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## Storm Invigorates Proponents of NYC Sea Barrier

Published: Thursday, 1 Nov 2012 | 7:10 AM ET

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By: Associated Press



The vast destruction wreaked by the storm surge in New York could have been prevented with a sea barrier of the type that protects major cities in Europe, some scientists and engineers say. The multibillion-dollar price tag of such a project has been a hindrance, but may appear more palatable after the damage from Superstorm Sandy has been tallied.



Victor J. Blue | Bloomberg | Getty Images

Members of the Fire Department of New York help residents make their way to dry ground on Hylan Boulevard in the Staten Island borough of New York.

"The time has come. The city is finally going to have to face this," said oceanography professor Malcolm J. Bowman at Long Island's Stony Brook University. He has warned for years of the potential for a catastrophic storm surge in New York and has advocated for a barrier.

Invented by Bowman and his colleague Douglas Hill, two European engineering firms have drawn up proposals for walling most of

New York off from the sea, at a price just above \$6 billion.

Before the storm, Mayor Michael Bloomberg's administration had said it was working to analyze natural risks and the effectiveness of various coast-protection techniques, including storm-surge barriers. But officials had noted that barriers were only one of many ideas, and they have often emphasized more modest, immediate steps the city has taken, such as installing floodgates at sewage plants and raising the ground level while redeveloping a low-lying area in Queens.

"It's a series of small interventions that cumulatively, over time, will take us to a more natural system" to deal with climate change and rising sea levels, Carter H. Strickland, the city's environmental commissioner, told The New York Times this summer.

Engineers know this approach as "resilience" — essentially, toughening the city piece by piece to make it soak up a surge without major damage. But the European engineering firms whose barriers protect the Netherlands and the Russian metropolis of St. Petersburg see this as unrealistic, given the vast

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amount of expensive infrastructure that underpins New York.

"How does New York as a city retreat into resilient mode? It's just difficult to see how that would happen," said Graeme Forsyth, an engineer for CH2M Hill in Glasgow, Scotland.

**Sandy** sent a record 14-foot storm surge into New York Harbor, flooding subway tunnels and airports. It forced the closure of the **stock market for two days**, the first time that's happened for weather-related reasons since 1888. There's **no estimate yet for the cost** of the devastation in New York City, but forecasting firm IHS Global Insight put the cost of the damage along the coast at \$20 billion, plus \$10 billion to \$30 billion in lost business.

Forsyth has worked on St. Petersburg's barrier, which consists of 16 miles of levees and gates shielding the city, built on what was once a swamp, from the Baltic Sea and the river Neva. The centerpiece of his firm's early-stage proposal for New York is a levee-like barrier that would stretch five miles from the Rockaway peninsula in Queens on Long Island to the Sandy Hook promontory in New Jersey. The barrier would stop a surge of 30 feet, twice the height from Sandy. Gaps would allow ships, river water and tides through, but movable gates could close off all of New York Bay from the Atlantic when necessary. The barrier would protect most of the city, with the exception of Rockaway itself. It would also shield parts of New Jersey.

To be sure, some scientists have reservations about the storm-surge barrier concept.

Some are concerned about how the structures could affect tidal flow and other environmental features of New York Harbor — and about whether barriers would be socially fair.

"Who gets included to be behind the gate, and who doesn't get included? ... How do you make that decision in a fair way?" Robert Swanson, an oceanographer who is Bowman's colleague at Stony Brook, said in an August interview.

Other experts question whether barriers would even work in the long term. Klaus H. Jacob, a Columbia University climate-risk researcher who has advised New York City officials, has noted that given the unknowns of climate change, any system designed now could prove inadequate in the future.

But advocates believe New York needs to take bigger steps given its concentration of people and financial infrastructure.

"With the kind of protection that has been considered so far, you cannot protect a multimillion-inhabitant city that runs part of the world economy," said Piet Dircke, who has worked on the extensive system of sea barriers in the Netherlands with the Dutch engineering firm Arcadis.

His firm's proposal is to build a barrier in the Verrazano Narrows between Brooklyn and Staten Island, shielding Upper New York Bay. It would be supplemented by two smaller barriers, one between Staten Island and New Jersey and the other on the East River. Such a barrier would have protected Manhattan and much of Brooklyn and Staten Island from Sandy, but left southern Brooklyn and Kennedy Airport exposed.

Robert Trentlyon, a New York community activist who has been advocating for storm-surge barriers, sees the one-two punch of Hurricane Irene in 2011 — which came within a foot of flooding subway stations in southern Manhattan — and Sandy as a sign that the time has come.

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"Having had two storm surges within one year, and their both being major ones, I just find it very difficult to think the city could not go ahead and act," the retired local newspaper publisher said by phone Sunday from his Manhattan apartment, which was left without power. His Chelsea neighborhood, though not his building, was among those that flooded.

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In August, U.S. Rep. Jerry Nadler urged city officials to take a comprehensive look at storm-surge barriers, bulkheads and other flood-fighting devices.

After the storm, reactions from the government have been mixed, as the region battles to recover from the storm rather than looking at how to prevent the next disaster.

"We cannot build a big barrier reef off the shore to stop the waves from coming in," Bloomberg said Monday. But Gov. Andrew Cuomo opened the door to new ideas Tuesday, saying that the government has a responsibility to think about new designs and techniques to protect the city in the face of what look like increasingly frequent megastorms.

One doesn't have to go to Europe or New Orleans to find examples of massive sea barriers: The city of Providence, R.I., has been protected by a 3,000-foot gated barrier since 1966. Construction was prompted by two devastating hurricanes in 1938 and 1954. The barrier has prevented flooding of the low-lying parts of the city several times since then, including during Sandy.

"This is not far-out science or engineering," Bowman said. "This is easy to do."

"Easy" doesn't mean it would be something that could be put in place quickly. Even after politicians line up behind the project, funding, permitting and environmental studies are likely to take years.

"It could take 20 years before people even start pouring concrete," Bowman said.

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