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Article

The Texas Coast: Ship Channel Network of the Petroleum Age

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Abstract

This article provides an overview of the Texas Gulf Coast as a port city region dedicated above all to oil and gas. By the late 1800s, the same trends in transportation and industry that encouraged ship channel construction around the world drew attention to schemes to transform the Gulf Coast's shallow bays and estuaries into inland deep-water harbors. An added factor in Texas was the vulnerability of Galveston and other coastal locations to hurricanes. Between 1902, when construction began on the 52-mile Houston Ship Channel, and the 1950s–60s, when a deep-water channel opened at Matagorda Bay along the mid-Texas coast, various levels of government—local, state, and national—combined to engineer one of the world's most elaborate navigation networks. Six deep-water channels were woven together by Gulf Intracoastal Waterway, which connected Texas to the Mississippi and beyond. During the years when these ports were taking shape, the Texas oil industry had begun to burgeon. In a reflection of the pre-Spindletop origins of Texas's deep-water movement, policy and planning continued to assume, until oil's dominance had become clear, that even the massive ship channels at Houston and Corpus Christi would serve mainly as outlets for agricultural commodities. It was the organizers of the state's petroleum sector who came to understand the Texas ship channels as exemplary locations for aggregating their diverse operations. This interplay between civil engineering and the energy sector made coastal Texas into a dynamic urban port region. Petroleum and petrochemicals, however, so thoroughly imprinted themselves on the landscape, economy, and life of Texas's oil port region that the region's post-oil future remained difficult to envision.

Keywords

Beaumont; climate change; Corpus Christi; Houston; petroleum industry; Port Arthur; port cities; ship channels; Texas cities

Issue

This article is part of the issue “Shipping Canals in Transition: Rethinking Spatial, Economic, and Environmental Dimensions From Sea to Hinterland” edited by Carola Hein (Delft University of Technology), Sabine Luning (Leiden University), Han Meyer (Delft University of Technology), Stephen J. Ramos (University of Georgia), and Paul van de Laar (Erasmus University Rotterdam).

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1. Introduction

This article offers an overview of the Texas Gulf Coast as a port city region that developed in tandem with the oil and gas industry, that came to thrive, as Carola Hein (2020, p. 194) puts it, on “the mix of oil and water.” The aggregation of ship channels, pipelines, storage terminals, refineries, and petrochemical plants from Louisiana's Chemical Corridor down to Corpus Christi in South Texas exemplifies how port city regions came during the twentieth century to function, again in Hein's words, “as nodes in the global petroleumscape” (Hein, 2020, p. 193).

Between 1902, when construction began on the Houston Ship Channel, and the 1950s–60s, when a deep-water channel opened at Matagorda Bay along the mid-Texas coast, the various levels of US government—local, state, and federal—combined to provide coastal Texas with six deep-water channels, dredged to between 40 and 50 feet, supplemented by feeder canals, and woven together by the Gulf Intracoastal Waterway (GIWW), which connected Texas to the Mississippi and the Atlantic seaboard (Figure 1). As the article points out, the movement to remake the Texas Gulf Coast for ocean shipping preceded the Spindletop discovery of

1901, which revealed the oil reserves on which Texas’s energy wealth would be built. The remaking of the Texas coast began as an episode in the transnational movement that took shape over the nineteenth century to reconstruct rivers, coasts, harbors, and waterfronts and, when deemed necessary, to engineer new navigation channels to accommodate new forms of shipping and the new scale and scope of commerce. In their conception, the great ship channels at Houston or Corpus Christi shared the impulse behind such ventures as the Manchester Ship Canal, the Chicago Sanitary and Ship Canal, the St. Lawrence Seaway, or the channelizing of the Rhine and Elbe in tandem with creation of Imperial Germany’s network of inland ports and ship canals.

Promoters initially envisioned both the Houston and Corpus Christi ship channels as outlets for cotton, grain, and other agricultural commodities shipped into those cities via railroad from rural Texas and other southwestern states. Key organizers of the state’s oil and gas sector, however, came to Texas with experience in Pennsylvania

or Ohio. They already grasped the dependence of their business on port cities. Petroleum entrepreneurs identified the nascent ship channels as first-rate locations for concentrating refining, storage, and tanker terminals. Providers of specialized services to the energy sector—drill equipment manufacturers, rig fabricators, and so on—concentrated along the ship channels as well. By the 1930s–40s, geographers and economists analyzing Houston and other Texas ports—as well as photographers attempting to convey their appearance and atmosphere—were fascinated by the port landscape they saw taking shape, characterized by refineries and petrochemical plants, mazes of pipelines, fields of storage tanks, and tanker loading docks, the “landscape of oil and water,” again in Hein’s words (2020, p. 195).

As the citations reveal, the article builds upon the author’s own research about Corpus Christi, while drawing upon contemporary as well as historical studies of Houston and elsewhere. The goal is to introduce the Texas coast altogether as a port city region, while

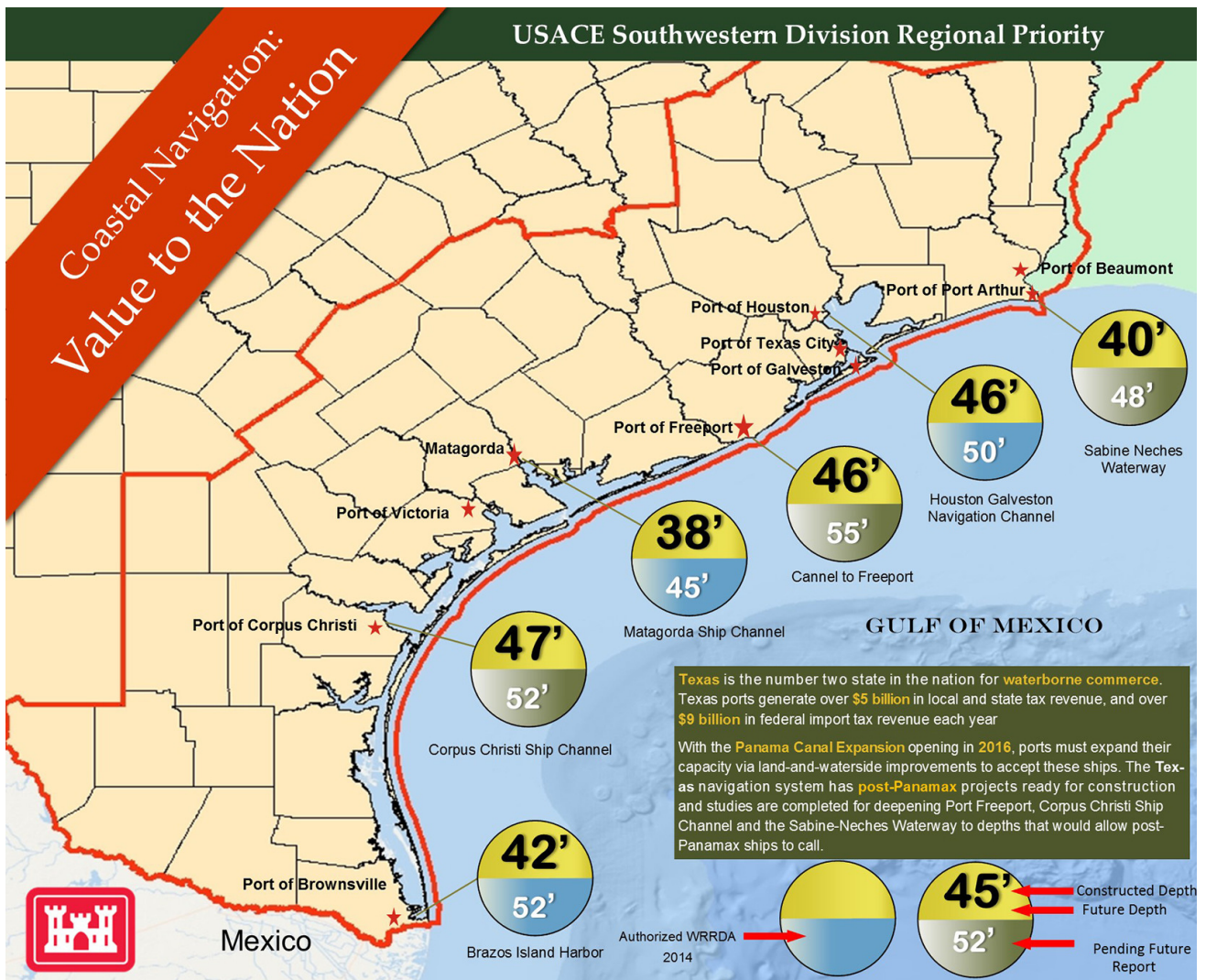


Figure 1. Texas’s six deep-water ship channels, connected by the GIWW. The upper figures in the circles reflected current depth, c. 2014. The lower figures reflected authorized or proposed depths. Courtesy of Galveston District, US Army Corps of Engineers.

pointing readers toward how researchers have examined the various ship channels and their cities.

The first section of the article sketches the nineteenth-century background of schemes to reconstruct the Texas coast. It briefly considers the rise and stagnation of Galveston, the site initially identified as suitable for a major port, according to the salt-water understanding of port location that Texas's Anglo American colonizers brought with them. Even before the Great Storm of 1900 devastated Galveston, the shortcomings of a modern port city on a barrier island two miles from the mainland were feeding arguments for a deep-water channel dozens of miles inland to Houston.

The second section recounts Texas's half-century era of ship channel construction and considers how these ports became intertwined with the oil industry and became the epitome of diversified industrial petroleum-landscape. In the concluding section, the author reflects upon the ambivalent commitment that Texas's oil port cities have shown toward diversifying away from the industry that brought this region prosperity and prominence. In the aftermath of crises that dramatized the economic and environmental hazards of continued dependence on oil and gas, these cities have engaged in searching discussions of possible new commercial directions. But such discussions repeatedly proved fleeting and their results sporadic.

The transnational project of which this thematic issue is a component seeks to understand the history of modern port cities, their industrial heritage, and their social and cultural character in order to assist in sketching out a range of possible futures. This includes a "post-oil future," to quote Hein (2020, p. 218) one more time, for port city regions that coalesced, as the Texas coast did, around oil and gas. A practical route toward taking "much of the oil out of the water and the port city regions," while essential, is daunting to imagine, as the case of what is probably the world's premier oil port region dramatizes (Hein, 2020, p. 218).

2. Texas, the Gulf, and Port Development Before Oil

The Gulf Coast of Texas extends approximately 375 miles from the Sabine Pass to the Rio Grande. The coast's estuaries empty into eight bays. The mainland is separated from the Gulf of Mexico by a string of seven barrier islands from Galveston Island in the north to Padre Island, the world's longest barrier island, in the south. An extensive plain, 100 miles wide, stretches inland from the shore, with humid forests toward the north and arid shrubland toward the south. Not far off Texas, the gulf is quite deep in places, but Texas's lagoons and bays are uniformly shallow, with drafts of eight or ten feet at best and passes that silt or form sandbars. The Laguna Madre, a delicate ecosystem which extends from Corpus Christi Bay down behind Padre Island to the Rio Grande and then in another segment to Tamaulipas, Mexico, averages under four feet deep (Tunnel, 2002, pp. 7–9). "The ports of

Texas," explains Jim Blackburn (2017, p. 37), the Houston environmental lawyer and policy expert, are "suitable in their natural state for only the shallowest draft commercial vessels."

Another noteworthy feature of the Texas coast—indeed of the Gulf Coast from Florida into Mexico—is how low-lying it is. The reputed highest point, the Corpus Christi Bluff south of the Nueces River, is 40 feet high. The salt dome at High Island on the Bolivar Peninsula northeast of Galveston is 38 feet. Only in a few other places does the shoreline rise more than five feet above sea level (Kosovich, 2008). Taken together, these features—the shallow bays, lagoons, and marshes, the low-lying shore, and the relative protection from Gulf of Mexico storms provided by barrier islands—explain most of the waterscape's history since Anglo American conquest and of course before that.

As elsewhere in the Americas, colonizers initially sought ports close to the ocean, in places accessible with minimal dredging. The port of Galveston originated in the 1810s in the activities of French privateers Louis Aury and Jean Lafitte. In the 1820s, newly independent Mexico tried to establish Galveston as an authorized port. Anglo Americans made it their port of entry to Texas and then a naval center during the Texas Revolution of 1835–36. Beyond taking control of Galveston, the Texas Republic in 1837 incorporated Houston and briefly used this new settlement as a capital. Houston's promoters sited their town where White Oak Bayou flowed into Buffalo Bayou, 18 miles upstream from where Buffalo Bayou flowed into with the San Jacinto River, which in turn connects to Galveston Bay. The town's developers insisted that Buffalo Bayou was reliably navigable. In reality, only light steamboats could make their way to early Houston (Bradley, 2020, pp. 9–12; McComb, 1969, pp. 13–14).

From a nineteenth-century perspective, Galveston qualified as "the sea Port...for this province" (Edward Lovelace quoted in McComb, 1986, p. 8). Goods and people unloaded at Galveston for transshipment up and down the coast or upstream to Houston and beyond. Galveston became the leading export point for Texas commodities, especially cotton, grain, and hides. Among its imports, Galveston maintained a trade in enslaved people, shipped mainly from US ports but at times smuggled from the Caribbean or Africa. With 4,177 people in 1850, Galveston ranked as Texas's largest city and by most measures its richest, a status maintained off and on into the 1880s (McComb, 1986, pp. 66–68, 85–86).

Galveston's location at the northern edge of a barrier island, two miles from the mainland, encouraged it to start fast but soon came to hamper it. As elsewhere along the Gulf Coast, the more protected, bay side of the island was shallow and obstructed by sand bars. Galveston Bay averages seven-nine feet deep. The island itself rises less than nine feet about sea level. A long series of hurricanes, with their devastating winds and surges, made clear the hazards of such a low-lying island town even before 6,000–8,000 people died there in the

Great Storm of 1900, still the deadliest natural disaster in US history. Galveston Island, moreover, offered minimal supplies of fresh water, as well as limited space for warehouses, freight yards, and industry. Under the Texas Republic and then during the US period, government as well as private investors endeavored to make Galveston as secure and functional as feasible. Shipping lines devised specialized shallow-hull sailing and steam ships to accommodate Galveston and the Texas coast more generally (Alperin, 1967, pp. 37–58; Barnett, 2007, pp. 185–192; McComb, 1986, pp. 42–49).

Railroads further exposed Galveston's limitations. As rail lines spread across Texas starting in the 1850s, Houston, with its broad, flat, well-watered site, became their Gulf Coast hub. In 1859, a rail line opened between Houston and Virginia Point, on the shore opposite Galveston. A trestle bridge was completed in 1860. This survived the US Civil War only to be wiped out in an 1867 hurricane. Railroads rebuilt it and added two more bridges over the next decades, all of which were wiped out again in the Great Storm of 1900 (Barnett, 2007, pp. 192–193; Bradley, 2020, pp. 37–38; McComb, 1969, pp. 34–40, 1986, pp. 49–58).

Nevertheless, Galveston still ranked in 1900 as the largest US cotton port, as well as the country's third leading port for wheat exports. The city seemed so indispensable that in 1880, the federal government established a Galveston District of the US Army Corps of Engineers, which oversaw a harbor-deepening program. By 1897, the harbor reached a depth of over 25 feet. After the 1900 hurricane, the Army Corps worked with local and Texas authorities on reconstruction and improvement, including a 17-foot seawall, eventually extended to ten miles long. By 1912, the island city was again the country's leading cotton port. While later coming to specialize in tourism and cruise ships, Galveston would remain a significant port for grain, fruits, and other commodities. Galveston's population reached a high in 1960 of 67,175 (Bixel & Turner, 2000, pp. 89–161; McComb, 1986, pp. 84–149). But this summary of Galveston's twentieth-century trajectory underscores how thoroughly it had fallen into the shadow of Houston, while falling behind Corpus Christi and Beaumont–Port Arthur as well. Both of these had been minor places before ship channels reached them.

Corpus Christi, two hundred miles south of Galveston and Houston, likewise illustrates geographic and economic factors that led Texas and US officials to contemplate deep-water channels to inland harbors even before petroleum began to affect navigation planning. The town originated in the late 1830s as an Anglo-American trading post on the western edge of Corpus Christi Bay, about 20 miles inland from Aransas Pass on the Gulf of Mexico. Corpus Christi's most picturesque feature was its sweeping crescent bay. More significant for the site's potential was the 40-foot bluff several hundred feet behind the shoreline. As already noted, this was reputed to be the highest point on the storm-ridden Texas coast.

The chain of events that led to the town's transformation began in the South Texas countryside. After the US Civil War, Anglo-American land operators—founders of the South Texas ranches that play a huge role in US western lore—accumulated land grants, often at the expense of Mexican landholders, who found themselves pressed financially and isolated politically. From annexation into the 1870s, the borderlands region remained loosely controlled, disputed territory, periodically wracked by raids and reprisals involving Mexican and Anglo and sometimes mixed-ethnic bands. Aided by the Texas Rangers, the ranch families determined to pacify the countryside, a cycle that culminated in a deadly 1875 raid by a gang with connections to northern Mexican military figures on a trading post northwest of Corpus Christi. In the aftermath, Anglo posses and vigilantes fanned out across the countryside carrying out “indiscriminate” reprisals, murdering “not only the outlaws, but also innocent Mexican settlers, ranchers and traders,” as the city's Works Progress Administration guide put it (Works Progress Administration in Lessoff, 2015, p. 92). These events secured the Anglo cattle operations, while making possible the subdivision of ranchland for agriculture. Ranch families worked with investors and engineers to extend railroads, found satellite towns, and promote the migration of Anglo farmers. When in the early twentieth century oil deposits were discovered on these lands, ranch families already had experience as diversified entrepreneurs.

South Texas ranch families identified Corpus Christi as their site for a port where railroads would converge. They built townhouses atop the bluff and underwrote a range of business and civic institutions. The silted passes and shallow harbor posed an obvious obstacle. In the 1870s, packing plants along the bay and on Padre Island stripped hides, tallow, horns, and bones from cattle and threw the meat into the bay or left it to rot on the shore. With Texas cattle so abundant and prices low, it did not pay even to pickle the beef for shipment through such a difficult port. Richard King, founder of the famous King Ranch, responded by underwriting an eight-foot channel through Corpus Christi Bay. When in May 1874, a Morgan Line freighter reached the town's Central Wharf, over 2,000 people turned out to greet it. After a decade, the channel silted again (Givens & Moloney, 2011, pp. 122–123; O'Rear, 2009, p. 18, 2022, pp. 59–62). In the 1890s, a former Union colonel from New Jersey lined up New York investors for another attempt to construct a shipping channel. The dredge for this project ended up abandoned, buried in the silt. Still, this undertaking drew attention to Corpus Christi's potential for both large-scale commerce and oceanside tourism: a combined “Southern Newport” and “Chicago of the Southwest” as a contemporary promotional pamphlet stated the aim (Lessoff, 2015, pp. 99–100; Figure 2). Regional interests in South Texas were coming together behind a deep-water channel. Yet Corpus Christi, with a 1900 population under 5,000, still seemed to the

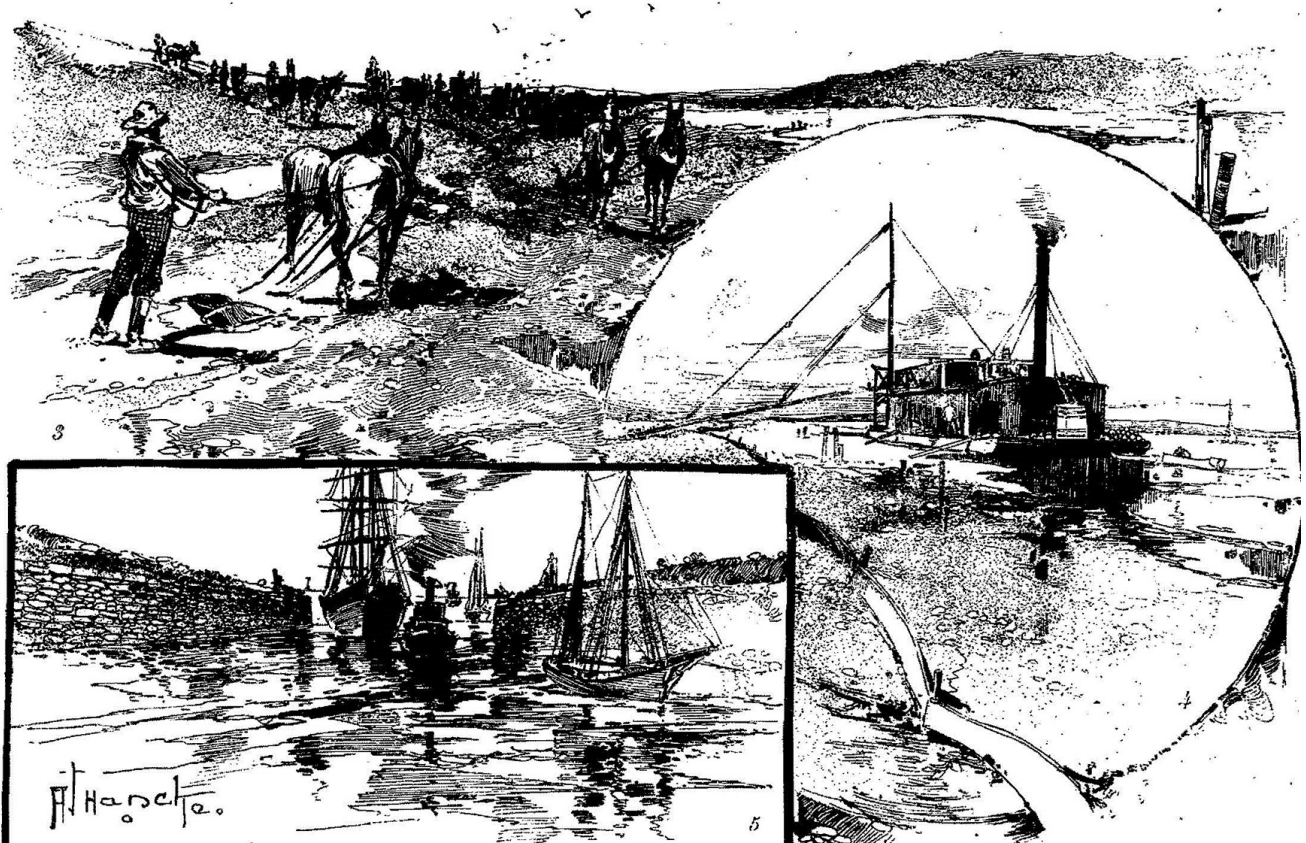


Figure 2. Print from *Engineering Magazine*, June 1892, of that decade’s failed attempt to dredge “Ropes Pass” through the barrier islands and across Corpus Christi Bay. Courtesy of Kilgore Collection, Special Collections and Archives, Texas A&M University—Corpus Christi.

Army Corps of Engineers too insignificant and remote to justify more than minor efforts to open it to shipping, by comparison to the money and effort then being devoted to both Galveston and Houston (Alperin, 1967, pp. 126–133).

3. A Coast Remade for Petroleum

In 1904, Robert Kleberg Sr., Richard King’s son-in-law and successor as operator of King Ranch, recruited a young Houston journalist named Roy Miller, a Kansas native with a business degree from the University of Chicago, as publicist for a rail project to the Rio Grande Valley. By age 24, Miller edited the *Corpus Christi Caller*, the region’s main newspaper, another local institution underwritten by ranching interests. The newspaper provided Miller a platform for election as mayor in 1913, where he oversaw infrastructure and beautification projects intended to make Corpus Christi up-to-date and attractive. After three terms, Miller lost re-election in spring 1919 and returned to his newspaper. “The future of Corpus Christi” hinged, Miller proclaimed, “upon ONE THING ALONE—DEEP WATER” (Miller quoted in O’Rear, 2009, p. 89). In September 1919, Corpus Christi was struck by a hurricane in which as many as 600 died. The editor organized a Deep Water Association to lobby

federal and state officials at last to construct a ship channel. The US Army Corps of Engineers continued to express skepticism that South Texas needed an elaborate port to match Galveston and Houston. Nearly all the effort that the Corps had expended to date had focused on Aransas Pass on the Gulf Coast. Rail connections there or to nearby Harbor Island would suffice, the Corps argued. Yet for all the damage wrought by the 1919 storm in Corpus Christi, these coastal sites were “practically swept clean,” as an official port history later explained (Port of Corpus Christi, 1976, p. 15). “A safe harbor,” Miller argued “should be established against” the Corpus Christi Bluff, many of whose residents made it comfortably through the September 1919 storm, unaware until the morning of the scale of destruction in the lower town and along the beaches (Miller quoted in Walraven, 1997, p. 7). When the Corpus Christi Ship Channel opened in September 1926, the seventh anniversary of the deadly storm, the official commemorative booklet stressed that “engineering ingenuity” had indeed provided South Texas with “*a safe port*” (Port of Corpus Christi, 1926, p. 6, italics original; Figure 3).

Massively expensive, dependent on public funds, navigation improvements are products of politics as well as economics, geography, and technology. Texas’s ship channels manifest the strength in the state of

death, the GIWW provided a shipping artery 12 feet deep and up to 125 feet wide from the Rio Grande to Florida (Judd, 2021; Lessoff, 2015, pp. 101–103; O’Rear, 2009, pp. 67–79). The Texas coast, in sum, emerged as a key node in the global petroleumscape largely because the petroleum business was able to build on pre-existing commercial-civic alliances and on navigation projects set in motion before the extent of oil reserves in the state and the US Southwest became evident.

Houston’s historians have understandably devoted much attention to events that led to construction of that city’s immense ship channel and then to how the port became the basis for Houston’s emergence as the self-proclaimed energy capital of the United States and even the world. As noted earlier, US and Texas officials as well as shipping interests remained committed to Galveston even after the Great Storm of 1900. Following a traditional saltwater strategy, Galveston’s backers “deepened its harbor to permit increasingly larger ships to enter,” explains William Barnett (2007, p. 191), a historian of US port development. Houston interests, by contrast, had for decades prioritized the site’s value to railroads and industry, whose concentration at Houston in turn became a rationale for opening Buffalo Bayou to shipping. Already in 1871, the first Army Corps survey noted that the advantages of opening a channel to this emerging railroad center were “obvious” (Alperin, 1967, p. 96).

By the early 1900s, 17 railroads met at four separate depots, justifying Houston’s promotional nickname, “Iron-Ribbed City.” The city served as eastern hub for the Southern Pacific system, whose Houston shops and yards employed over 1,200 by the early 1890s. Railroad construction and repair provided Houston with an industrial base in metals and machinery that later proved attractive to the oil industry (McComb, 1969, pp. 92–110; Platt, 1983, pp. 80–83). Against this background, Congress in 1896, five years before Spindletop, authorized a 25-foot channel all the way from Galveston Bay (by 1950, this would be deepened to 34 feet). In this way, Barnett (2007, p. 191) remarks, Houston become “the site where Texas railroads met the sea” (Figure 4).

Congress waited until 1902 to begin funding the project, which the city and its banks also underwrote through bond sales. Opened in 1914, the Houston Ship Channel had an origin separate from the Texas oil boom. Even so, the potential mutual benefit of these contemporary events became evident even as the ship channel was being built. At first, investors in the East Texas fields envisioned moving oil by train or pipeline to nearby Beaumont and Port Arthur. But Houston’s comprehensive railroad network, its diverse, highly skilled industry, and its vibrant financial and commercial sectors made it an attractive base for oil operations. Motives to concentrate around Houston increased as reserves

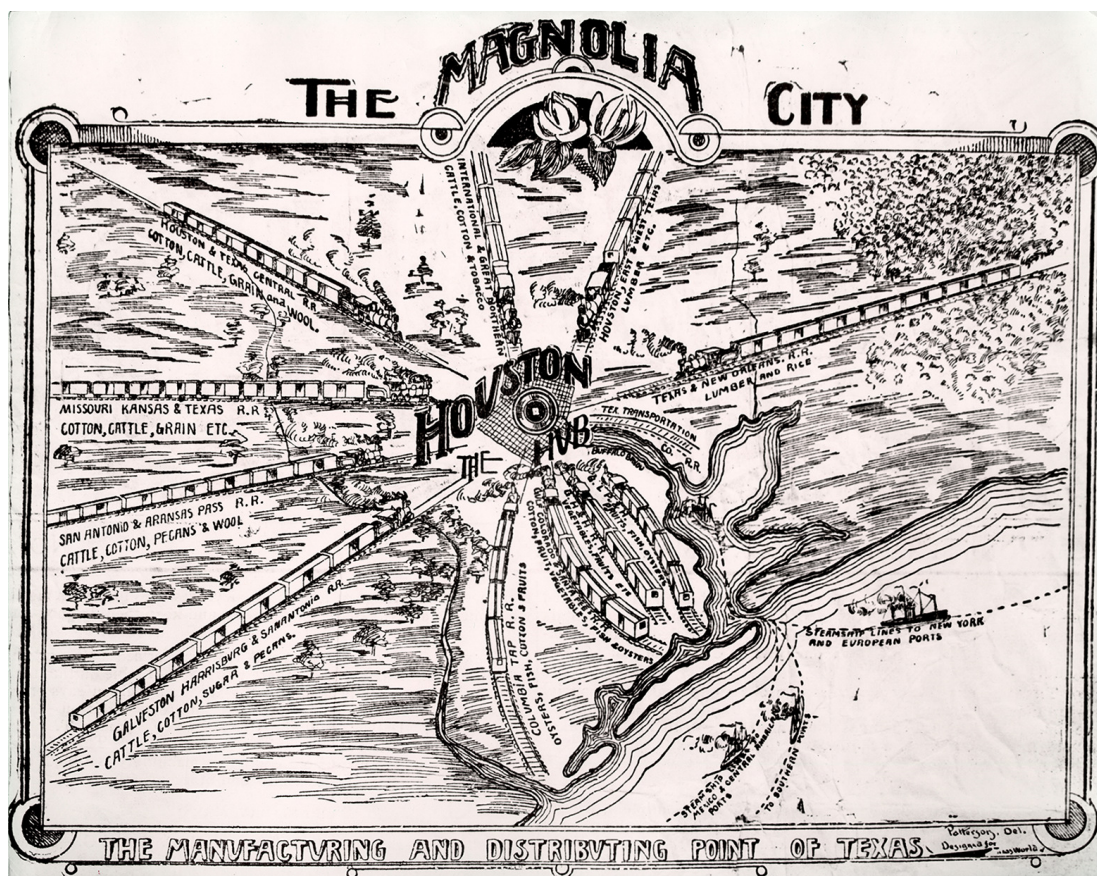


Figure 4. An 1898 print publicizing Houston as the railroad and industrial hub of the Texas coast. Courtesy of University of Houston Libraries Special Collections (<https://id.lib.uh.edu/ark:/84475/do06149p703>).

were discovered near the city, starting in 1905 with the Humble Oilfield 18 miles to the northeast.

Texas oil evokes swaggering, independent personalities, the industrial-era frontiersmen of the novel and movie *Giant*. While this stereotype had a reality behind it, experienced investors, managers, and technicians exerted a presence from the start. The founders of three major companies to emerge from the early Texas boom—Gulf, Texaco, and Sun—all had backgrounds in Pennsylvania and understood how indispensable Pittsburgh, Cleveland, and Philadelphia had been to the industry’s growth. Texas Company (Texaco) founder Joseph Cullinan, who started with Standard Oil and who had run an oil equipment business in Pennsylvania before turning to Texas, moved his headquarters to Houston by 1908. Gulf Oil, organized by Pittsburgh’s Mellon banking family, moved its headquarters to Houston in 1916. In 1919, Standard Oil of New Jersey (ESSO, forerunner of Exxon) acquired the majority share of Texas-based Humble Oil, which then began construction of its own Houston headquarters. Houston also became a locus for the American operations of foreign interests, such as Royal Dutch Shell, which starting in the 1920s built a refinery in the area, along regional offices and research facilities (Hein & Lessoff, 2022, pp. 28–31).

Even as petroleum’s managerial and technical functions concentrated in Houston’s offices, entrepreneurs such as Cullinan pointed to the Houston Ship Channel as ideal for transportation and processing. The Port Authority of Houston controlled expanses of land along the channel suitable for refineries, storage, pipelines, and much else. The port could ensure the industry a steady supply of fresh water (McComb, 1969, pp. 115–116; Sibley, 1968, p. 152). By 1930, the Port of Houston’s nine refineries processed up to 194,000 barrels daily. Refineries spread around the region, for example to Texas City on the mainland side of Galveston Bay. Baytown, near the juncture of the San Jacinto River and Buffalo Bayou, took shape as a company town for the ESSO affiliate Humble after the opening of an oil field along the creek that ran through the town site. By World War II, Humble’s Baytown operation was the largest US refinery, a status retained into the twenty-first century, when the refinery, by now renamed after Exxon/Mobil, employed 7,000 people processing 584,000 barrels/day (Bradley, 2020, pp. 152–153; Figure 5).

Oil firms located storage terminals at the Houston Ship Channel, fed by pipeline networks for crude and refined oil and, eventually, natural gas. Equipment and rig manufacturers and industrial construction companies also clustered around the Port of Houston. The most



Figure 5. The Humble Oil Refinery at Baytown along the Houston Ship Channel, 1944, already the country’s largest refinery. Reprinted by permission, Bob Bailey Studios Photographic Archives, e_bb_2078, The Dolph Briscoe Center for American History, The University of Texas at Austin.

renowned of these—Hughes Tool—began in 1908 with a Spindletop contractor, Howard Hughes Sr., who allegedly bought an idea for a specialized drill bit from a millwright he met in a bar. By World War II, the Hughes plant, now under the leadership of the founder’s son, aviator and adventurer Howard Hughes Jr., had branched into aircraft construction and military contracting. The construction firm Brown & Root made a fortune in public works contracting and shipbuilding before moving into chemical plant construction, pipelines, and offshore platforms. Brown & Root’s 1962 merger with the oil field services firm Halliburton reinforced Houston’s role as a provider of facilities and logistics to the multinational petroleum industry (Pratt & Castaneda, 1999, pp. 223–226).

This infrastructure drew manufacturers of petrochemicals, synthetic materials, and fertilizers. Cement works, metals producers, and inorganic chemical plants also located along the ship channel and up and down the coast. Such industries used high-energy manufac-

turing processes that benefited from reliable supplies of natural gas. By 1950, 27 chemical plants lined the ship channel, “future chemical capital of the world,” as an analysis in the *Geographic Review* proclaimed. Products ranged from alkalis and chlorine to “synthetic glycerin, sodium silicate, industrial alcohols, insecticides, plastic resins, sulphuric glycering, ammonium sulphate, and ammonium phosphate” (Parsons, 1950, p. 77) This study’s prediction seemed fulfilled by the 1980s when coastal Texas from Beaumont–Port Arthur area to metropolitan Houston accounted for half of US petrochemical capacity (Figure 6).

The hope that the Houston Ship Channel would serve Texas agriculture did come to fruition. A study from 1931 noted that in 1925 about a third of the US cotton crop moved through Texas ports. Cotton staple and cotton seed products remained more valuable—in dollar terms—than petroleum products, though in tonnage terms, petroleum already accounted for two-thirds

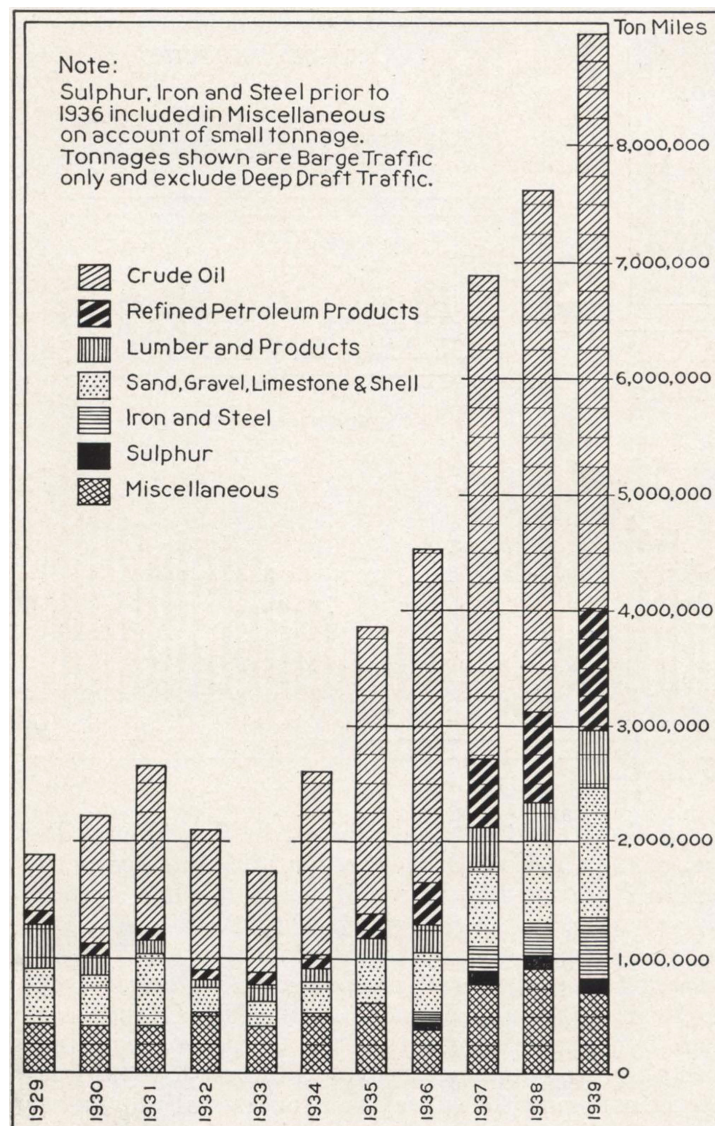


Figure 6. Chart tracing the speed with which crude and refined oil came to dominate traffic on the GIWW between 1929 and 1939. From Odom (1941, p. 204). Courtesy of JSTOR.

of the Texas coast's trade. Galveston and, to a lesser degree, Houston handled grain on a scale comparable to cotton. Nonetheless, what stood out to contemporaries was the scope, scale, and complexity of the petroleum industry landscape at Houston and nearby ports. "Pipelines, ranging from six to twelve inches in diameter, converge upon this port region; and pumping stations keep petroleum pulsating through them from all the great centers of production," the 1931 study remarked. "Thousands of acres of land adjacent to ship-channels at Port Arthur, Beaumont, Houston, and Texas City are used as storage-tank farms, as sites for petroleum refineries and by-product plants, and for wharf and terminal facilities by petroleum companies." Specialized factories, meanwhile, made and repaired "machinery, pipe equipment, and packages used in the industry" (Chambers, 1931, pp. 72–73). By mid-century, 80 percent of cargo shipped from the Port of Houston consisted of petroleum products (Odom, 1941, p. 202; Parsons, 1950, p. 72).

A similar shift in landscape and understanding took place in an even shorter time at the Corpus Christi Ship Channel after its 1926 opening. Already in 1916, the blowout of an exploratory well at White Point along Nueces Bay revealed substantial reserves within a few miles of the ship channel's eventual route. Corpus Christi's promoters likewise followed Houston's in stressing that an inland port offered synergies among railroads, shipping, freightyards, and industry. And as at Houston, the Port Authority of Corpus Christi controlled "ample room" for "all necessary piers, docks, and slips, and railway switches and terminals," along with "an unlimited quantity of fresh water" for industry (joint brief, City of Corpus Christi and the Corpus Christi Commercial Association, 1920, quoted in Lessoff, 2015, p. 67). Despite all this, oil and gas received hardly any mention in engineering studies, policy papers, promotional literature, and press accounts either during the campaign for the Corpus Christi channel or during its construction. Discussion focused on "a water outlet for [South Texas's] fabulous agricultural wealth" (Port of Corpus Christi, 1926, p. 6). Photos of cotton production illustrated brochures and pamphlets, with hardly an oil well in sight.

Farm products would remain a significant part of Corpus Christi's business. Yet petroleum-related activities soon overshadowed agricultural commodities. Corpus Christi gained the capacity to handle oil in 1930. By 1935, oil had surpassed cotton. By 1937, eight refineries lined the ship channel, processing 45,000 barrels daily. South Texas's commercial-civic leaders recognized fairly early natural gas's value in attracting diverse industries. In the early 1930s, business and civic leaders were so eager to win a \$7 million inorganic chemical plant, a joint venture of American Cyanamid and Pittsburgh Plate Glass, that they underwrote the deepening and extension of the channel, the construction of a second turning basin (of an eventual five), and the upgrading of the city's water supply. Local investors also underwrote the Southern Minerals Corporation (SOMICO), eventually a

\$100 million gas pipeline and supply company, intended to fulfill the "industrialist's dream" of "gas wells in sight of ship masts" (Industrial Banquet program, 1934, quoted in Lessoff, 2015, p. 103; Figure 7). By the 1960s, in addition to refineries, the Corpus Christi Ship Channel was lined by organic and inorganic chemical plants, aluminum and other metals operations, and a Halliburton cement factory, along with food processors and grain and cotton operations (Figure 8).

"Petroleum and natural gas," the *Geographic Review* summarized in 1950, formed "the basis for Gulf Coast's rapid urban and industrial growth" (Parsons, 1950, p. 73). Since Spindletop, the study explained, Texas by itself accounted for a third of US production and over 20 percent of world production. By mid-century, over one-third of US refining capacity was located in the coastal region of Texas and Louisiana, including the two largest refineries, at Baytown on the Houston Ship Channel and at Baton Rouge, Louisiana, along with six of the 12 largest (Parsons, 1950, pp. 73–80).

Unlike at Houston and Corpus Christi, proximity to oil fields explicitly influenced the deep-water system at Beaumont-Port Arthur from the start (Spindletop was about three miles south of Beaumont). The East Texas oil boom prompted Congress to assume control of privately funded navigation projects in the area and to underwrite a channel through the Sabine Pass on the Texas-Louisiana border, then 24 miles up the Sabine River to Port Arthur, and then about 20 more miles up the Neches River to Beaumont. Another branch of this project extended eastward to Orange on the GIWW. By the mid-twentieth century, the Y-pattern Sabine-Neches Waterway stretched 61 miles, with the channel over 30 feet deep. Beaumont, hitherto a railroad center and river port that mainly handled lumber, increased ten times from about 9,400 to about 94,000 people between 1900 and 1950. Port Arthur, founded as a land speculation in 1894, went from 900 people to over 57,000 in the same half-century. Clusters of refineries meant that the Beaumont-Port Arthur area at times produced nearly as much oil as Houston and sometimes exceeded Houston in cargo tonnage. Port Arthur employed 11,000 at two huge refineries adjacent to one another, "drawing oil by pipe line from East and West Texas, Oklahoma, Kansas, and Louisiana" (Parsons, 1950, pp. 72–74; see also Alperin, 1967, pp. 59–66).

By the 1940s, the discovery of more natural gas reserves encouraged further clusters of chemicals and metals operations along the mid-Texas coast. About 60 miles south of Houston, Freeport became a key example of the shorter harbor projects that supplemented Texas's major channels. There, starting in the 1920s, a three-mile, 32-foot channel was constructed at the Brazos River. During World War II, this became the site of a Dow Chemical complex underwritten by the US government. The centerpiece of this complex was a plant that extracted metallic magnesium, a lightweight alloy with strategic uses, from seawater. Dow's processes required

OIL AND GAS FIELDS IN THE CORPUS CHRISTI AREA,
AND GAS-PROCESSING PLANTS

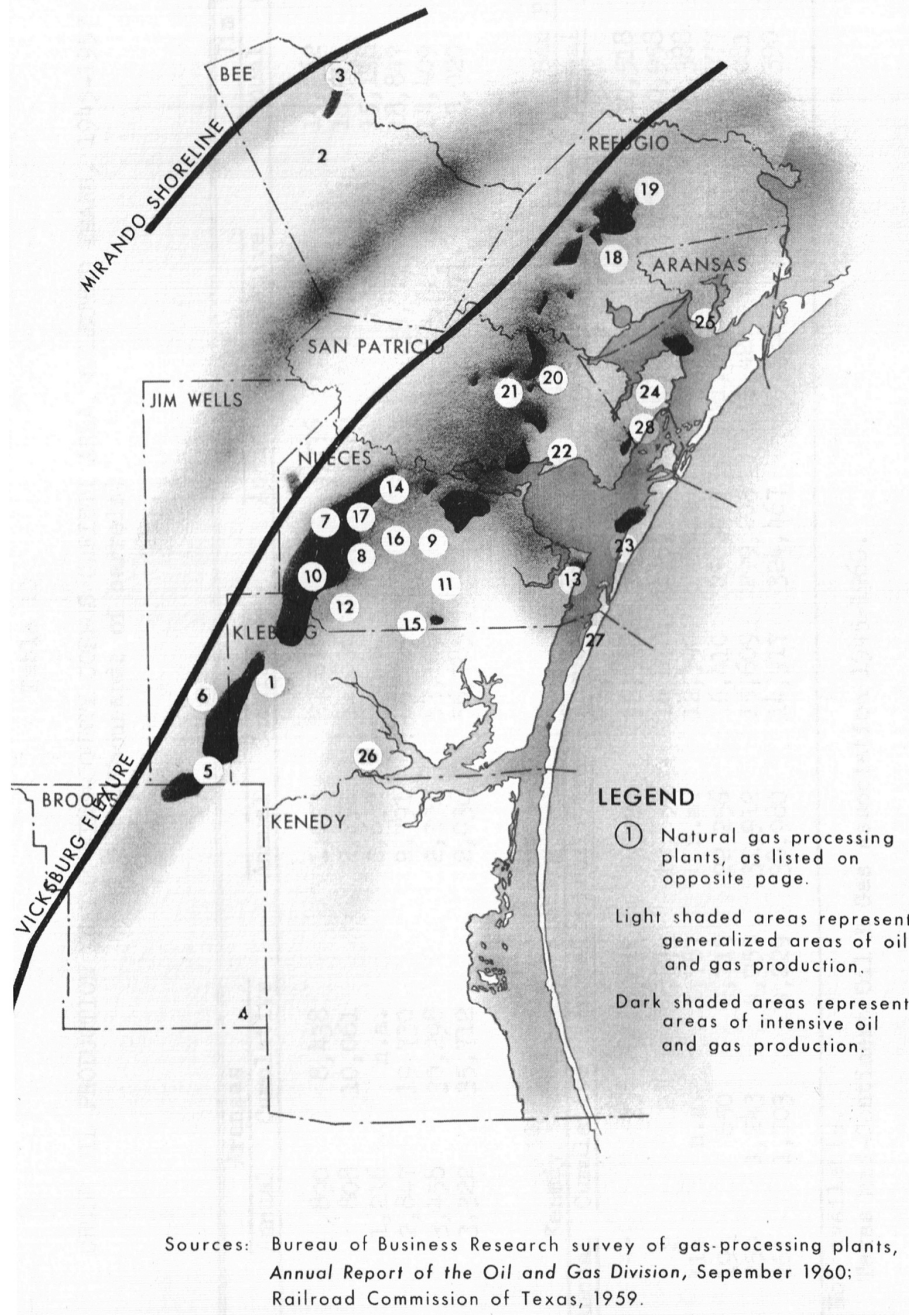


Figure 7. Oil and gas fields in the vicinity of the Port of Corpus Christi, 1960. Source: Ryan (1961, p. 113).

copious fuel, as did the aluminum plant that Alcoa built in the early 1950s at Point Comfort on Matagorda Bay. Union Carbide and Dupont likewise located in this area after World War II. In the 1950s–60s, federal and state officials pushed a deep water channel through Matagorda Bay (Foscue, 1950, pp. 12–13; Parsons, 1950, p. 76). The bay, with its agglomeration of chemicals plants, remained as vulnerable to gulf storms as in the 1870s–80s, when hurricanes forced abandonment of Indianola, for decades a staging ground for German and

Anglo-American migration into central Texas. All that remains of Indianola is a historic marker.

4. The Weighty Heritage of Oil and Water

Hurricanes had loomed large in navigation planning for the Texas coast since the nineteenth century. By the early twenty-first century, climate change rendered disaster planning ever more urgent. Hurricane Harvey in August 2017 drew widespread attention to the region’s

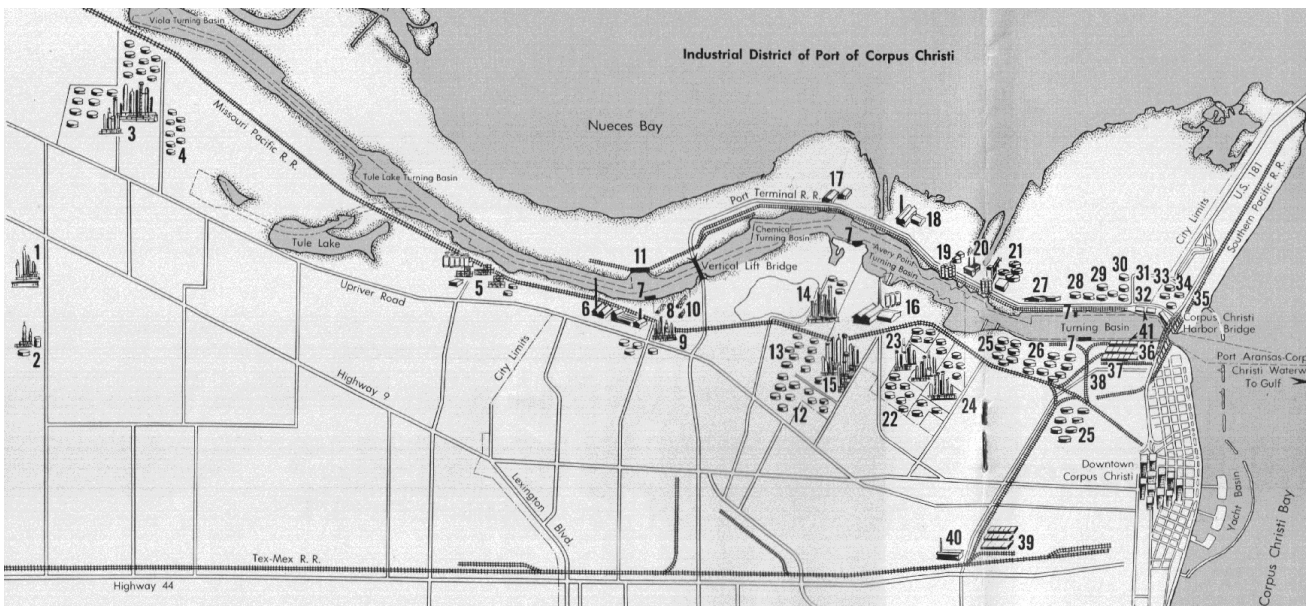


Figure 8. Industry along the Corpus Christi Ship Channel, 1958. Author’s collection.

vulnerability. Yet Harvey’s unprecedented flooding came mainly from rainfall when the storm stalled over the Houston area. That catastrophe had little *directly* to do with the Houston Ship Channel or the petroleum industry. As a reader remarked on an earlier draft, any city built in a comparable way amid metropolitan Houston’s wetlands and bayous would have experienced similar flooding.

Experts concerned about the possible catastrophic interchange between the petroleum industry, ship channels, and Gulf of Mexico hurricanes had already been developing models and projections based on Hurricane Ike, which landed at Galveston as a category 2 storm on September 13, 2008. The 10–15-foot surge that hit Galveston could not surmount the 17-foot Galveston Seawall on the island’s east side, but floods in excess of 12 feet inundated Galveston from the bayside to the west. A surge up to 20 feet submerged the Bolivar Peninsula northeast of Galveston. For all the damage inflicted on Galveston and the Bolivar Peninsula, observes the environmental lawyer Jim Blackburn (2017, p. 81), “the Houston region was spared the worst.” Analysts at Rice University’s Severe Storm Prediction, Education and Evacuation from Disaster Center calculated that if a similar storm—its intensity increased perhaps 15 percent—had made landfall a few dozen miles to the southwest, a storm surge plausibly estimated around 24 feet would submerge refineries and petrochemical plants at Texas City and Baytown before heading up the Houston Ship Channel. Storm water would crush storage tanks or lift them from their foundations, while breaking apart gas and oil pipelines. Over 2,220 oil or petrochemical storage tanks would experience flooding, as would “at least six refineries and well over a hundred chemical plants,” Blackburn (2017, p. 84) notes. Up to 90 million gallons of oil and hazardous chemicals would flow

into the urban area or into the rivers and bays. These projections did not even estimate the effect of rising sea levels and stronger storms related to climate change. Such scenarios prompted proposals for elaborate protection systems, such as the so-called Ike Dike, modeled in part on Rotterdam’s Maeslant Barrier and the Eastern Scheldt Barrier in Zeeland (Blackburn, 2017, pp. 81–95; Figure 9).

Such scenarios added a new dimension to arguments made off and on since the 1960s that the Texas coast should look to de-emphasize petroleum. By the 2000s, this included schemes to shift the region toward renewable energy, fossil fuel’s apparent successor. Those who saw Houston as potentially as formidable in renewables as it has been in fossil fuels pointed to the ship channel and its range of transportation and industrial facilities, but also to the technical and managerial skill that petroleum caused to accumulate in the metropolitan area. The energy industry explains why the Houston area is home to 57,000 engineers, as well as approximately 235,000 tech jobs and 8,800 tech firms (Medlock, 2021, pp. 2–3). Corporate headquarters, geological, technical, and financial services, energy-sector consultants, and specialized law firms concentrated in downtown skyscrapers or in the office parks of West Houston’s Energy Corridor. By the 1980s, 34 of the 35 largest oil companies had a white collar as well as blue collar presence (Feagin, 1985, p. 1219). Such a broad base in corporate enterprise, finance, research, and the professions had already facilitated successful moves into aerospace after the founding in 1961 of what later became known as the Johnson Space Center and into medical services and biomedicine, with the step-by-step expansion of the Texas Medical Center in the decades after World War II.

By the early 2000s, meanwhile, the Port of Corpus Christi had become the preferred entry point for turbines

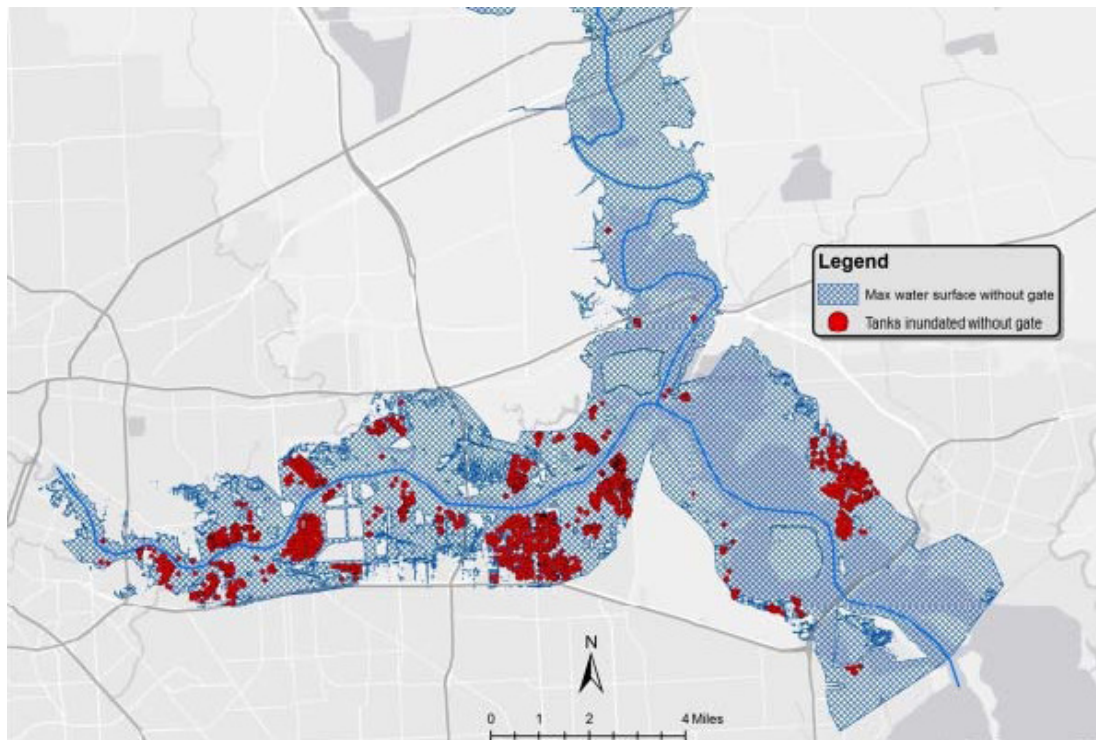


Figure 9. Projection of oil and hazardous substance tanks in the Houston area likely to be flooded by a 25-foot storm surge in the absence of a proposed coastal protection system. The Houston Ship Channel runs roughly west from Galveston Bay in the lower right. Source: Blackburn and Bedient (2018, p. 35).

for the vast wind farms on the Texas plains that in turn had made the state home of over a quarter of US wind energy capacity. Yet Corpus Christi’s move into wind energy illustrates the tentative nature so far of any shift away from fossil fuels. Corpus Christi’s investments in renewables amounted to a fraction of the billions invested in the Corpus Christi region to support South Texas’s Eagle Ford shale oil field and to process and ship that field’s output (Figure 10).

Likewise, despite a major expansion into container traffic, the Port of Houston still in the main meant oil and gas. By 2020 Houston handled 69 percent of container traffic along the US Gulf Coast. Yet 69 percent of Houston’s cargo still consisted of liquid bulk, that is to say, oil and petrochemicals (Medlock, 2021, p. 3; Port Houston, 2020, pp. 7–9). Though usually outranked by Houston and Corpus Christi in terms of tonnage handled, Beaumont did manage to develop an identity apart from oil and gas, through its function as the largest cargo handling port for the US military.

Over the decades, for the most part, the energy sector’s transitions and upheavals had tended to reinforce ties between Texas’s ship channel network and the oil and gas industry. As the original Texas oil fields waned after World War II, Texas ports reoriented themselves toward offshore and multinational operations. More than the Texas Medical Center or anything else, the energy sector accounted for Houston’s status as a global city, with Houston firms active everywhere oil was found, from the Americas to the North Sea

across the Middle East and to Southeast Asia. Likewise, the Organization of Petroleum Exporting Countries (OPEC) embargoes and oil price shocks of the 1970s, functioned—counterintuitively, as Houston urbanist Joe Feagin noted at the time—to distract from the 1960s trend toward diversification that aerospace and biomedicine represented. The OPEC crisis encouraged Houston energy firms toward large new investment in “exploration, drilling, and machinery,” employment in all of which increased in the 1970s (Feagin, 1985, p. 1220).

The most memorable crisis that illuminated the persistent hold that oil and gas exerted on Texas ports was the oil bust of the 1980s. The 1973 OPEC embargo caused prices to inflate from under \$4/barrel to nearly \$32/barrel early in the next decade. Then the recession of the early 1980s started a downward cycle that ended at around \$12.50 in 1986. Bankruptcies spread through the energy sector, which had spent a decade investing based on continued high prices. From there, the crisis spread to banking, real estate, and other sectors of the regional economy. Houston unemployment peaked at around nine percent in 1987, when the energy sector began a slow recovery (Livingston, 2020).

Corpus Christi’s unemployment peaked at 11.6 percent. That city’s port authority responded with efforts to enter the tourist-and-convention sector that had thrived along the South Texas coast since the late 1800s. The port also established a foreign trade zone in an unsuccessful attempt to use tariff advantages to diversify manufacturing. It built a cold-storage warehouse in the hope

Corpus Christi – NGL Supply

Natural gas and NGL supply prior to Eagle Ford development was concentrated southwest of Corpus Christi as served by the natural gas plants shown below. Data not compiled for 2013 plant throughput.

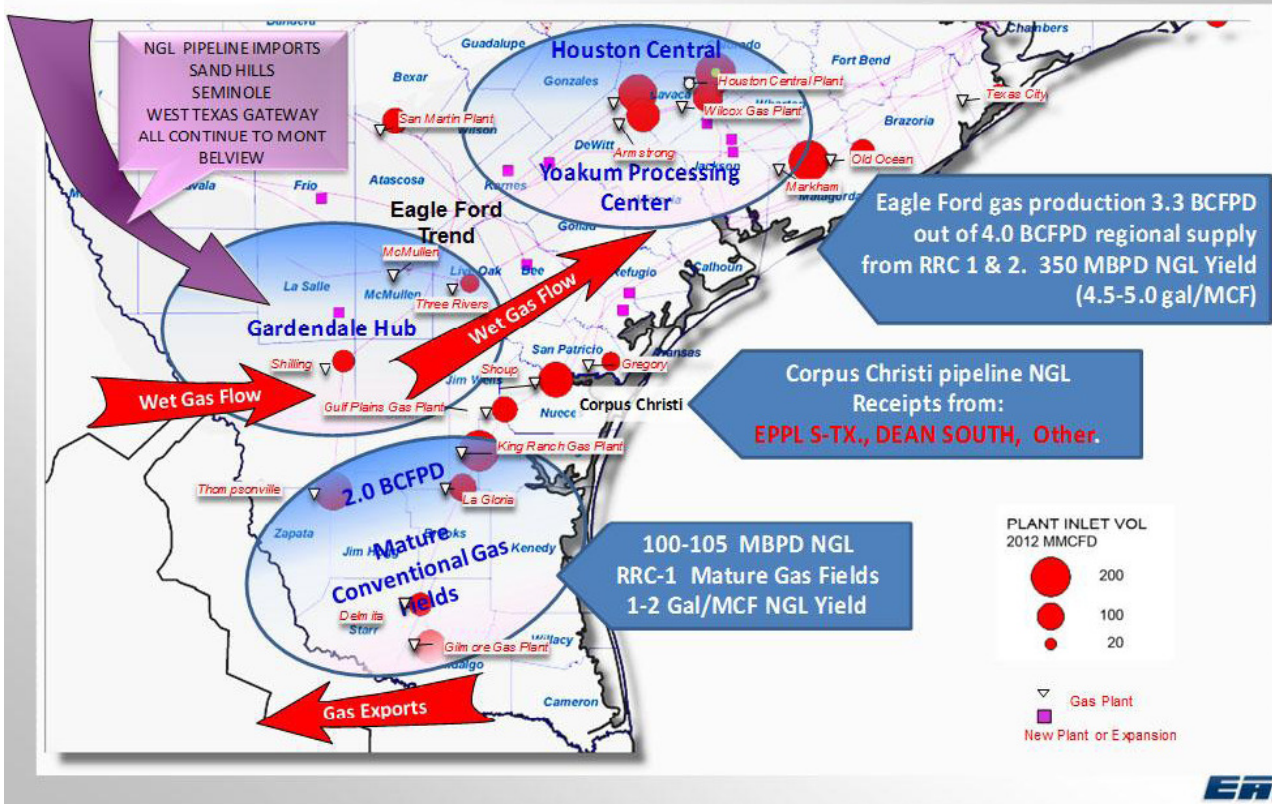


Figure 10. Accelerated production in the 2010s at the Eagle Ford shale oil field northwest of Corpus Christi—along with similar fields elsewhere in the state—spurred investment in facilities for handling natural gas and liquefied natural gas (NGL) there and at other Texas ports. Source: Port of Corpus Christi Authority (2013, p. ES-13).

of attracting agricultural imports from Mexico under the NAFTA agreement. Yet the main reshuffling at Corpus Christi following the 1980s price collapse was within the oil and gas sector itself. Through the 1960s, the South Texas energy sector had mixed locally owned firms with branch operations of corporations headquartered elsewhere. By the 1990s, Corpus Christi—consistently ranked as one of the country’s largest ports, often in the top five—basically functioned as a secondary or satellite center for national and multinational corporations. Through the 1980s crisis and then into the twenty-first century, petroleum and related activities accounted for around 70–80 percent of cargo tonnage at Corpus Christi. Most of this production and traffic was now managed from Houston, San Antonio, or Wichita, whose Koch Industries gained a major presence in Corpus Christi refining during these years. The 1980s crisis accelerated the decline of Corpus Christi’s independent operators in exploration, drilling, pipelines, equipment, and geological services, all of which remained sluggish until the Eagle Ford boom of the 2010s (Lessoff, 2015, pp. 254–271).

In the 2010s, Houston, Corpus Christi, and other Texas ports envisioned the widening of the Panama Canal

as another opportunity to shift away from petroleum. In Corpus Christi, the possibility of serving as a gateway to the south amounted to an older vision overshadowed by the shift to petroleum, which had tied the South Texas port more firmly into North American business networks (Lessoff, 2015, pp. 260–266). The price turmoil that accompanied the 2020 coronavirus pandemic briefly invigorated these sorts of arguments and ideas for finding new directions. But similar to earlier episodes, the price spike that followed the 2022 Russian invasion of Ukraine quelled such discussions.

The research group that put together this thematic issue has documented path dependence in port city regions and the consequent difficulties ports can have adapting to new circumstances (Hein & Schubert, 2021). The Texas Gulf Coast may stand as a strong instance of this pattern. Despite its pre-oil origins, Texas’s port city region coalesced in a way that bound it deeply and broadly to oil and gas. A post-oil future now implies a level of deindustrialization and related disruption to the regional political economy that neither Texas nor the United States is prepared to manage. Little wonder, then, that civic and business interests in Texas’s oil port cities—

and the residents of this region more generally—have to date responded unenthusiastically to arguments for removing oil from their water.

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Conflict of Interests

The author declares no conflict of interests.

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