LPBF
SAVE OUR LAKE
SAVE OUR COAST
LAKE PONTCHARTRAIN BASIN FOUNDATION

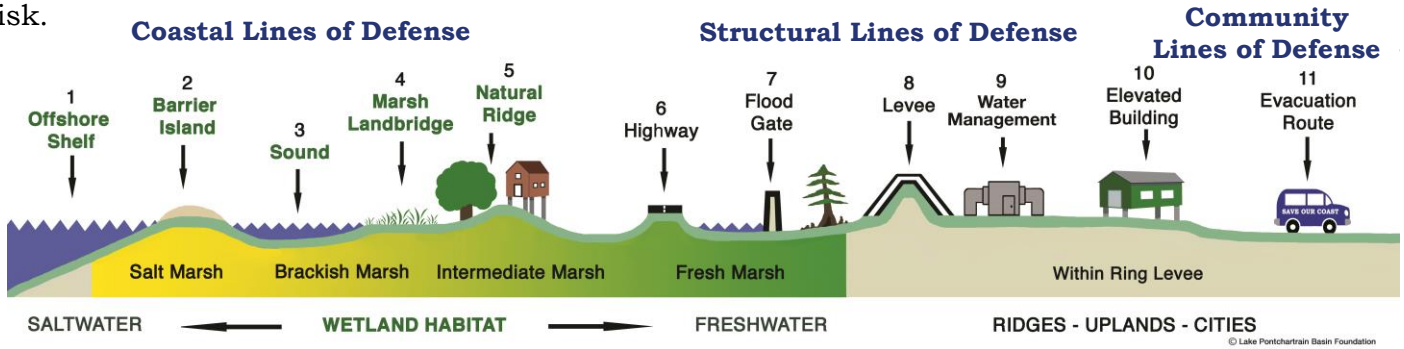
Coastal Sustainability Program

Hurricane Surge Defense System Study

The Hurricane Surge Defense System

The Greater New Orleans (GNO) region depends on a complex system of elements that together mitigate and manage the flood risk from hurricane induced tidal surges. The network of levees, pumps, and floodgates, or the *structural lines of defense*, are an integral, and the most visible, component of this system. The two other major components are the *coastal lines of defense* and the *community lines of defense*. Together, these three components comprise the Multiple Lines of Defense Strategy (MLODS) for Sustaining Coastal Louisiana.

MLODS provides a framework that lets us use the professional tools and standards of systems engineering to assess the current status of our storm surge risk reduction system. Systems engineering defines a system as: "an integrated set of elements, segments and/or subsystems that accomplish a defined objective." Systems engineering helps us determine if the components of MLODS function in an integrated fashion to accomplish the objective of managing storm surge risk.



The Hurricane Surge Defense System consists of 12 Lines of defense.

Lake Pontchartrain Basin Foundation's report called "A Systems Engineering Based Assessment of The Greater New Orleans Hurricane Surge Defense System Using the Multiple Lines-of-Defense Framework" provides a detailed assessment of the current system of levees, pumps, gates, coastal landscape features, and community resilience steps that the region depends upon for reducing the risk from storm surges. The report can be accessed using the link below.

System Interactions and Factors of Concern

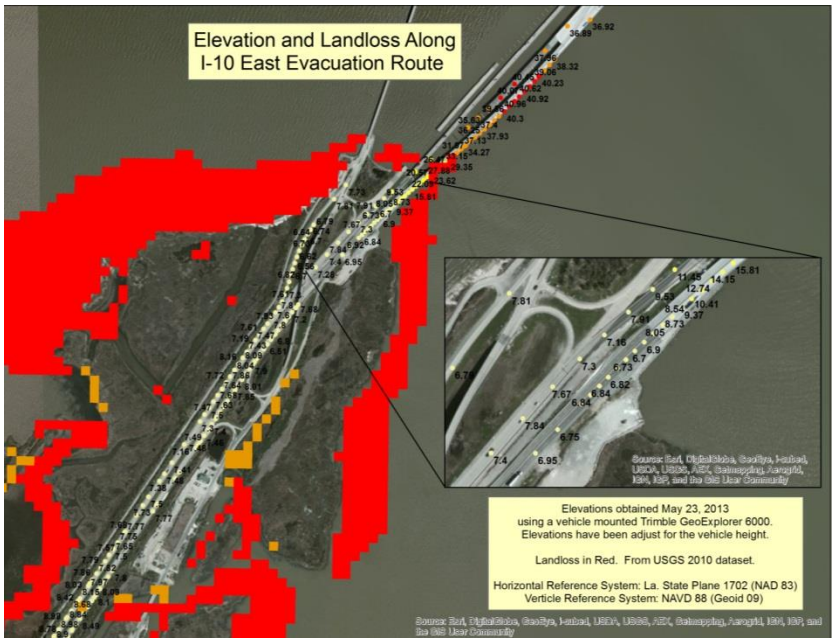
The tools of systems engineering allow us to identify system interactions that create major factors of concern. A *system interaction* is when the performance of one system element is impacted by the other elements, while a *factor of concern* is an element or interaction between elements that potentially reduces the system's ability to meet the defined objective. The two examples on the back describe major factors of concern for the GNO region identified in the report. One results from the interaction of the barrier islands element of the system with the evacuation route element, and the other results from the need for conflicting operations of drawbridges as vessels and people evacuate the region simultaneously.

LPBF's Systems Engineering based assessment of the Hurricane Surge Defense System can be downloaded from: http://www.saveourlake.org/PDF-documents/our-coast/MLODS-SysEngReport_FinalComplete_Aug2014.pdf

I-10 East Evacuation Route & Chandeleur Islands

Interstate 10 East is a major evacuation route, and during peak evacuation an estimated 2,000 vehicles per hour cross the "Twin Spans" bridge over Lake Pontchartrain to escape the threat of storm surge flooding in GNO. After Hurricane Katrina, the Twin Spans were rebuilt in an $800 million project that raised the bridge to 30 ft. above sea level. Not far from the bridge, the rebuilt levee system to protect New Orleans rises to 20 ft. Between the levee and foot of the bridge is an approximately 1 mile section of interstate that is at ground level and outside the levee system. Most of this section of highway is 7 – 8 ft. elevation. However, just before the foot of the bridge, atop of narrow peninsula that has experienced landloss on all three sides, the highway dips to 6.7 ft. above sea level. Wedged between two major, unrelated hurricane construction projects, this low, unprotected section of a major evacuation route is prone to flooding early during storm surge events, thus blocking any further evacuation.

Located 60 miles from the foot of the bridge, the Chandeleur Islands are a rapidly eroding barrier island chain and an important coastal line of defense. Hydrological studies have determined that the elevation and integrity of the Chandeleurs influences the timing and height of the peak surge, with the surge peaking 1.5 feet higher and 1 hour sooner if the islands erode until they are completely submerged. Exemplifying the concept of system interactions, the Chandeleurs' ability to mitigate storm surge then impacts the available window of time to evacuate people through the low elevation, vulnerable section of eastbound I-10.



The approach to the newly rebuilt I-10 East bridge over Lake Pontchartrain along with land loss (in red) and elevation measurements obtained by LPBF using precision GPS equipment.

With the lowest measured elevations at 6.7 ft. above sea level and little remaining marsh shoreline to break waves, this section of a crucial evacuation route is prone to flooding early during surge events. It also illustrates how the coastal lines of defense can interact with the community and structural lines of defense to create factors of concern.

IHNC/GIWW Closure Operations

The Inner Harbor Navigation Canal (IHNC) and Gulf Intracoastal Watery (GIWW) are two manmade navigational canals on the eastern side of GNO. During Hurricane Katrina, they were major conveyance pathways for storm surge and the location of many levee breaches. Subsequently, the area has been subject to major levee, floodwall and floodgate upgrades. While these structural improvements provide a potentially improved level of protection, the gates, in particular, create a new set of concerns related to system behavior and interaction, one that also affects evacuation. Simply put, closing the gates in anticipation of a tropical system is a complicated procedure that must be coordinated with navigational interests, railroads, and the Port of New Orleans. Most navigational vessels are required to evacuate the IHNC/GIWW before a hurricane. This in-turn requires that the vessels pass under a number of drawbridges. Since the drawbridges must be opened to let vessels pass, they then hinder vehicular evacuation of the general population.