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What if the Water Wins?

By Stephan Faris

Just downstream from the Dutch Port of Rotterdam, a storm-surge barrier waits for the seas to rise. Twin latticework arms, each as long as the Eiffel Tower and twice as heavy, stand ready to swing together to shield the city from the wind-whipped waves. Together, they form one of the longest moving structures in the world.

The Maeslant Barrier, or Maeslantkering, is the culmination of an effort initiated in the wake of a 1953 flood, when a storm surge overwhelmed the country's dikes and killed 1,800 people. Completed in 1997, the \$7.5 billion Delta Works — a series of dams, dikes, locks and gates — was designed to put a permanent end to flooding in a country where two-thirds of the population lives below sea level. "The general idea was that water would never be a threat to the Netherlands again," says Tineke Huizinga, Vice Minister for Transport, Public Works and Water Management.

But even as the great barrier was being tested, it was becoming clear that climate change would one day make the effort obsolete. In 1995 and '98, several rivers burst their banks, forcing mass evacuations. Then, in 2005, the country watched in horror as Hurricane Katrina shattered New Orleans. "We saw what could happen," says Eric Boessenkool, an adviser for international affairs at Rijkswaterstaat, the Dutch equivalent of the U.S. Army Corps of Engineers. "And it really changed our mind-set."

Rising water levels are a problem not just for the Netherlands; they are one of the problems that will be addressed by the U.N. Climate Change Conference in Copenhagen, or Cop15, next month. The Maldives, an island nation, is slipping beneath the waves, and countries from Bangladesh to the U.S. are confronting littoral issues that result from a warming climate.

Dutch law mandates that the country's most densely populated regions be protected from the extremes of a 1-in-10,000-years storm. But as the emissions from our cars, factories and power plants have warmed the world, safety has become a moving target. Last year a government-commissioned report estimated that the level of the North Sea would rise between 0.65 m and 1.5 m by the end of the century. It warned that the country's rivers would swell dangerously and that the need for action was "urgent." "Add an extra meter to the level of the sea, and this barrier can stand it," says Alwin Nijhuis, head of communications for the Maeslantkering. "But more than that ..." ([Should President Barack Obama attend the Copenhagen conference?](#))

The Netherlands, which has wrestled with the ocean for centuries, is the ideal lab for finding solutions to the risks of global warming. A saying there boasts that "God created the earth, but the Dutch created the Netherlands." Early farmers built up hills on which to take refuge from periodic floods, then gradually extended these into dikes that protected entire regions. In the medieval era, monks sectioned off patches of swamp and drained them. The trademark windmills powered the pumps. Construction reached a peak in the past century when the erection of a 32-km dike along a North Sea inlet transformed a shallow sea into a freshwater lake, large tracts of which were drained dry and built on. By 1986 an entire new province had been seized from the waves.

There's a growing recognition, though, that the age-old approach to flooding — taller dikes, stronger pumps and more storm gates — may have to give way to embracing the water. Upstream from Rotterdam, for instance, dredgers are pulling up infill from the 1930s, when the Meuse River was straightened for ship traffic. The river's old course will become a crescent-shaped inlet and nature reserve, ready to absorb the floodwaters when they arrive, helping, along with other projects, to lower water levels by 75 cm.

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After all, if nothing is done to ease the pressure, building a taller dike magnifies the consequences of its failure. Thus, the Dutch are experimenting with surrendering turf to the water altogether, purposely flooding some areas to protect more-vulnerable zones downstream. A few bends away from the dredgers, a thin line of houses sits on the water's edge just beyond the protection of the dikes. The colorful, arch-roofed homes sit atop concrete pads — but they're designed to float safely when the waters rise.

Of course, it's one thing to carve out space for water in the countryside. In an urban center like Rotterdam, it's another thing entirely. Europe's largest port and the country's industrial heart is extremely vulnerable, with some neighborhoods as much as 7 m below sea level. "It's all water here," says Mayor Ahmed Aboutaleb. "We get it from four directions: the sea, the river, the rain and the groundwater."

Rotterdam is experimenting with new types of dikes, including some that contain commercial and office space. Meanwhile, the increase in precipitation and upswelling will be absorbed by temporary water storage in all new construction. Parks and playgrounds are being structured to capture floodwaters. A downtown parking garage is being fitted with a water tank beneath its entrance ramp. Retention ponds will serve as scenic elements for high-end housing. "The philosophy behind this is controlled flooding," says Arnoud Molenaar, program director for the city's climate-change department. "If you wanted to deal with the peak rainfall, you'd need sewer pipes as large as the subway."

The Dutch mastery of the interplay between land and water has created commercial opportunities. Two Netherlands-based companies control 40% of the global dredging business, including the construction of artificial islands in Dubai. California has enlisted Dutch experts to help it plan for a sea-level rise in the San Francisco Bay. In New Orleans, the Dutch engineering firm Arcadis has won more than \$200 million in engineering and management contracts for the construction of a series of storm-surge gates. The company was also asked to submit a flood-protection plan for New York City, where it proposed a storm barrier that would sit behind the Verrazano Bridge, ready to defend against a direct hit from a hurricane.

Yet the secret to the Netherlands' success isn't the strength of its barriers. "It looks like science and engineering," says Piet Dircke, an urban-water-management consultant at Arcadis. "But the main lesson to learn from the Dutch is funding." The country is divided into water boards, elected bodies with the ability to levy taxes whose sole responsibility is to provide safety from the waves. First formed in the Middle Ages, the water boards are the country's oldest form of representational government and a major factor in its flood-proofing prowess. "The value of a dike is only seen when it fails," says Huizinga. "The water boards mean that there is always the money to maintain them."

That's the significance of Dutch history for the talks in Copenhagen, where the allocation of adaptation funding for the poorest countries is shaping up to be a major point of contention. While the Netherlands can afford to keep its citizens dry, countries like Bangladesh — equally threatened by global warming — simply can't. The World Bank has estimated an annual cost to developing countries of \$75 billion to \$100 billion to adapt to rising sea levels. But rich countries have been reluctant to commit the funds. In the run-up to the talks, the Dutch were among the first to stress the importance of adaptation. They, more than anybody else, should know what that will take.

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