CASE STUDY

ARMORMAX® Anchored Reinforced Vegetation
Penn Levee Armoring
Jefferson Parish
Lafitte, LA

ARMORMAX® STANDS UP TO HURRICANE GUSTAV AND IKE

ArmorMax - An Engineered Solution for Levee Armoring

When Hurricane Katrina made landfall on August 29, 2005 it caused devastating flood damage to large portions of southeastern Louisiana—but it was not the only hurricane to hit the area that year. Hurricane Rita made landfall in late September, causing catastrophic tidal inundation to the community of Lafitte as it passed south of Jefferson Parish, Louisiana.

Penn Levee Phase I installation completed summer of 2007

One of the many levees that needed rehabilitation was the Penn Levee. The LA DOTD and the Lafitte Levee Board made the decision to incorporate the ArmorMax anchored reinforced vegetation system into the project design. The Decamp Street Levee which intersects the Penn Levee was also armored with ArmorMax.

Not only did the ArmorMax system offer a cost-effective approach to armoring the levees, but the innovative approach offered immediate protection from erosion and scour forces caused by wave overtopping and storm surge similar to what happened from Katrina. When wave overtopping occurs, the levee soil surface is subject to severe erosion and scour that can lead to breaches causing catastrophic failure. The ArmorMax system, which consists of a high performance turf reinforcement mat (HPTRM) and earth percussion anchors, is an engineered armoring solution that provides permanent erosion protection to the levee resisting soil movement and uplift that can occur.

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PROJECT FILE

PROJECT ▸ PENN LEVEE
LOCATION ▸ JEFFERSON PARISH, LA
PRODUCT ▸ ARMORMAX®
APPLICATION ▸ LEVEE ARMORING
ENGINEER/AGENCY ▸ LA DOTD
DATE ▸ PHASE I - SUMMER 2007, PHASE II- SUMMER 2008

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The design for the 1.8 mile (2.90 Km) long Penn Levee included the use of the ArmorMax system to armor the levee crest (top) and down the backside slope to the Borrow canal. The project was installed in two phases. Phase I installation was completed in July 2007 with the ArmorMax system installed starting 5 feet (1.52 m) from the sheet pile wall to 18 feet (5.49 m) across the levee crest. Phase II installation started in May 2008 and started where Phase I ended 25 feet (7.62 m) down the back side of the slope. Prior to installation the levee was prepared by “scalping” the vegetation with a mower and then back-dragging it to fill in any depressions and remove any obstructions. The HPTRM component was then installed and secured with Type 2 earth percussion anchors in a checkerboard grid pattern at five feet (1.52 m) centers. The earth percussion anchors act as a tie-down mechanism with 500 lbs (227 Kgs) of maximum pull-out strength for greater factors of safety. The ArmorMax installation in both phases was complete in 6 weeks each time versus typical installation of rock riprap which could take 4 to 5 months. "This is a great product for levee reinforcement. We can install ArmorMax in a very short period of time, which is extremely important for levee construction and armoring," said Ray Reiser, , owner of River West Construction, which was responsible for the product's installation. The DeCamp Street Levee had an additional 1,300 feet (396.24 m) of ArmorMax installed from the front toe of the levee over the crest and down to the backside toe.

Phase II installation was completed July 2008

Five weeks of vegetation growth after Phase II installation

"ArmorMax is going to help protect Lafitte residents against the destruction and devastation experienced by hurricanes Katrina and Rita,” said Lafitte County Mayor and Levee Board President, Tim Kerner. “I hope other levee officials will follow our lead, and use this product to reinforce the levees in their districts," Kerner added.

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Just five weeks after installation the ArmorMax system was put into action. Hurricane Gustav made landfall on September 1st, 2008 along the Louisiana coast subjecting the Penn levee to heavy rainfall. A few weeks later, Hurricane IKE battered the Penn Levee with up to a 12 foot storm surge (3.66 m) putting the ArmorMax system to the ultimate test.

On September 13th, 2008 Hurricane IKE engulfed the entire Gulf of Mexico as the largest Atlantic hurricane ever recorded with higher destructive potential than Katrina. 70% larger than an average hurricane it became the 3rd costliest storm in US history, leveling parts of Galveston where it made landfall, and causing $31.5 billion in damage. The northeast quadrant of the storm, containing the fiercest winds, battered the Louisiana coast line from 300 miles away.

At 3:17 pm IKE generated 6 foot swells that pounded Penn Levee. Water on the backside of the levee began to rise and wave action created overtopping. Just over three hours later at 6:22 pm, the top of the levee experienced consistent, concentrated flow of water with significant erosive capabilities. Water on the back side of the levee rose nearly to the top. Only four hours later at 7:14pm, the ArmorMax system took the full force of waves generated by Ike as the water level rose 8.5 feet, submerging the levee to within 6 inches of the top of the sheet pile wall.

Hurricane IKE Storm Surge at 3:17 pm

Hurricane IKE Storm Surge at 6:22 pm

Penn Levee completely submerged at 7:14 pm

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Three Days After IKE Storm Surge & Flooding

ArmorMax System Withstands Debris Loading from IKE

Three days after IKE up to 80% of the levee was still submerged with significant amounts of debris in the water, over a foot in some areas, continuing to stress the armoring system. The ArmorMax system continued to hold and protect the levee, even with the debris, because of the superior tensile strength of the high performance mat. The debris was unable to penetrate and tear the mat which is important for it to work over a long period of time. Even in areas where the vegetation had yet to take root, the Armormax was able to literally "hold its ground", and prevent erosion and scouring from taking place on the levee, preventing it from breaching or completely failing.

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GEOSYNTHETICS

6025 Lee Highway, Suite 425 PH: 423 899 0444
PO Box 22788 PH: 800 621 1273
Chattanooga, TN 37422 FAX: 423 899 7619

www.geotextile.com

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