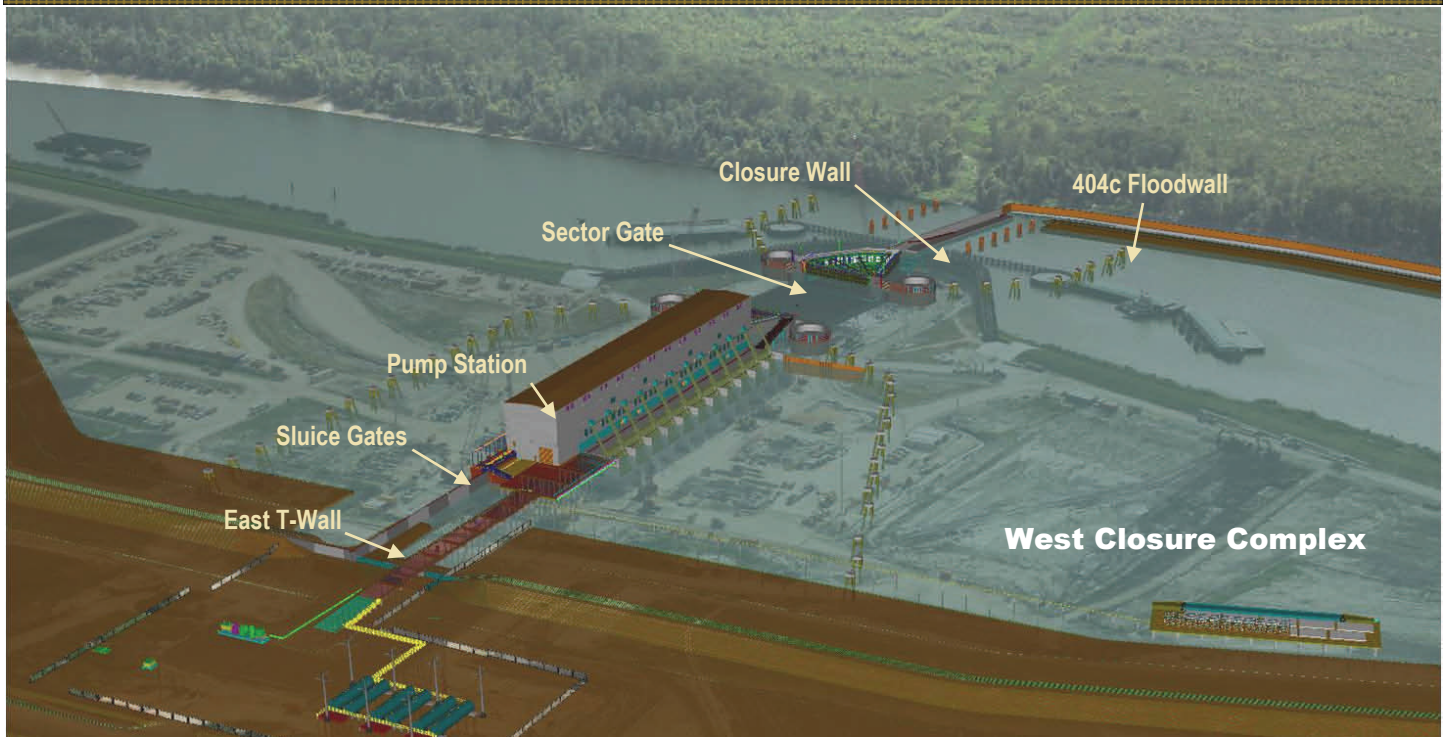
US Army Corps of Engineers
Mississippi Valley Division

Corps Hurricane Response

Task Force Hope Status Report Newsletter *November 30, 2011*

HSDRRS...*what lies beneath?*



This illustration of the West Closure Complex shows the 250-acre site that served as a construction zone to build the complex and its support structure, all of which is now underwater except for the east T-wall, the sluice gates, the pump station, the sector gate, the closure wall and the 404c floodwall. USACE Illustration

by Susan Spaht

The Hurricane and Storm Damage Risk Reduction System includes 133 miles of levees, floodwalls, surge barriers, gated structures and pump stations across the Greater New Orleans area. The constructed system inspires awe and wonder when you observe its 32-foot high floodwalls that run 23 miles through St. Bernard Parish, its 28-foot high surge barrier wall that stretches almost two miles across the Gulf Intracoastal Waterway and the Mississippi River Gulf Outlet, its 225-foot-wide sector gate at the West Closure Complex, to name only a few major projects. These are imposing and impressive surge defense structures that inspire confidence in those of us who live and work behind them.

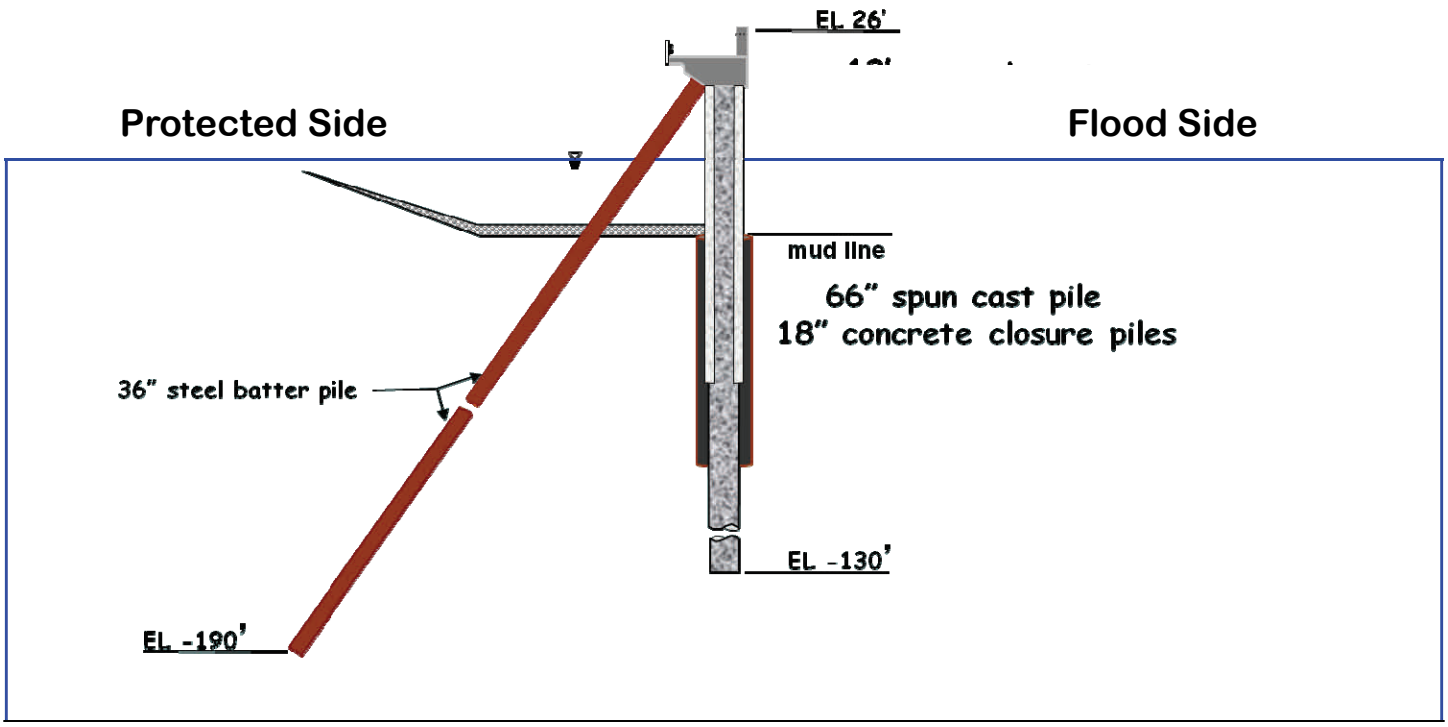
But have you considered *what lies beneath?*

The Corps of Engineers and its contractors take great pride in the strength and resilience of these state-of-the-art perimeter defense structures, and just as much pride in what makes them really formidable: the foundations that lie beneath them. In some cases, the Corps has spent more time and effort working beneath the ground than above.

Continued on page 2


Inner Harbor Navigation Canal Surge Barrier

IHNC Surge Barrier Wall - *What Lies Beneath*



Continued from page 1

"The soils underlying much of the footprint of the HSDRRS are under-consolidated and quite soft," said Mike Park, Chief of Task Force Hope. "Before the Corps could build structures on top of the soil, we often found it necessary to strengthen the ground below and compensate for the weak soils with appropriate - and often innovative - designs."

There are many ways to strengthen soil and prepare it for its unique place in the HSDRRS.

Consider these:

T-Walls After Hurricane Katrina, the Corps replaced most I-walls with stronger T-walls throughout the HSDRRS. T-walls resemble an in-

Continued on page 3

Continued from page 2

verted letter "T" with the crossed section at or just below the surface. The floodwall is braced with angled steel beams (H-piles) deep beneath the surface. It also has steel sheet piles which serve as seepage cutoff. The Harvey Canal floodwall on the West Bank, for example, rises 15-19 feet high, and what lies beneath are steel beams as deep as a 12-story building.

St. Bernard Floodwalls The Corps constructed a 23-mile long floodwall down the east and south perimeters of the parish. The floodwall, called the Chalmette Loop, rises 26-32 feet above sea level. The wall runs from the IHNC Surge Barrier all the way down to the Mississippi River at Caernarvon, and includes two major sector gates and 14 additional floodgates. The foundation beneath the floodwall required more than 42,000 H-piles which were driven into the existing levee -90 feet to -166 feet. To prevent seepage, more than 10,000 sheet piles were driven into the existing levee at a depth of -40 feet to -70 feet. What lies beneath, therefore, is 2X to 3X the size of the surface wall, providing the structure its added strength and resilience.

Deep Soil Mixing Some areas of the HSDRRS required stabilization of the soil before construction on the surface could proceed. Deep soil mixing is one process that was used. It involves injecting cement grout columns deep into the native soil to produce stabilized soil columns. This process was used, for example, at the 17th Street and Orleans Avenue Outfall Canals. It was also used for the New Orleans East levee which earned the distinction of being the largest deep soil mixing project in the world.

Deep Soil Mixing strengthens soil at 17th Street Canal

Wick Drains Another below-the-surface soil stabilization technique used by the Corps was wick drains. These specially-designed pieces of porous synthetic fabric are pressed deep into the soil. When a load is placed on the surface of the soil, the compression forces water into the wick drains which provide a route for the water to be pushed up to the surface. Consequently, the foundation dries out and consolidates faster. The result is soil that is more compressed and more stable for surface construction. Wick drains were used extensively in New Orleans East where the soil was often water-saturated.

IHNC Surge Barrier The 1.8-mile surge barrier wall at the Gulf Intracoastal Waterway is the world's largest barrier wall. It rises an impressive 26 feet above the water line across the GIWW and the Mississippi River Gulf Outlet channel. Lying beneath the mighty wall, the Corps drove 1,278 concrete soldier piles, 2,514 closure piles, and 647 steel batter piles. The soldier piles were driven to a depth of -129 feet, and the batter piles were driven to a depth of -190 feet. Therefore, what lies beneath this massive wall is 5X to 7X deeper

Continued on page 4

Continued from page 3

below the waterline than it is above the waterline.

Gulf Intracoastal Waterway West Closure Complex One of the largest components of the HSDRRS is the West Closure Complex located on the GIWW, just below the confluence of the Harvey and Algiers Canals. The WCC includes the largest sector gate in the U.S., and the largest drainage pump station in the world.

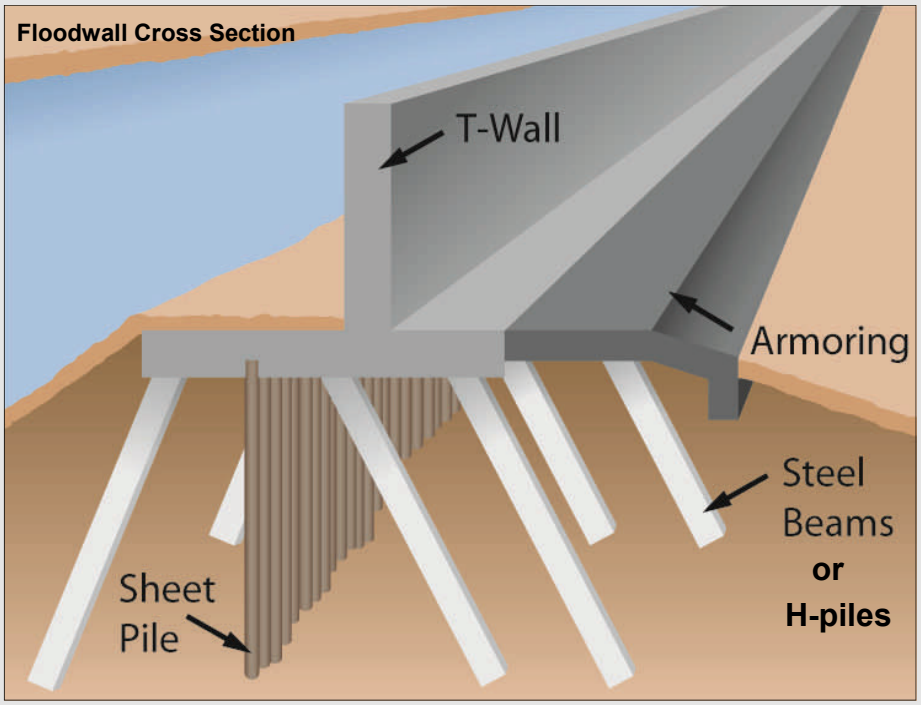
Pump Station: What lies beneath the surface is an enormous concrete structure that supports the 19,140-cfs pump station and each of its 11 5,400-hp pumps. The 8-foot thick pump station foundation includes approximately 22,000 cy of concrete that sits at -18 feet to -26 feet below the water surface. Approximately 1,115 steel pipe piles were used, both 30-inch and 24-inch pipe piles, and driven to a tip elevation of -162 feet. The sheet pile cut-off wall lies at the center of the station to -46 feet.

Sector Gate: What lies beneath the massive sector gate is a 10-foot thick concrete foundation that sits at -16 feet to -26 feet below the water surface. The foundation required approximately 29,000 cy of concrete and 416 30-inch steel pipe piles. The sheet pile cut-off wall lies at the center of the foundation to -53 feet.

Now when you observe a floodwall, a pump station, a floodgate or another element of the HSDRRS, you know that what you see is only its surface strength. The rest of the story is *what lies beneath*.

HSDRRS….*What Lies Beneath?*

The Harvey Canal floodwall (now complete) on the West Bank stands 15-19 feet tall with steel pilings as deep as a 12-story building. USACE Photos



This cross section of a T-wall shows how the floodwall is constructed with steel sheet piles to prevent seepage, and massive H-piles which are placed at an angle to provide strength.


St. Bernard Parish Floodwall

The last monolith is placed into the St. Bernard flood-wall, a perimeter wall that runs 23 miles through the parish. The flood-wall is anchored beneath by more than 42,000 H-piles driven to depths of –40 feet to –166 feet to provide stability and strength to the floodwall.

HSDRRS....*What Lies Beneath?*


Installing wick drains, New Orleans East

Wick drains were used extensively in New Orleans East to dry out and stabilize the soil for construction.

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The *Status Report Newsletter* supports the information program for Task Force Hope and its stakeholders. It also serves as the primary tool for accurately transmitting the Corps' hurricane risk reduction efforts to stakeholders.

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US Army Corps of Engineers

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