

Post-Oil Environments: Responsive Design Strategies for Coastal City-Landscapes of Oil

OSWALD JENEWEIN

University of Texas at Arlington

Keywords: Climate Adaptation, Landscape Urbanism, Participatory Engagement, Post-Industrial Society, Coastal Cities

This paper summarizes parts of an interdisciplinary research and design project on climate adaptation strategies on the scale of architecture and the city within the case-study territory of Corpus Christi Bay in South Texas. In particular, this paper assesses the challenges of the emerging process of re-industrialization along the Texas Coast, highlighting significant impacts of industrial growth on the city landscape of Downtown Corpus Christi, which is located directly adjacent to the industrial oil port. A proposed masterplan is shown in this paper to demonstrate how responsive design strategies may benefit post-oil city-landscapes in the age of anthropogenic climate change. The emphasis is storm-water and flood mitigation, walkability, alternative transportation, and urban place-making in response to community input related to the United Nations Sustainable Development Goals (SDGs) and the AIA Framework for Designing for Equitable Communities.

Methodologically, this project builds upon a mixed-methods approach. It includes qualitative and quantitative data gathered through Participatory Action Research, a successful tool to connect the research team and students to local communities, stakeholders, and constituents. The paper suggests that this era of re-industrialization needs to be seen as a transformative process that enables the aging city-landscape to adapt to both changing ecological conditions and the time after this late oil-boom. Urban identity, socio-economic diversity, and healthy conditions for urban ecosystems are essential parameters to inform the development of comprehensive strategies for the built environment.

The responsive design strategies shown in this paper propose the implementation of an infrastructural landscape addressing these challenges. The central element of the masterplan is a canal that serves multiple purposes, including disaster preparation and response infrastructure, storm-water management, and alternative transportation for inner-city and city-to-city connections, has been developed to adapt Downtown Corpus Christi to the projected ecological changes.

LANDSCAPES OF OIL AND WATER

A short time after the Coronavirus outbreak sent countries worldwide into a lockdown in April 2020, the price for West Texas Intermediate, a primary benchmark for oil pricing, dropped negative for the first time in history. The Corona Pandemic hit many sectors of the global economy. The sudden decline of oil demand quickly created oversupply, leaving oil tanks and crude carriers stranded at maximum capacity.¹ The United States' Consolidated Appropriations Act of 2016 repealed the 40-year ban on crude oil exports. With the passing of Bill 261-159, Congress enabled a Fossil Fuel Renaissance in America.² Ever since, the state of Texas has undergone another oil boom, responsible for more than 80% of the entire oil exports of the United States.

With the late oil boom, natural gas fracking in Texas' Eagle Ford shale started to decline while drilling activity in the Permian basin in West Texas Rapidly increased. Even though most oil exploration and production activity can be found in West Texas, cities along the Texas coast are in the business of refining and distributing petrochemical products. From Beaumont and Port Arthur in the North to Brownsville in the South, no city has expanded its petrochemical activity as much as Corpus Christi. Corpus Christi's oil export numbers are now at the level of Texas' largest city, Houston - an astonishing fact given that the 362,294 people living in Corpus Christi and the surrounding Nueces County only account for about 7% of the population of Houston's Harris County.³

Clustered around Texas' bays and estuaries, four major regions of urban environments are scattered across the 80% undeveloped lands along the predominantly rural coast.⁴ Corpus Christi Bay is an excellent case-study region for the current process of re-industrialization highlighting the conflict between two critical recourses: oil and water. Petrochemical processes require a lot of freshwater, which is already a scarce resource along the Texas coast. Many times, industrial water demand outperforms residential and non-industrial commercial use. Besides, the impacts of the climate crisis are threatening freshwater supplies and coastal ecosystems. Coastal storms and flooding are additional factors putting coastal cities, their people, fauna and flora, at risk.

The late oil-boom has increased the dependencies of coastal Texas on the fossil fuel industry and also drastically increases the demand for fresh water. Simultaneously, coastal cities are on the fore-front of experiencing the repercussions of global warming as the impacts of climate change have started to materialize: flooding, sea-level-rise, and storms threaten the fragile ecosystems within and around the case-study-cities.⁵

Within this context, this project proposes built interventions that aim to balance oil and water as critical resources that have been both a premise for settlement and the engine for growth in coastal cities in Texas.

CLIMATE ADAPTATION

The impacts of global warming cause major risks for the Texas Coast. 64 hurricanes hit the Texas Coast since 1851, which accounts for one hurricane every three years on average during this period.⁶ Wind, rainfall, and storm surge are the three most damaging components of a hurricane or tropical storm, putting the natural and built environment at frequent risk. According to the National Oceanic and Atmospheric Administration, the relative sea-level rise trend for the Corpus Christi region is 5.11 millimeters per year, measured from 1983 to 2019. This value is significantly lower than the 6.62 millimeters per year measured from 1957 till 2011 in the Houston area or the 9.13 millimeters per year along Louisiana's shore.⁷ From the devastating Hurricane of 1919, to Celia in 1970, Harvey in 2017, or most recently Laura in 2020, coastal cities have historically been prone to storm events. In the age of anthropogenic climate change, storms are set to become more intense and frequent.

Industrial activities are additional anthropogenic factors which may lead to an increased ecological impact of the natural and built environment. Research suggests that channel deepening increases (storm) surge vulnerability in bays and estuaries.⁸ Downtown Corpus Christi is located at the estuary of the Nueces River at the verge of Nueces Bay and Corpus Christi Bay. Directly adjacent to Downtown is the so-called Inner Harbor, a part of the Port of Corpus Christi. The Corpus Christi Ship Channel Improvement Project authorizes the widening and deepening of the existing ship channel from the Gulf of Mexico to the inner harbor from 47 feet to a new depth of 54 feet once constructed.⁹ Additionally, the existing Harbour Bridge will be torn down and replaced by the new Harbor Bridge located slightly south of Downtown Corpus Christi to allow for increased clearance for Inner Harbor ship traffic. In conjunction with the increased clearance, the deeper channel enables the new generation of Very Large Crude Carriers (VLCCs) to access the industrial facilities in Port Corpus Christi. Besides the ecological impacts of dredging and industrial ship traffic, wake waves from large vessels may accelerate beach and shoreline erosion, directly impacting the natural end built environment of specific locations around Corpus Christi Bay. Studies show, that ships within a 500 feet proximity to the

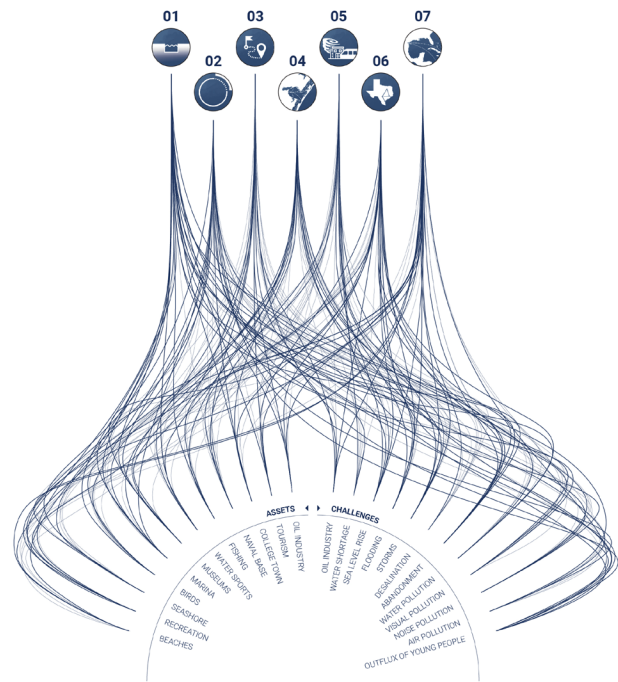


Figure 1. Diagram shows the relationship between major assets, challenges, and strategies. (Oswald Jenewein)

shoreline produce large enough waves to accelerate erosion. The size and speed of ships is crucial for the impact of the wake wave impact.¹⁰

This mix of ecological and anthropogenic impact factors has formed the premise for an informed participatory process engaging with a variety of public and private stakeholders and community members.

PARTICIPATORY ENGAGEMENT

This project is the outcome of a participatory design and research process with the goal to develop climate adaptation strategies for Downtown Corpus Christi, Texas in the realm of urban ecology. Methodologically, this project utilized a mixed-methods approach aiming to (1) analyze natural and built assets, (2) define ecological challenges within the built environment based on community input, and to (3) synthesize these challenges into climate adaptation strategies. The outcome of this undertaking has been summarized in a comprehensive downtown masterplan.

The United Nations Sustainable Development Goals (SDGs) and the AIA Framework for Design excellence have been used as a general guide for the participatory research and design process. A particular focus of the project has been set on the framework of designing for equitable communities. The major community visioning workshops conducted under the title of "Emerging Corpus Christi Bay" were divided into four focus groups around the topics of blue, green, gray, and

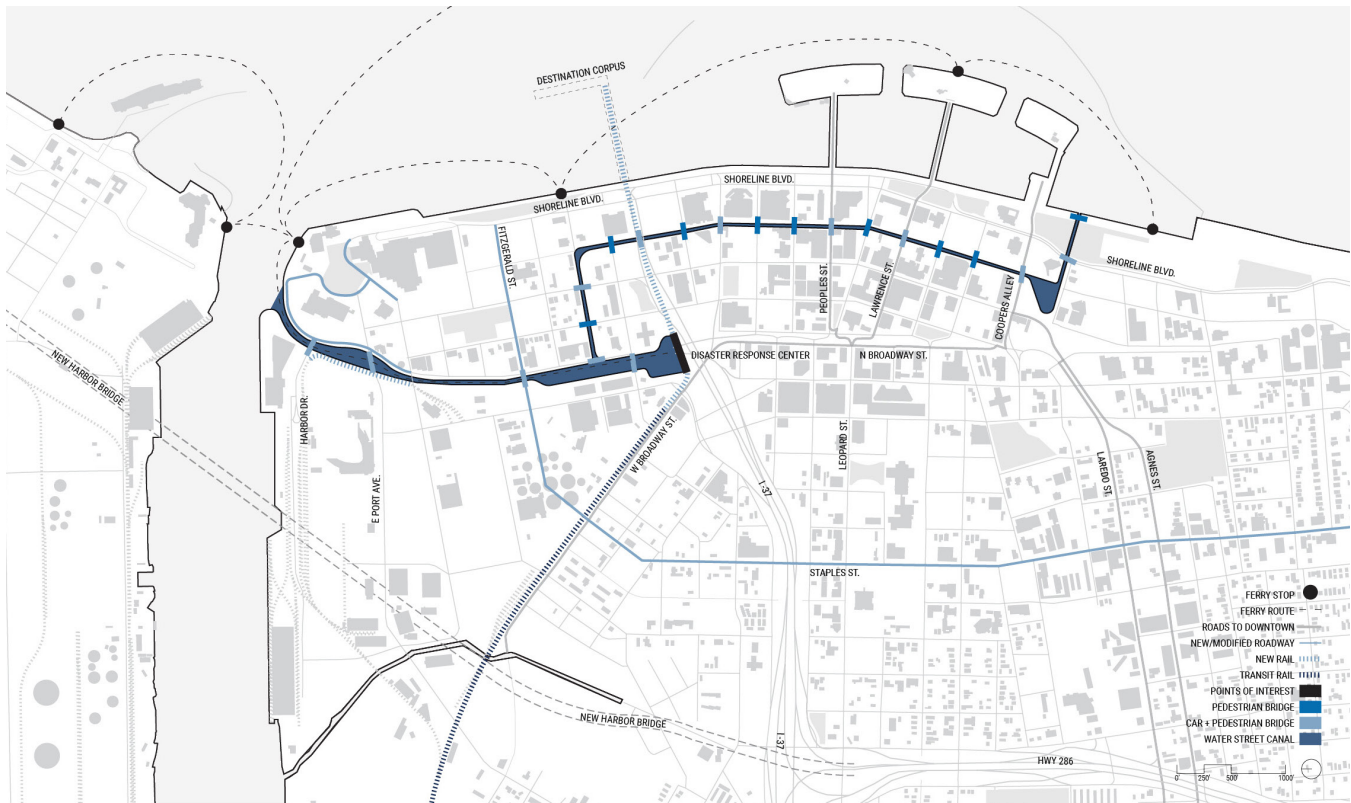


Figure 2. Masterplan for Downtown Corpus Christi, TX . (Oswald Jenewein)

brown infrastructure as they relate to urban ecology. After participating in discussions on these four topics, a closing panel summarized and discussed the gathered information to synthesize the most significant assets and challenges residents had found in their environment.

The major method during the engagement phase was Participatory Action Research (PAR). PAR focuses on the development of collaborative alliances between researchers and community members to investigate, reflect on, and take action to solve a problem.¹¹ PAR is an essential component of this project and has been applied to enhance civic engagement in the project and to build strong partnerships between academics, residents, community organizations, and governmental representatives to overcome the boundaries between these worlds.

“Action research is a “theory that is grounded in experience in practice, by solving complex problems in totally new situations, collaboratively as a team of ‘community scholars.’ [...] everyone contributing in different ways, but on equal footing as everyone else.”

—Kurt Lewin, *Action Research and Minority Problems*

The community input had been gathered both quantitatively and qualitatively before it was analyzed and applied as premise for the design phase of the project.

SEVEN STRATEGIES FOR DOWNTOWN

Based on research and community input, seven adaptation strategies for downtown Corpus Christi have been developed:

The first strategy is to reintroduce water to Water Street. Water Street has historically been the natural shoreline of Corpus Christi’s Marina Arts District. In response to a hurricane in 1919, a seawall had been constructed and was ultimately completed in March of 1941. Alongside the seawall came a one-block expansion of downtown between Water Street and Shoreline Boulevard. The top of the shoreline is approximately 20 feet above sea level, while the low point in Water Street marks a 14-foot drop in elevation to only 6 feet above sea level. This drop puts Water Street into a topographical low. The existing Harbour bridge, which connects downtown and North Beach, will be removed and replaced in a new location slightly south. As the new bridge is already under construction, the soon to be available land underneath the old Harbour Bridge will become an opportunity zone for development. This project proposes a continuous canal spanning from the downtown Marina across Water Street and the then former Harbour Bridge grounds to the Sea District at the Inner Harbor’s mouth. The primary purpose of this canal is flood and stormwater mitigation. Given Water Street’s low elevation, surface water could naturally drain into the canal and ultimately back into Corpus Christi Bay. Floodgates on either entrance of the canal prevent tidal flooding. The Water Street canal is also a central



Figure 3. Masterplan for Downtown Corpus Christi, TX . (Oswald Jenewein)

infrastructural element that creates a walkable district for recreational and commercial activities. Reintroducing a body of water to Water Street, unsealing surface, and extending zones for landscaping allow fauna and flora to contribute to an improved urban ecology in the center of Corpus Christi. Additionally, vacant lots are an opportunity for new green spaces in downtown. The canal combined with vegetation will contribute to reducing urban heat islands, lower vehicular emissions, and provide shaded and walkable connections for commercial and recreational use.

The second strategy focuses on increased connectivity for all road users. Throughout the Marina Arts District, many streets are one-way streets. In the Sea District, major roads like Shoreline Boulevard and Chaparral Street end in a cul-de-sac. Given the amount of vacant land and buildings, the traffic in downtown Corpus Christi is relatively low. To allow for a better flow of vehicular traffic, bicycles, scooters, and pedestrians, this project proposes to reintroduce two-way traffic on all streets and to reconnect Shoreline Boulevard with Chaparral Street. Therefore, Corpus Christi's major museums and convention venues would be on a comprehensive loop rather than on a dead end. In addition, reconnecting Staples Street to downtown enables its function as a catalyst for development along the entire Staples corridor. This system introduces a better flow for public transportation systems. A shared street concept evolves into a shared public space in strategically

chosen areas, combining social activities, parking, cycling, pedestrians, public transport, and vehicular traffic. Streets as shared spaces unite rather than divide urban districts and allow for a vibrant urban culture of opportunities.

The third strategy proposes to develop downtown as cultural and commercial destination. The canal along Water Street and in the Sea District creates opportunity zones for development. It is crucial that downtown Corpus Christi expands its identity as the commercial and cultural capital of Texas' coastal bend region. Mixed-use development across downtown Corpus Christi needs to be a strategic goal from both public and private entities. Economic diversity is key to create downtown as a vibrant part of the city. Affordable housing, business incubators, and startups are equally important to achieve this economic diversity as shopping destinations and other commercial, residential, and recreational projects. The canal is an opportunity to activate the waterscape for new modes of transportation through downtown. Boats and passenger ferries could offer a fast and pleasant way to reach destinations within and beyond downtown and North Beach, connecting the USS Lexington and the Texas State Aquarium to the city center.

The fourth strategy aims to connect downtown across the bay. To reinforce the role of downtown as a regional center, this project proposes to activate Corpus Christi Bay as a water

body that unites cities along its shore. Passenger boats and ferries should connect the Marina Arts and Sea District to other parts in Corpus Christi, like Ward Island, with its Texas A&M Campus, and Padre Island. Beyond Corpus Christi, the boats should also connect to cities across the bay like Portland, Ingleside on the Bay, and Port Aransas, or potentially even further to Aransas Pass, Rockport, and Fulton. These connections could help to grow a unifying regional identity of the Coastal Bend and become an attraction for residents and tourists alike. Passenger boats and ferry routes also serve additional purposes like evacuation in preparation of a storm or to conduct ambulance services to connect people living longer distances from hospitals faster than by road.

The fifth strategy promotes to plan for disaster preparedness and response. The climate crisis makes more frequent and stronger storms combined with wind, rainfall, and flood events inevitable. Coastal regions have historically been prone to increased storm activity, but climate predictions require to plan for more severe scenarios. The future development of Downtown Corpus Christi needs to include strategic planning on disaster preparedness and response. This project proposes the construction of a disaster response center right at the intersection of the Marina Arts and Sea District in downtown adjacent to the former Union Pacific railroad station's site. The Texas Eagle passenger train operated by the Missouri Pacific Railroad and Texas Pacific Railway connected Corpus Christi through San Antonio all the way to Saint Louis until 1971 when the service got disconnected. The climate crisis may lead to a new era of rail traffic as passenger trains can be used for emergency evacuation. The proposed disaster response center in Corpus Christi simultaneously reactivates the passenger rail connection to San Antonio, serves as a central train station for the coastal bend region, and serves multiple purposes regarding natural disasters. These include training in the preparation phase, sheltering people during storms, and potential medical treatment in the aftermath of a storm. The COVID-19 Pandemic highlights that such a facility could also have a significant impact in times of spreading diseases that cause increased hospitalizations.

The sixth strategy proposes to (re-)link Corpus Christi to the Texas Triangle. To expand to a more diverse economic portfolio, Corpus Christi should refine its identity as a major commercial and recreational destination in Texas. While more than 70% of people in Texas live within the Texas Triangle, spanning from Dallas Fort Worth to San Antonio to Houston, Corpus Christi is about two hours away from this Triangle. Expanding Downtown Corpus Christi's identity as a recreational destination, commercial center for the region, and as the cultural capital of the Coastal Bend, could be the starting point of transforming the Texas Triangle into a Texas Trapezoid. A rail connection from Downtown Corpus Christi to San Antonio may lead to increased commercial and tourist activity. This connection could bypass traffic and enable a fast

and coinvent commute between the two cities. If constructed as a high-speed train, Corpus Christi and San Antonio could be connected in only 45 minutes one-way.

The seventh strategy suggests to diversify as a portal to Texas and gateway to the world. The Port of Corpus Christi has a geopolitical role in the logistical landscape of energy supply. The industrial activity in and around the port is a major part of Corpus Christi's economic portfolio. This project proposes that Corpus Christi should diversify its portal activities beyond industrial use. The proposed passenger train connection to San Antonio could provide public transportation access from and to Corpus Christi for up to tree million people in the greater San Antonio area and the Rio Grande Valley. The master plan proposes a potential mid-size cruise ship terminal if technological progress allows for a more environmentally friendly operation of appropriately sized vessels. Corpus Christi as a destination for offshore rides, for a day trip, an extended weekend, or longer could offer passengers the opportunity to board and deboard train and cruise in a single hybrid station. Corpus Christi and its convenient train connection from San Antonio to Downtown Corpus Christi with a station that ends on the water would allow for a unique customer experience.

CONCLUSION

Oil has significantly contributed to the history of the built environment around Corpus Christi Bay. While oil will be an important part of Corpus Christi's economic portfolio for years to come, this paper claims Corpus Christi already as a Post-Oil Environment. "Post-Oil Environments acknowledge the changing environmental conditions as a direct result of burning fossil fuels. Post-Oil Environments describe the current transition-period away from carbon-dependency towards a collective ecological awareness of anthropogenic climate change."¹² Now is the time for petrochemical cities like Corpus Christi to activate the economic power of the fossil fuel industry to develop strategies that enable a post-oil future of the city, its residents, fauna and flora, and the ecosystem as a whole.

This project is based on the participation of Corpus Christi's residents and several public and private stakeholders. It is the initial step to continue the conversation on what downtown Corpus Christi could be an should be. The proposal aims to serve as a catalyst for sustainable growth, aiming to shape the identity of Downtown Corpus Christi as an opportunity zone for the ecological development of a 21st century city torn between the impacts of increased industrial development and the climate crisis.

ENDNOTES

1. NYSE New York Stock Exchange, WTI (West Texas Intermediate). Financial Times Article <https://www.ft.com/content/88997d67-bf69-409e-8155-911fc1f2fd6f> (accessed Sep 14, 2020)
2. United States Bill 261-159, Consolidated Appropriations Act of 2016
3. United States Census Data. <https://www.census.gov/quickfacts/nuecescounty-texas> (accessed Nov 11, 2020)
4. Jim Blackburn et.al., "A Texan Plan for the Texas Coast," First edn, Texas A&M University Press, College Station (2017): 9-13
5. Alan Lessoff, "Where Texas Meets the Sea: Corpus Christi & its History," First ed. Vol. number 21; Austin: University of Texas Press (2015)
6. National Weather Service (2020). Information available https://www.weather.gov/media/crp/Hurricane_Guide_Final_English.pdf. (accessed Nov 15, 2020)
7. National Oceanic and Atmospheric Administration. (2020). Sea Level Trends. Available: <https://tidesandcurrents.noaa.gov/sltrends/sltrends.html>. (accessed Nov 15, 2020)
8. Ramin Famikhilili et.al. "Tide-Storm Surge Interactions in Highly Altered Estuaries: How Channel Deepening Increases Surge Vulnerability." *Journal of Geophysical Research Oceans* 125. (2020)
9. Port of Corpus Christi (2020). Information available <https://portofcc.com/capabilities/logistics/intercoastal-waterways>. (accessed Nov 17, 2020)
10. Donna Bilkovic, et.al. "Review of boat wake wave impacts on shoreline erosion and potential solutions for the Chesapeake Bay." STAC Publication Number 17-002, Edgewater, MD. (2017). p.50-53
11. Alice McIntyre, "Participatory Action Research," Sage Publications, Los Angeles. (2008): 1-22
12. Oswald Jenewein. "The Texas Coast as Geopolitical Territory. The Spatial Regime of Burning Fossil Fuels on Coastal Landscape of Oil." Austrian Marshall Plan Foundation. Vienna. (2019)