L.3 Port Activity Attributable To Barge Transportation, 1994

PORTS	TOTAL PORT (Thousand Tons)	TOTAL INTERNAL (Thousand Tons)
BEAUMONT	21,201	10,412
BROWNSVILLE	3,396	1,131
FREEPORT	17,450	3,997
GALVESTON	10,257	2,244
HOUSTON	143,663	50,965
ORANGE	686	651
PORT ARTHUR	45,586	5,444
TEXAS CITY	44,351	14,281
MATAGORDA	7,380	2,068
CORPUS CHRISTI	76,060	13,501
TOTAL	**370,030**	**104,694**

Source: U.S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, Part 2, New Orleans, 1994.

Table L.4 lists the economic activity directly attributable to the GIWW in Texas. The number in each cell of this table is simply 28.3 percent of the number in the corresponding cell of Table L.2. The last row of the table shows that in 1994, 132 GIWW water transportation establishments directly generated 3,462 jobs and a personal

*Garrett and Burke, 30.

income of $92.1 million. Input-output analysis will show that this sizable direct impact was multiplied by successive rounds of spending so that the total impact of the industries is substantially larger. Comparing the data of 1986 with that of 1994 naturally shows the same percentage downturns in the industries as those implied by Table L.2.

TABLE L.4 GIWW Water Transportation In Texas, 1986 and 1994

	1986			1994		
	No. Est.	**No. Emp.**	**Income ($ millions)**	**No. Est.**	**No. Emp.**	**Income ($ millions)**
Water Transportation (SIC 44 - SIC 449)	54	2,008	56.3	33	1,274	49.2
Water Transportation Services (SIC 449)	83	2,251	47.5	99	2,188	42.9
TOTAL	**137**	**4,259**	**103.8**	**132**	**3,462**	**92.1**

Total Impact of GIWW Water Transportation

Table L.4 lists the direct impact of GIWW water transportation on employment and payroll. Table L.5 lists both the direct and total economic impacts of GIWW water transportation upon Final Demand, Employment, and Payroll for the years 1986 and 1994.

Derivation of the Estimates

The derivation of Table L.5 requires several steps, the understanding of which enables one to interpret the results correctly. The first step is to estimate the output (also referred to as final demand or sales or revenues) generated by the water transportation industries in the Coastal Zone of Texas. It is important to note that an independent estimate of the output of GIWW water transportation establishments is not available, and so this study must generate it internally using the model. This analysis calculates a rough estimate of output by dividing the number of employees (given by County Business Patterns) by the Direct Effect Coefficient in the table of employment multipliers of the input-output model, and by converting the results to current dollars using the GDP deflator for 1994 of 1.30. The Demand rows and Direct Effect column of Table L.5 list the resulting estimates of output. The estimate of Total Demand derives from the multiplication of the direct output estimate by the Final Demand Coefficient in the table of employment multipliers of the input-output model.

TABLE L.5 Economic Value of GIWW Water Transportation, 1986 and 1994

WATER TRANSPORTATION (SIC 44 - SIC 449)	Direct Impact	Multiplier	Total Impact
1986			
Demand	$224.1 mi	3.25	$728.2 mi
Income	$ 92.2 mi ($ 56.3 mi)	2.06	$190.4 mi ($116.0 mi)
Employment	2,008 jobs	3.34	6,710 jobs
1994			
Demand	$184.9 mi	3.25	$600.8 mi
Income	$ 76.1 mi ($ 49.2 mi)	2.06	$157.1 mi ($101.4 mi)
Employment	1,274 jobs	3.34	4,258 jobs
WATER TRANSPORTATION SERVICES (SIC 449)			
1986			
Demand	$251.2 mi	3.25	$816.3 mi
Income	$103.4 mi ($ 47.5 mi)	2.06	$213.4 mi ($ 97.9 mi)
Employment	2,251 jobs	3.34	7,522 jobs
1994			
Demand	$317.5 mi	3.25	$1031.7 mi
Income	$130.7 mi ($ 42.9 mi)	2.06	$269.8 mi ($ 88.4 mi)
Employment	2,188 jobs	3.34	7,312 jobs

The second step of the analysis is to estimate the impact of GIWW water transportation on employment using the following formulas:

- Change in sector output *converted to 1986 dollars* = Adjusted Output
- Adjusted Output (converted to a millions of dollars base) times the Direct Effect Coefficient of the employment multiplier table = Direct Employment
- Adjusted Output times the Total Effect Coefficient of the employment multiplier table = the Total Number of Employees

The Employment rows of Table L.5 lists the direct and total employment effects of GIWW water transportation over time and by industry. The Direct Employment effects

are the same numbers as those reported in County Business Patterns and listed in Table L.4

The third step of the analysis is to estimate the impact of GIWW water transportation on personal income by using the following formulas:

- Change in sector output times the Direct Effect Coefficient in the table of income multipliers = Direct Personal Income impact of the sector.
- Change in sector output of GIWW water transportation times the "Total Effect" coefficient = Total Personal Income impact of the sector.

The top numbers in the "Income" cells of Table L.5 list the estimates that result from this process. The numbers in parentheses in the direct effect column are the data derived from County Business Patterns. Comparing the numbers within each cell shows that the model substantially overestimates the income impact of GIWW transportation. This suggests that either the state-wide direct effect coefficient for employment is too low for GIWW water transportation or that the Direct Effect Coefficient for Income is too high. If the direct effect coefficient for employment is too low, Demand is also overestimated. It is assumed that the numbers in parentheses represent the true income impact of the water transportation industries. The corrected total income is calculated by multiplying the corrected direct income by the model's multiplier.

The multipliers of Table L.5 are "implied multipliers" that result from using the coefficients of the input-output model as described in the preceding paragraphs. In other words, the direct and total impacts are calculated first. The multipliers of Table L.5 are then calculated by dividing each total impact by the corresponding direct impact.

Total Demand, Employment and Income Impacts

Table L.5 shows that in 1994, Water Transportation experienced $184.9 million of direct demand and that multiplier effects resulted in a total demand of $600.8 million. The corresponding figures for Water Transportation Services are $317.5 million and $1,031.7 million.

The corrected income estimates show that Water Transportation directly earned $49.2 million in 1994, while multiplier effects generated a total of $101.4 million. In Water Transportation Services, the corresponding figures were $42.9 million and $88.4 million.

In 1994, Water Transportation caused the direct creation of 1,274 jobs, while indirect job creation led to a total of 4,258 jobs. In Water Transportation Services, the figures were 2,188 and 7,312 jobs.

In 1994, both sectors together sold directly $502,400,000 worth of goods and services, and, in order to do so, they employed 3,462 workers. This activity directly generated a personal income of $92,100,000. Multiplier effects produced a total impact of

$1,632,500,000 in sales, 11,568 jobs, and $189,800,000 in personal income.

Taxes

Table L.5 can be used to generate an estimate of sales taxes paid to the State of Texas as a result of GIWW water transportation. The personal income earned both directly and indirectly due to the water transportation industry gives rise to taxable sales. The Office of the Texas Comptroller of Public Accounts estimates that 33 percent of personal income generates sales that are subject to State sales taxes.* This implies that in 1994, Water Transportation and Water Transportation Services together generated $62.63 million ($189.8 mi. X .33) in sales subject to the State sales tax. Applying the State sales tax rate of .0625 to this figure implies that GIWW water transportation generated $3,914,375 of sales tax revenue in 1994 for the State of Texas.

In addition, barge operators pay a federal fuel tax of 24.3 cents per gallon of diesel fuel. Twenty cents per gallon are placed in a U.S. Treasury fund and are used, in partnership with the federal government, to provide one half the cost of constructing and replacing navigational facilities on the inland waterway system. The tax is not a direct payment to the State of Texas, but it benefits the State indirectly by funding expenditures made within the State. The 1989 report estimates that Texas barge operators paid $1.1 million dollars in 1986.** Between 1986 and 1995, the tax doubled from 10 to 20 cents per gallon and another 4.3 cents per gallon tax was imposed for deficit reduction.

Data are available from the Corps on the total 20 cent fuel tax paid nationally, total ton miles of barge traffic nationally, and total ton miles of barge traffic in Texas.*** The revenues coming from the 20 cent fuel tax were estimated by dividing the total tax paid nationally by the total ton miles nationally, and then multiplying by the total ton miles in Texas. This procedure yields an estimate of $2,676,971 paid by Texas operators during 1995. This figure seriously underestimates the fuel tax paid by Texas GIWW operators because barges operating on the Mississippi and Ohio river systems are much larger and much more fuel efficient. Operators on the Texas portion of the GIWW are undoubtedly above average in their use of fuel per ton mile and in fuel tax payment. David Greer of the Corps took a "wild guess" that the true payment would be close to $4,000,000. In order to derive an accurate estimate, empirical studies of the fuel efficiency of various types of barges would be necessary.

The 4.3 cent tax per gallon of fuel for deficit reduction was estimated in the following fashion. The total fuel tax paid nationally was divided by the $.20 tax per gallon of fuel

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*Marybell Cruise, Texas State Comptroller of Public Accounts, Telephone interview by James Michael McGuire, 25 August 1996.

**Ibid., 31.

***David Greer, Transportation Geographer, Navigation Division, U.S. Army Corps of Engineers, Institute for water Resources, Telephone interview by James Michael McGuire, 6 March 1997.

to estimate the total gallons of fuel burned nationally. The total deficit reduction tax paid nationally was estimated by multiplying the total number of gallons by the $0.043 tax per gallon. The Texas share of this payment was estimated by multiplying the total national tax by the Texas share of total ton miles. Texas operators paid an estimated $575,806 in deficit reduction tax in 1995.

The conservatively estimated grand total of fuel tax paid during 1995 is $3,252,777. If Mr. Greer's "wild guess" is correct, the total 1995 would be $4,575,806. Calculations using 1994 data yield a total fuel tax payment of $2,920,534 for that year.

Other contributions may exist, but have not been measured. They may include property taxes, local sales taxes, fees, and contributions to civic organizations.

Changes Over Time

Despite the sizable economic impact of GIWW water transportation, a comparison of the figures over time indicate a decline in impact between 1986 and 1994. Table L.6 summarizes the changes in economic impact over the time period.

Table L.6 shows an 17.5 percent decline in both the direct and the total demand for Water Transportation, but a 26.4 percent increase in the demand for Water Transportation Services. Water Transportation employment declined by 36.6 percent, while employment in Water Transportation Services experienced a 2.8 percent decline. The declines in census data income for the two industries were 12.6 percent and 9.7 percent.

The 1994 demand and income figures are reported in nominal terms. If corrections are made for inflation, the real demand for Water Transportation and Water Transportation Services fell by approximately 36.6 percent and 2.8 percent, respectively. Real personal income fell by 32.8 percent in the Water Transportation sector, and by 30.5 percent in Water Transportation Services.

Did these declines really occur? The table lists changes for only two years in an eight year time span. One possibility is that 1994 was an exceptionally low year in otherwise prosperous times. In order to explore this possibility, income and employment data for all water transportation were collected for the 35 counties of the Texas Coastal Region for the years intervening between 1986 and 1994. Tables L.7 and L.8 display the results.

TABLE L.6 Changes In Economic Impact, 1986-1994

WATER TRANSPORTATION (SIC 44 - SIC 449)	DIRECT IMPACT	TOTAL IMPACT	PERCENTAGE CHANGE
Demand	-$39.2 mi	-$127.4 mi	-17.5
Income	-$ 7.1 mi	-$ 14.6 mi	-12.6
Employment	-734 jobs	-2,452 jobs	-36.6
WATER TRANSPORTATION SERVICES (SIC 449)			
Demand	$66.3 mi	$215.4 mi	26.4
Income	- $ 4.6 mi	- $ 9.5 mi	-9.7
Employment	-63 jobs	-210 jobs	-2.8

Table L.7 reveals some cyclical variation in all the variables pertaining to all Water Transportation, but the overall trend is downward until 1992. After 1992, employment and payroll show marked improvement, although the numbers still fall short of their 1986 levels. The shortfall would be still more evident if payroll were measured in real terms. In 1993, the number of establishments was very large because the Census Bureau mis-categorized some Service establishments as Water Transportation establishments. In 1994, the Census Bureau again categorized establishments correctly. Consequently, the number of establishments, like payroll and income, is probably rising steadily since 1992. Nevertheless, the industry has a long way to go in order to achieve the levels of activity recorded in 1986, especially if payroll is placed on a real basis.

TABLE L.7 All Water Transportation (SIC 44 - SIC 449), 1986-1994

Year	No. Est.	No. Emp.	Payroll ($millions)
1986	190	7,166	198.9
1987	133	5,219	151.9
1988	89	4,325	164.8
1989	109	4,907	210.7
1990	122	4,626	170.8
1991	130	4,537	188.2
1992	106	2,917	106.8
1993	147	4,349	152.6
1994	116	4,502	173.8

TABLE L.8 All Water Transportation Services (SIC 449), 1986-1994

Year	No. Est.	No. Emp.	Payroll ($ millions)
1986	294	7,955	167.7
1987	322	9,373	121.9
1988	304	10,036	181.8
1989	293	9,459	177.1
1990	302	9,034	159.9
1991	312	8,649	162.1
1992	311	8,409	179.3
1993	265	7,728	165.6
1994	349	7,731	151.4

Table L.8 shows the data for Water Transportation Services between 1986 and 1994. The performance of Water Transportation Services has been considerably more stable than that of Water Transportation. There was some cyclical movement, but only a slight trend downward. Of course, the downward trend would appear more pronounced if payroll were measured in real terms. The reported number of establishments in 1993 was artificially low because some service establishments were categorized under Water Transportation. The 1994 payroll may be artificially low because the payroll for many firms was not reported in order to protect the confidentiality of firms. Still, it is remarkable that Water Transportation Services employs 70 percent more employees than Water Transportation, but has a lower total nominal payroll.

A second consideration is that the methodology used in deriving the estimates of demand

suggests that there might be an exaggeration in the decline in demand. The equations used in deriving the demand estimates show that the estimates are dependent upon the number of employees provided by the census data. In other words, the model assumes a constant relationship between employment and demand over time. However, the model is 10 years old, and it is possible that technological changes have raised sales relative to employment. The fact that tonnage hauled on the GIWW seems to have risen (see Table L.3) suggests that this may indeed be the case. If so, the total impact of GIWW water transportation on 1994 demand is underestimated, and the downward trend is exaggerated.

A third possible source of error is that the model defines Water Transportation broadly, including activities that are not associated with GIWW transportation. The estimates assume that GIWW transportation follows the trend of the entire sector. It is not impossible that one part of the sector declined while GIWW transportation increased. As noted earlier, the tonnage shipped through the GIWW grew faster than the total tonnage shipped through the major ports. Also, an industry spokesman stated that there has been a shift away from shipping crude to shipping products that traditionally move at higher prices than crude. Higher tonnage shipped at higher prices suggest an increase not a decrease, in demand for GIWW transportation. The spokesman also stated that it is unlikely that freight transportation employment declined with the increase in tonnage shipped.

Conclusions

The impact on Texas of the GIWW water transportation industries in isolation appears to be large even though the impact seems to have diminished between 1986 and 1994. The estimates indicate that in 1994, the GIWW water transportation industries generated a total of $1,632,500,000 in sales, 11,570 jobs, and $189,800,000 in personal income.

TABLE L.9 Summary of Water Transportation and Water Transportation Services, 1994

WATER TRANSPORTATION & WATER TRANSPORTATION SERVICES	Direct Impact	Multiplier	Total Impact
Demand	$502.4 mi	3.25	$1,632.5 mi
Income	$ 92.1 mi	2.06	$ 189.8 mi
Employment	3,462	3.34	11,570

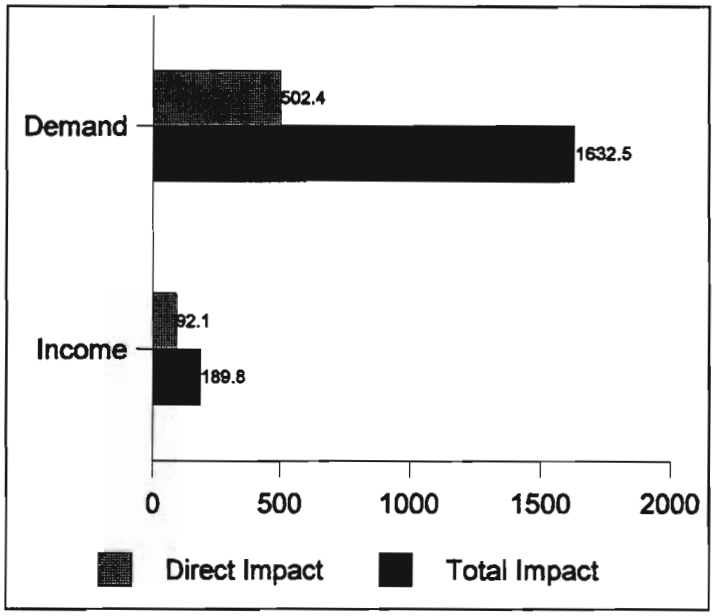

FIGURE L.1 Water Transportation Industries Impacts—Demand and Income

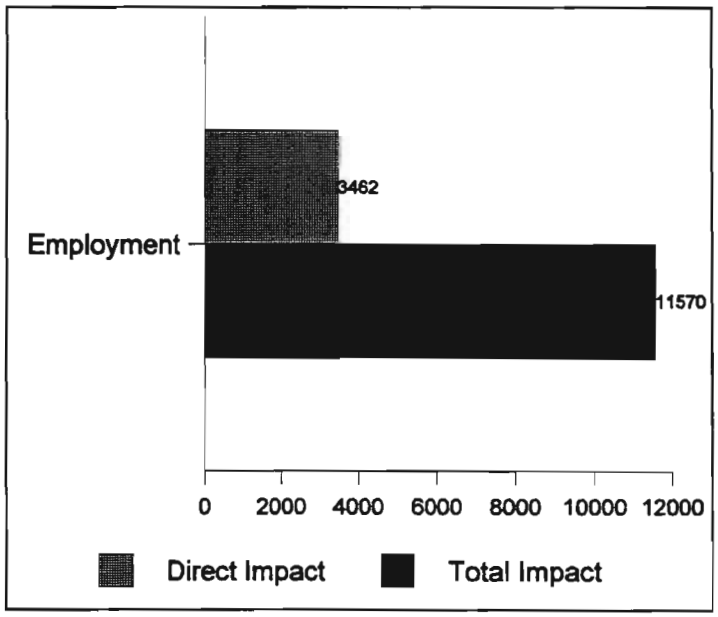

FIGURE L.2 Water Transportation Industries Impact—Employment

The GIWW appears to be generating significant tax revenues for the State of Texas, although the analysis of this source of benefits is in a rudimentary stage. The estimate is that the personal income generated by the GIWW water transportation industries during

1994 yielded the State of Texas $3,914,375 in sales tax revenue. At the same time, the industries paid approximately $2,090,000 in federal fuel taxes, at least some of which were spent in the state. Other payments such as property taxes and fees have not been recorded.

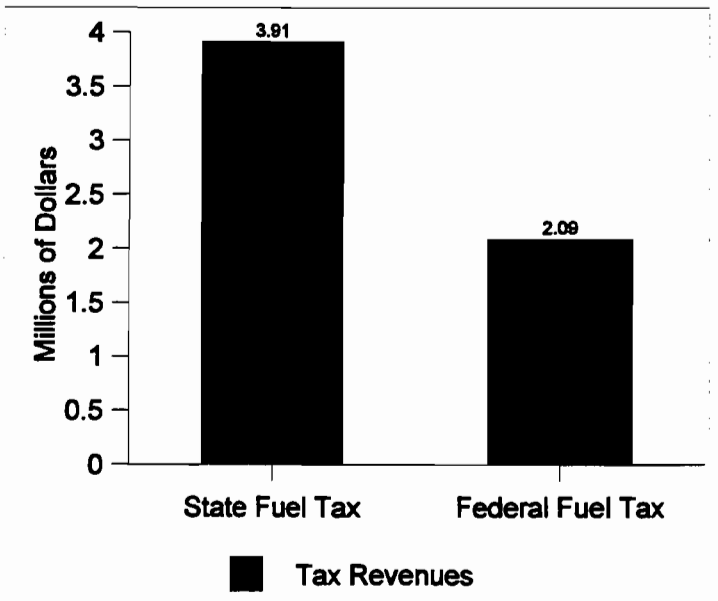

FIGURE L.3 Water Transportation Industries Tax Revenues

From a methodological point of view, two weakness of the analysis reduce the accuracy of the estimates. The first is that the estimation of direct output (sales) of the GIWW water transportation industries must occur internally. All of the estimates of total effects depend upon this internally generated estimate of output. An independently generated estimate of output would greatly enhance the reliability of the total estimates for demand, employment, and personal income.

A second major methodological weakness is that the coefficients used in estimating the impact are now ten years old. Technological improvements may have changed the coefficients. Updating the Texas Input-output model would improve the accuracy of the estimates.

Appendix M--Goods Shipped on the Texas Portion of the GIWW 1994

Values of import and export commodities are taken from the Bureau of Census Foreign Trade Division data base as cited in a preliminary report, "Corps of Engineers Harbor Projects: Development of Tools, Measures, and Organization for Evaluating Performance," Volume I-Technical Report, IWR Report 97-R-13, October 1997, produced by the Army Corps of Engineers, Institute for Water Resources.

Each U.S. harbor has a record of its shipments and receipts of imports, exports, and domestic traffic that is reported by shippers to the Waterborne Commerce Statistics Center (WCSC) and recorded by a four-digit publication commodity code. For this study, the domestic values were used.

The Bureau of Census Foreign Trade Division publishes a database of commodity values of "all waterborne shipment between the United States and its trading partners aggregated to a ten-digit Harmonized Commodity Description and Coding System (HS). Shipments exported are valued at the Free Alongside Ship (FAS) basis. The values of shipments imported are the Customs value (or cost) and the insurance and other freight charges (CIF)."

"The ten-digit harmonized code is the basic six-digit harmonized code system with four additional digits for statistical purposes in evaluating trade policies. For this analysis, the six-digit code was the basic level of aggregation used to develop a bridge between the Harmonized codes (over 17,000 in the ten-digit version) and the 144 WCUS (Waterborne Commerce of the United States) four-digit Publication Commodity codes. Available bridges between the six digit HS and the three-digit SIC codes, between three-digit SIC codes and five-digit WCUS codes, and between WCUS five-digit codes and their four-digit publication codes were utilized, to the degree possible to aggregate the data by WCUS commodity codes. The results of this analysis is the table presented in Appendix B [Corps of Engineers Harbor Projects: Development Tools, Measures, and Organization for Evaluating Performance, Volume I-Technical Report, IWR Report 97-R-13, October 1997, produced by the Army Corps of Engineers, Institute for Water Resources, pages 1-3] that establishes a unit value (in dollars per ton) for the WCUS four-digit codes. Values of domestic traffic were estimated by a weighted average of Import and Export prices. In the few cases where no export or import prices were available, the Engineering News Record data on construction costs were utilized."

GOODS SHIPPED ON THE TEXAS PORTION OF THE GIWW 1994				
Sorted by 1994 Dollar Value				
		1994	Dollar Value	1994
WCUS#	Description	Short Tons	Per Ton*	Dollar Value
3240	NITROGEN FUNC. COMP.	1,268,000	$ 4,370	$ 5,541,160,000
3211	ACYCLIC HYDROCARBONS	1,558,000	$ 1,820	$ 2,835,560,000
3297	CHEMICAL ADDITIVES	1,165,000	$ 1,824	$ 2,124,960,000
3299	CHEM. PRODUCTS NEC	376,000	$ 3,973	$ 1,493,848,000
7110	MACHINERY (NOT ELEC)	188,000	$ 7,609	$ 1,430,492,000
2211	GASOLINE	8,106,000	$ 155	$ 1,256,430,000
3220	ALCOHOLS	2,486,000	$ 461	$ 1,146,046,000
3260	ORGANIC COMP. NEC	929,000	$ 1,173	$ 1,089,717,000
3219	OTHER HYDROCARBONS	5,099,000	$ 155	$ 790,345,000
2100	CRUDE PETROLEUM	7,763,000	$ 99	$ 768,537,000
5480	FABRICATED METAL PRODUCTS	194,000	$ 3,745	$ 726,530,000
3212	BENZENE AND TOLUENE	2,238,000	$ 314	$ 702,732,000
2330	DISTILLATE FUEL OIL	5,099,000	$ 132	$ 673,068,000
5330	IRON, STEEL SHEETS	484,000	$ 1,364	$ 660,176,000
2340	RESIDUAL FUEL OIL	7,360,000	$ 89	$ 655,040,000
3230	CARBOXYLIC ACIDS	800,000	$ 797	$ 637,600,000
2430	ASPHALT, TAR & PITCHES	1,340,000	$ 338	$ 452,920,000
4420	IRON AND STEEL SCRAP	446,000	$ 920	$ 410,320,000
2429	NAPTHA, PETRO SOLVENTS	2,287,000	$ 135	$ 308,745,000
2350	LUBRICATING OILS & GREASE	1,495,000	$ 174	$ 260,130,000
3190	FERT. & MIXES NEC	116,000	$ 1,790	$ 207,640,000
2990	PETROLEUM & COAL PRODUCTS	1,533,000	$ 120	$ 183,960,000
8900	WASTE AND SCRAP, NEC	1,178,000	$ 150	$ 176,700,000
3273	AMMONIA	916,000	$ 154	$ 141,064,000
5390	PRIMARY I&S NEC	138,000	$ 986	$ 136,068,000
6888	ICE	110,000	$ 1,029	$ 113,190,000
6442	RICE	337,000	$ 327	$ 110,199,000
2640	LIQUIFIED GASES	846,000	$ 130	$ 109,980,000
5370	IRON & STEEL PIPE & TUBE	138,000	$ 734	$ 101,292,000
3275	INORG. ELEM., OXIDES, HALOGEN	229,000	$ 393	$ 89,997,000
3120	PHOSPHATIC CHEM FERT	125,000	$ 708	$ 88,500,000
5360	IRON & STEEL SHAPES	233,000	$ 369	$ 85,977,000
3274	SODIUM HYDROXIDE	1,034,000	$ 82	$ 84,788,000
6861	SUGAR	188,000	$ 372	$ 69,936,000
3110	NITROGENEOUS CHEM FERT	630,000	$ 96	$ 60,480,000
4650	ALUMINUM ORES, CONC	1,088,000	$ 54	$ 58,752,000
2221	KEROSENE	356,000	$ 151	$ 53,756,000
7900	MANUFAC. PROD. NEC	8,000	$ 6,211	$ 49,688,000
3272	SULPHURIC ACIDS	806,000	$ 59	$ 47,554,000

4782	CLAY	29,000	$	1,631	$ 47,299,000
2410	PETRO. JELLY AND WAXES	41,000	$	1,127	$ 46,207,000
4860	SLAG	126,000	$	344	$ 43,344,000
5315	FERROALLOYS	65,000	$	612	$ 39,780,000
4331	SAND, GRAVEL, CRSHD ROCK	2,189,000	$	17	$ 37,213,000
4322	LIMESTONE	468,000	$	79	$ 36,972,000
4190	FOREST PRODUCTS NEC	3,000	$	11,747	$ 35,241,000
2540	COKE, PETROLEUM COKE	873,000	$	37	$ 32,301,000
3276	METALLIC SALTS	64,000	$	465	$ 29,760,000
5312	PIG IRON	154,000	$	140	$ 21,560,000
5320	IRON & STEEL PRIMARY FORMS	49,000	$	361	$ 17,689,000
5429	SMELTED PROD. NEC	8,000	$	2,146	$ 17,168,000
3271	SULPHUR, LIQUID	211,000	$	75	$ 15,825,000
6241	WHEAT	115,000	$	120	$ 13,800,000
3285	PERFUMES & CLEANSERS	3,000	$	4,294	$ 12,882,000
6522	SOYBEANS	57,000	$	216	$ 12,312,000
1200	COAL COKE	117,000	$	85	$ 9,945,000
5540	PRIMARY WOOD PRODUCT	22,000	$	321	$ 7,062,000
4327	PHOSPHATE ROCK	7,000	$	921	$ 6,447,000
4410	IRON ORE AND CONCENTRATES	212,000	$	30	$ 6,360,000
5421	COPPER	3,000	$	1,909	$ 5,727,000
7500	TEXTILE FIBERS, NEC	1,000	$	5,641	$ 5,641,000
6782	ANIMAL FEEDS	34,000	$	165	$ 5,610,000
7600	RUBBER & PLASTIC PR.	2,000	$	2,689	$ 5,378,000
5290	MISC. MINERAL PROD.	5,000	$	1,052	$ 5,260,000
4900	NONMETALLIC MINERALS, NEC	139,000	$	31	$ 4,309,000
4110	RUBBER & GUMS	3,000	$	1,368	$ 4,104,000
6653	VEGETABLE OILS, MARGARINE	6,000	$	658	$ 3,948,000
4670	MANGANESE ORES, CONC	38,000	$	93	$ 3,534,000
6445	OATS	40,000	$	86	$ 3,440,000
6447	SORGHUM GRAINS	30,000	$	102	$ 3,060,000
7300	ORDNANCE & ACCESS.	1,000	$	2,669	$ 2,669,000
3130	POTASSIC CHEM FERT	13,000	$	184	$ 2,392,000
6344	CORN	23,000	$	104	$ 2,392,000
4170	WOOD IN THE ROUGH	12,000	$	195	$ 2,340,000
5220	BUILDING CEMENT	56,000	$	41	$ 2,296,000
7400	MANUFAC. WOOD PROD.	1,000	$	1,525	$ 1,525,000
5422	ALUMINUM	2,000	$	742	$ 1,484,000
4690	NONFERROUS ORES, CONC	7,000	$	209	$ 1,463,000
6747	GRAIN MILL PRODUCTS, NEC	3,000	$	467	$ 1,401,000
4189	LUMBER	2,000	$	577	$ 1,154,000
4515	MARINE SHELLS, UNMFG	54,000	$	20	$ 1,080,000
3298	WOOD & RESIN CHEM	2,000	$	441	$ 882,000

4323	GYPSUM	44,000	$	16	$	704,000
1100	COAL AND LIGNITE	13,000	$	38	$	494,000
6865	MOLASSES	7,000	$	67	$	469,000
6838	TALLOW, ANIMAL FATS, OIL	1,000	$	363	$	363,000
3279	INORGANIC CHEM. NEC	1,000	$	339	$	339,000
4338	SOIL & FILL DIRT	19,000	$	17	$	323,000
4161	WOOD CHIPS	6,000	$	44	$	264,000
6746	WHEAT FLOUR & SEMOLINA	1,000	$	180	$	180,000
3286	PLASTIC CHEMICALS	0	$	1,455	$	0
3293	EXPLOSIVES	0	$	3,741	$	0
4335	WATERWAY IMPRVMT MATERIAL	0	$	120	$	0
6134	FISH (NOT SHELLFISH)	0	$	2,350	$	0
6136	SHELLFISH,EXC PREPARED	0	$	6,000	$	0
7210	MOTOR VEHICLES & PARTS	0	$	7,320	$	0
9900	UNKNOWN OR NEC	0	$	749	$	0
	TOTAL	**66,072,000**			**$**	**26,497,269,000**
*Domestic Cargo						

GOODS SHIPPED ON THE TEXAS PORTION OF THE GIWW 1994				
Sorted by WCUS Number				
		1994	Dollar Value	1994
WCUS#	Description	Short Tons	Per Ton*	Dollar Value
1100	COAL AND LIGNITE	13,000	$ 38	$ 494,000
1200	COAL COKE	117,000	$ 85	$ 9,945,000
2100	CRUDE PETROLEUM	7,763,000	$ 99	$ 768,537,000
2211	GASOLINE	8,106,000	$ 155	$ 1,256,430,000
2221	KEROSENE	356,000	$ 151	$ 53,756,000
2330	DISTILLATE FUEL OIL	5,099,000	$ 132	$ 673,068,000
2340	RESIDUAL FUEL OIL	7,360,000	$ 89	$ 655,040,000
2350	LUBRICATING OILS & GREASE	1,495,000	$ 174	$ 260,130,000
2410	PETRO. JELLY AND WAXES	41,000	$ 1,127	$ 46,207,000
2429	NAPTHA, PETRO SOLVENTS	2,287,000	$ 135	$ 308,745,000
2430	ASPHAULT, TAR & PITCHES	1,340,000	$ 338	$ 452,920,000
2540	COKE, PETROLEUM COKE	873,000	$ 37	$ 32,301,000
2640	LIQUIFIED GASES	846,000	$ 130	$ 109,980,000
2990	PETROLEUM & COAL PRODUCTS	1,533,000	$ 120	$ 183,960,000
3110	NITROGENEOUS CHEM FERT	630,000	$ 96	$ 60,480,000
3120	PHOSPHATIC CHEM FERT	125,000	$ 708	$ 88,500,000
3130	POTASSIC CHEM FERT	13,000	$ 184	$ 2,392,000
3190	FERT. & MIXES NEC	116,000	$ 1,790	$ 207,640,000
3211	ACYCLIC HYDROCARBONS	1,558,000	$ 1,820	$ 2,835,560,000
3212	BENZENE AND TOLUENE	2,238,000	$ 314	$ 702,732,000
3219	OTHER HYDROCARBONS	5,099,000	$ 155	$ 790,345,000
3220	ALCOHOLS	2,486,000	$ 461	$ 1,146,046,000
3230	CARBOXYLIC ACIDS	800,000	$ 797	$ 637,600,000
3240	NITROGEN FUNC. COMP.	1,268,000	$ 4,370	$ 5,541,160,000
3260	ORGANIC COMP. NEC	929,000	$ 1,173	$ 1,089,717,000
3271	SULPHUR, LIQUID	211,000	$ 75	$ 15,825,000
3272	SULPHURIC ACIDS	806,000	$ 59	$ 47,554,000
3273	AMMONIA	916,000	$ 154	$ 141,064,000
3274	SODIUM HYDROXIDE	1,034,000	$ 82	$ 84,788,000
3275	INORG. ELEM., OXIDES, HALOGEN	229,000	$ 393	$ 89,997,000
3276	METALLIC SALTS	64,000	$ 465	$ 29,760,000
3279	INORGANIC CHEM. NEC	1,000	$ 339	$ 339,000
3285	PERFUMES & CLEANSERS	3,000	$ 4,294	$ 12,882,000
3286	PLASTIC CHEMICALS	0	$ 1,455	$ 0
3293	EXPLOSIVES	0	$ 3,741	$ 0
3297	CHEMICAL ADDITIVES	1,165,000	$ 1,824	$ 2,124,960,000
3298	WOOD & RESIN CHEM	2,000	$ 441	$ 882,000
3299	CHEM. PRODUCTS NEC	376,000	$ 3,973	$ 1,493,848,000

4110	RUBBER & GUMS	3,000	$	1,368	$	4,104,000
4161	WOOD CHIPS	6,000	$	44	$	264,000
4170	WOOD IN THE ROUGH	12,000	$	195	$	2,340,000
4189	LUMBER	2,000	$	577	$	1,154,000
4190	FOREST PRODUCTS NEC	3,000	$	11,747	$	35,241,000
4322	LIMESTONE	468,000	$	79	$	36,972,000
4323	GYPSUM	44,000	$	16	$	704,000
4327	PHOSPHATE ROCK	7,000	$	921	$	6,447,000
4331	SAND, GRAVEL, CRSHD ROCK	2,189,000	$	17	$	37,213,000
4335	WATERWAY IMPRVMT MATERIAL	0	$	120	$	0
4338	SOIL & FILL DIRT	19,000	$	17	$	323,000
4410	IRON ORE AND CONCENTRATES	212,000	$	30	$	6,360,000
4420	IRON AND STEEL SCRAP	446,000	$	920	$	410,320,000
4515	MARINE SHELLS, UNMFG	54,000	$	20	$	1,080,000
4650	ALUMINUM ORES, CONC	1,088,000	$	54	$	58,752,000
4670	MANGANESE ORES, CONC	38,000	$	93	$	3,534,000
4690	NONFERROUS ORES, CONC	7,000	$	209	$	1,463,000
4782	CLAY	29,000	$	1,631	$	47,299,000
4860	SLAG	126,000	$	344	$	43,344,000
4900	NONMETALLIC MINERALS, NEC	139,000	$	31	$	4,309,000
5220	BUILDING CEMENT	56,000	$	41	$	2,296,000
5290	MISC. MINERAL PROD.	5,000	$	1,052	$	5,260,000
5312	PIG IRON	154,000	$	140	$	21,560,000
5315	FERROALLOYS	65,000	$	612	$	39,780,000
5320	IRON & STEEL PRIMARY FORMS	49,000	$	361	$	17,689,000
5330	IRON, STEEL SHEETS	484,000	$	1,364	$	660,176,000
5360	IRON & STEEL SHAPES	233,000	$	369	$	85,977,000
5370	IRON & STEEL PIPE & TUBE	138,000	$	734	$	101,292,000
5390	PRIMARY I&S NEC	138,000	$	986	$	136,068,000
5421	COPPER	3,000	$	1,909	$	5,727,000
5422	ALUMINUM	2,000	$	742	$	1,484,000
5429	SMELTED PROD. NEC	8,000	$	2,146	$	17,168,000
5480	FABRICATED METAL PRODUCTS	194,000	$	3,745	$	726,530,000
5540	PRIMARY WOOD PRODUCT	22,000	$	321	$	7,062,000
6134	FISH (NOT SHELLFISH)	0	$	2,350	$	0
6136	SHELLFISH,EXC PREPARED	0	$	6,000	$	0
6241	WHEAT	115,000	$	120	$	13,800,000
6344	CORN	23,000	$	104	$	2,392,000
6442	RICE	337,000	$	327	$	110,199,000
6445	OATS	40,000	$	86	$	3,440,000
6447	SORGHUM GRAINS	30,000	$	102	$	3,060,000
6522	SOYBEANS	57,000	$	216	$	12,312,000
6653	VEGETABLE OILS, MARGARINE	6,000	$	658	$	3,948,000

6746	WHEAT FLOUR & SEMOLINA	1,000	$	180	$ 180,000
6747	GRAIN MILL PRODUCTS, NEC	3,000	$	467	$ 1,401,000
6782	ANIMAL FEEDS	34,000	$	165	$ 5,610,000
6838	TALLOW, ANIMAL FATS, OIL	1,000	$	363	$ 363,000
6861	SUGAR	188,000	$	372	$ 69,936,000
6865	MOLASSES	7,000	$	67	$ 469,000
6888	ICE	110,000	$	1,029	$ 113,190,000
7110	MACHINERY (NOT ELEC)	188,000	$	7,609	$ 1,430,492,000
7210	MOTOR VEHICLES & PARTS	0	$	7,320	$ 0
7300	ORDNANCE & ACCESS.	1,000	$	2,669	$ 2,669,000
7400	MANUFAC. WOOD PROD.	1,000	$	1,525	$ 1,525,000
7500	TEXTILE FIBERS, NEC	1,000	$	5,641	$ 5,641,000
7600	RUBBER & PLASTIC PR.	2,000	$	2,689	$ 5,378,000
7900	MANUFAC. PROD. NEC	8,000	$	6,211	$ 49,688,000
8900	WASTE AND SCRAP, NEC	1,178,000	$	150	$ 176,700,000
9900	UNKNOWN OR NEC	0	$	749	$ 0
	TOTAL	**66,072,000**			**$ 26,497,269,000**
*Domestic Cargo					