

Briefing Paper on Lower Galveston Bay Watersheds
Gulf Coastal Region: Bolivar Peninsula, Galveston Island, and Follett's Island

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Description of the Watershed

This region consists of the land boundary between the Galveston Bay system and the Gulf of Mexico and the subdivisions of the bay system adjoining the land barriers. Thus Bolivar Peninsula, Galveston Island and the peninsula known as Follett's Island are the land components of this region. Behind these barriers are East Bay, West Bay and Christmas Bay. The ecological aspects of this subdivision include the habitat zones of the barrier islands starting with the beach and moving inland through the dunes, the grassland and associated wetlands, the estuarine marsh and the bay. This region encompasses 107 square miles and contains the municipalities of Crystal Beach, Galveston, Jamaica Beach, and Sea Isle.

Barrier islands like Galveston and Follett's are basically large sand bars formed over time across the mouth of the estuary by the deposition of sediment by currents. Barrier islands are not geologically permanent structures. They tend to move inland and seaward as the relative sea level rises and falls. The relationship between the land and the barrier islands also changes. Bays can be filled in by sedimentation and accretion of land through marsh development. Barrier islands can also be cut into smaller pieces by the force of hurricane tidal surges. This is the most dynamic subdivision of the bay because it is constantly modified by forces associated with the ocean.

Land Use and Habitat in the Watershed

Prior to the establishment of Houston as a major center of population, industry, and trade; Galveston was a thriving seaport because it had the advantage of location on the ocean and a good harbor. The 1900 hurricane destroyed the infrastructure of the port and city. The port never recovered its preeminence. However, the city remained and is emblematic of human settlement on these barrier islands. Fanning out in both directions from Galveston along the coast are residential developments that impact the water and ecosystems of the bay. As human construction has covered more of the land area, more habitat has been lost to wildlife. Habitat protection is a high priority issue for this region of the Galveston bay system.

Along the beachfront, development has won a battle with natural systems. The Galveston Seawall was constructed after the 1900 storm and sits in the place that would be occupied by beach and dunes. Housing development on Bolivar Peninsula and the west end of Galveston Island originally sat behind the dunes. Homes in these areas sit in places that would be beach and dune in a natural system. The existence of these homes along the beach shoreline prevents the natural retreat of dunes and beach with sea level rise.

Beach and dunes are habitat for a variety of plants and wildlife species which occur in lower abundance because their habitat is reduced from historical levels. There are programs managed by government and private organizations to enrich certain beaches with sand and to re-build dunes over artificial structures, such as geotubes, fences and discarded Christmas trees.

The grasslands in the middle of the barrier islands/peninsulas were historically used for grazing. Cattle are still grazed on Bolivar Peninsula and the west end of Galveston Island. However, housing developments are gradually replacing pasture.

Development has impacted the grasslands in the middle of the barrier island and peninsulas less than the habitat nearer the beach and bay. On the bay side, there is development that has converted grassland or marsh into residential and commercial uses. Some of the developments have added the extra impact of canal construction. Marsh and prairie soil was excavated to create canals that connect houses to the bay. Boat traffic from these developments has required channels and disturbed bottom communities and increased erosion of salt marsh substrate.

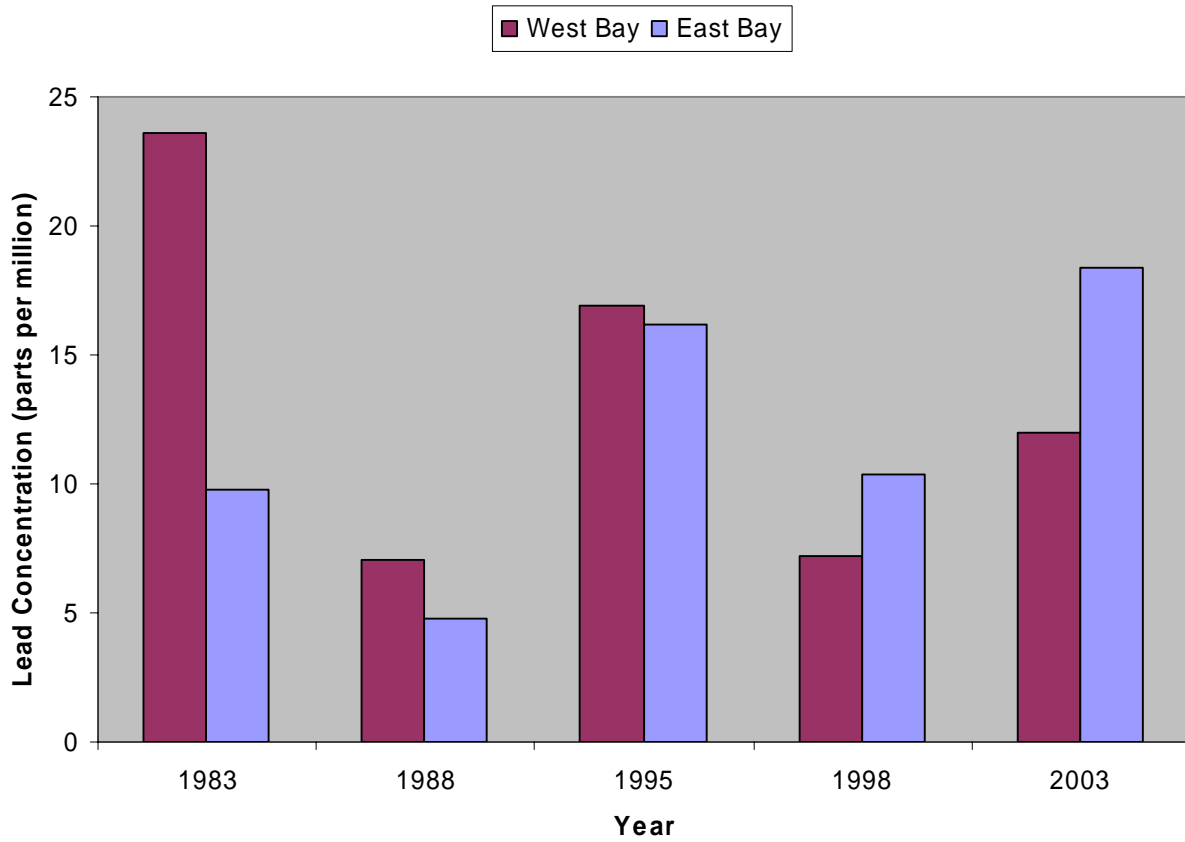
Water Quality Issues

Water pollution severity is related to the concentration of the pollutants. In the sections of the bay close to the Gulf, there is ample water exchange to dilute most pollution discharges below criteria levels for impaired water quality. In this subwatershed, there are few industrial sources of pollution. The island and peninsulas are locations primarily of residences, rather than industry.

In other sections of the bay, significant water quality degradation is observed around major industrial complexes and in ship channels. The Galveston Ship Channel has limited industrial activity around it and is very close to the Bolivar Roads through which the majority of the bay's water is exchanged. It appears that limited discharges and high flushing are responsible for relatively good water quality around the city. However, the Galveston Ship Channel is monitored less than other industrial locations. There is only one sediment sample on record in the Texas Commission on Environmental Quality (TCEQ) database (for the years 1968-2003) with concentrations for metals and pesticides.

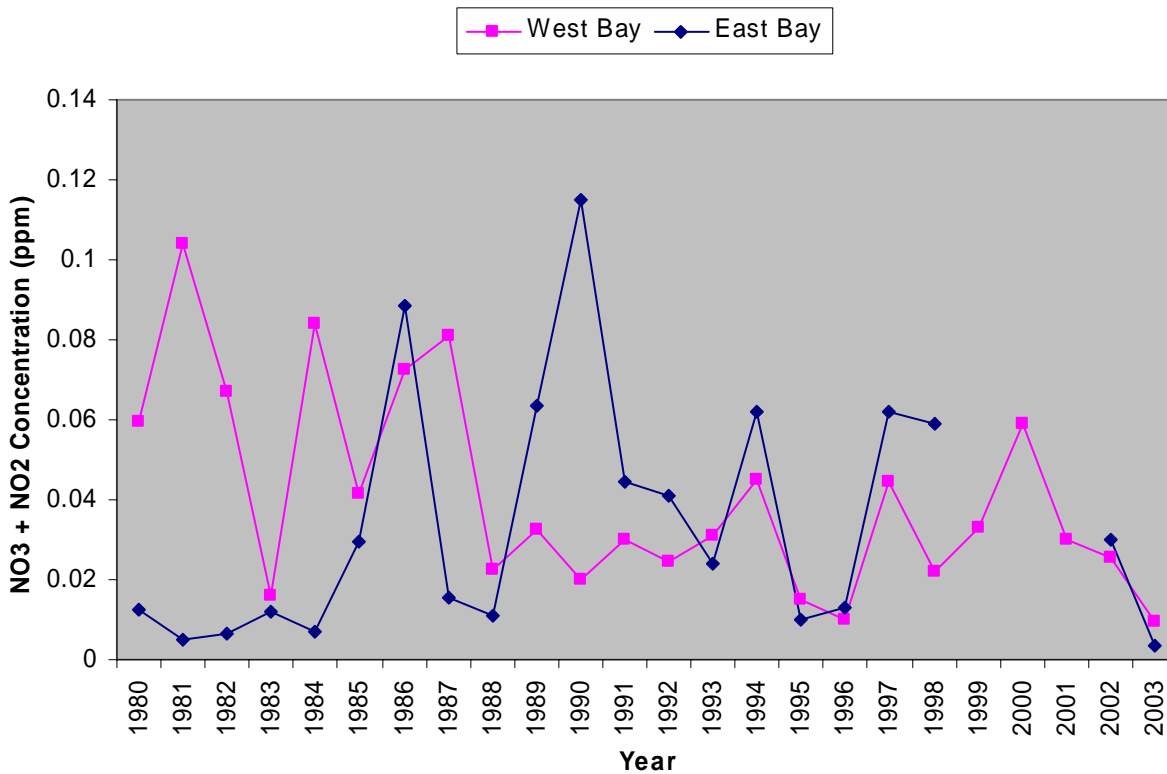
In the TCEQ database of water and sediment quality monitoring results, some records of high levels of some pesticides and industrial organics in sediment have been recorded for West Bay. However, these observations occurred in one year and have not been observed again. It appears that there is little pollution in East and West Bay from industrial organics or pesticides. There is some contamination of the sediments with metal, particularly lead. The levels of lead shown in the following graph are not considered hazardous for humans or other living organisms. The probable effects level of lead used for estuarine sediments is 112 parts per million (ppm).

Figure 1. Annual average lead in sediments of West Bay and East Bay in the Galveston Bay Estuary. Figure created by the Galveston Bay Status and Trends Project. Data source: Texas Commission on Environmental Quality.



Nutrients are found at concentrations above the natural background, but at levels that are not a concern for the ecosystem. There is a general declining trend in nutrient concentrations observed in the monitoring record of Galveston Bay as a whole. The records for East and West Bays shown in the graph below are consistent with a decline in West Bay and no trend in East Bay.

Figure 2. Annual average nitrogen concentrations in water samples from West Bay and East Bay in the Galveston Bay Estuary. Figure created by the Galveston Bay Status and Trends Project. Data source: Texas Commission on Environmental Quality.



Public Health Issues

More contact recreation occurs on Galveston Island and on the peninsulas northeast and southwest than in any other region of the bay. Gulf beaches are the most often used locations for swimming. The bay sides of these land masses are used for wade fishing and swimming to a lesser degree. *Enterococcus* bacteria are the monitoring parameter most useful as an indicator of the risk of exposure to waterborne human pathogens from contact recreation. The Texas General Land Office (GLO) has the responsibility for monitoring beach water for these bacteria. There are 49 sampling locations on Gulf beaches and one in the bay in this subwatershed. Sampling for water contamination occurs weekly from May to October. The results as well as advisories and warnings are posted on the GLO web site. During the summer there are typically some locations that exceed the screening level in some samples.

The other public health issue is seafood safety. Seafood from anywhere in the bay could be consumed by residents or visitors to this subwatershed. However, we will only discuss the safety of seafood in the waters adjoining Galveston Island and the peninsulas. The Texas Department of State Health Services (DSHS) sampled fish and crabs from East, West and Christmas Bays in a survey conducted in 1999. Finfish in Christmas Bay by the DSHS were found to have elevated levels of heavy metals in their flesh. Seafood from East and West Bay had low levels of

contamination compared to other parts of the bay. None of the samples collected from East, West, or Christmas Bays were found to have contamination levels high enough to warrant a consumption advisory. There are concerns about the consumption by children and pregnant women of certain species of large predatory fish captured in the Gulf of Mexico, e.g. king mackerel. Bioaccumulation of mercury from coal fired power plant emissions in fish high up the food chain is a global concern. Deep sea fishing trips departing from Galveston Bay often target fish of this type.

The waters from the northeastern tip of Galveston Island to about nine miles into West Bay are restricted for oyster harvest because of historical bacterial contamination. *Vibrio vulnificus* is a naturally occurring bacteria in these waters and potentially lethal if introduced to a cut or consumed by a person with a weak immune system. Little information is available on environmental conditions that contribute to increasing concentrations of *Vibrio* that would permit one to predict where in the bay this bacterium would have the highest abundances.

Other Issues

The Gulf Margin is closely associated with outdoor recreation, including fishing. The protection of fishing resources is of concern to residents and visitors. This subwatershed benefits from the successful management of fishing resources. This is also the area that is most associated with sea turtle and marine mammal protection. The return of nesting sea turtles to the beaches of this area is of importance to the region.

Relative sea level rise is causing loss of land area from the barrier islands and peninsulas. Also, the fragile nature of the shoreline beaches and marshes makes shoreline management a major issue in the area adjoining the Gulf. Retreat of the Gulf shoreline where there is no seawall has caused some property owners to lose property and even their homes as water covers more of the sand bar. On the bay side, similar processes are occurring. Property loss can be temporarily avoided by construction of a bulkhead, but unbulkheaded shoreline is retreating. Shoreline management projects include beach nourishment with sand, geotubes for dune restoration, reconstruction of intertidal marsh, and geotubes placement in the bay to protect shoreline from wave energy.

Conclusion

This subwatershed is most often associated with the bay by residents and visitors. The land areas are fragile and threatened by relative sea level rise. Shoreline management is a major concern to residents. The adjoining bay waters are not as polluted as tributaries of the Upper Bay, but there are some pollution problems in East and West Bay. Fish caught in the waters of this subwatershed are considered safe to eat, with the exception of some predatory fish from Gulf waters that should not be consumed in quantity by children and pregnant women. There are restrictions on harvesting oysters in some areas of West Bay. Contact recreation on the beaches and in the bay waters is sometimes contraindicated due to bacterial concentrations, but normally safe. The area benefits from successful management of sport fish populations. In this area, the water is relatively unpolluted, the fish and wildlife populations relatively healthy, but the land itself is fragile and threatened by relative sea level rise.