

## In The News

### What will it take to safeguard New Orleans?

By Bill Marsh  
New York Times

New Orleans has long lived with the hurricane protection that it and the nation, were willing to pay for. Measured against the costs of Katrina's fury, however, better armor may suddenly seem more affordable.

With officials vowing to rebuild New Orleans, the question of how fully to defend the city against another catastrophe will be examined as never before.

Unlike San Francisco or Los Angeles, where there is no way to prevent widespread destruction from the most powerful earthquakes, New Orleans is uniquely dependent on one feature: its aging network of levees. If levees hold back the water, the city is spared. If they fail, much of the city is ruined.

"For people to feel confident about coming back again, they're going to have to rebuild the levee system," said Ivor van Heerden, Deputy Director of the Louisiana State University Hurricane Center. They must be taller and stronger, he said, built for the worst-case Category 5 storm. Existing levees were designed decades ago to withstand only a quickly receding Category 3.

The success of levees in a restored New Orleans will depend partly on the resilience of other civil engineering, and on wetlands between the city and the Gulf of Mexico. Today, the condition of these outer defenses is poor: barrier islands and wetlands are disappearing, and gates to protect against storm surges and waves are years away.

Mississippi River levees have choked off the sediment that built and nourished surrounding wetlands. With the rise in sea levels, about 30 square miles is submerged every year.

The slow march of the Gulf Shore toward New Orleans can only be bad for civil defense. Computer modeling shows that in smaller, more frequent hurricanes, storm surges increase as land is diminished.

"Land absorbs wave energy; the physics have been well established," said Gregory W. Stone, a Professor of Coastal Geology at Louisiana State University. His study found that coastal surges increased 8 to 10 feet from 1950 to the 1990's because of land loss.

In another 15 years, models project, surges and waves on the coast will have increased a further 6 to 12 feet if the erosion continues.

But the benefit of revived wetlands to New Orleans may be limited.

"I don't think a city should depend on tall grass," said Hassan Mashriqui, a Professor of Engineering at Louisiana State. "In general, if there is a barrier, that helps. If there is a 25-foot surge coming, does that make it two feet less in New Orleans? It has yet to be proven."

That's because a Katrina-size hurricane, on course to blow a large surge into the city, has yet to occur - an eventuality too serious, some say, to count on islands and marshes to stop the water.

"The enemy is the Gulf of Mexico," said Roy K. Dokka, a Professor of Engineering at Louisiana State. "If you're at sea level and the National Weather Service tells you you're going to have a 20-foot storm surge, you need to have a wall more than 20 feet high."

The engineering challenges are daunting and costly: the city is sinking, and old elevation measurements used to determine levee heights are obsolete. (They were inaccurate, anyway.) Bigger levees are heavier and more likely to sink. Gates that block surges entering Lake Pontchartrain might deflect the water elsewhere, perhaps to other coastal settlements, which would in turn need their own levee systems.

Those gates were proposed and blocked on environmental and other grounds in the 1970's. "Probably a lot of lives could have been saved if they had been in place," said Mr. Stone.

Experts say the best protection for New Orleans would include major improvements in these five areas.

New levees -- they must be taller and much stronger, with an inner levee system that walls off smaller districts so a breach doesn't flood the whole city. Sophisticated sensors should monitor water conditions and weaknesses in the levees, alerting authorities. Material to fill breaches should be stockpiled for quick use. At left, a temporary watertube levee installed near the airport as Hurricane Ivan approached last year.

Barriers at inlets -- surges from Katrina ripped apart the twin spans of Interstate 10, above. Even greater surges are possible, racing across Lake Pontchartrain and inundating the city and shore towns. Immense gates along the rebuilt spans and at other inlets would allow tides to flow through in good weather, but close to stop a storm surge from entering the lake.

More effective pumps -- the system to drain the flood failed completely. Pumps should have their own power supply and be in sturdy, elevated structures. Workers should remain at all times to remove debris blocking intakes; they will require safe houses to ride out storms.

Barrier at the "v" -- two large canals intersect east of the city center, above, creating a funnel shape that can accelerate surges into the heart of New Orleans. This may have led to the failure of the levee along the Industrial Canal during Katrina. Another gate here, which would close during storms, could protect the city.

Restoration of wetlands -- controlled diversion of Mississippi River water carrying sediment could rebuild coastal marshes, an effort expected to cost \$14 billion. Some have called for the protection of cypress forests, left, which are harvested for garden mulch. The trees stabilize land and reduce erosion.