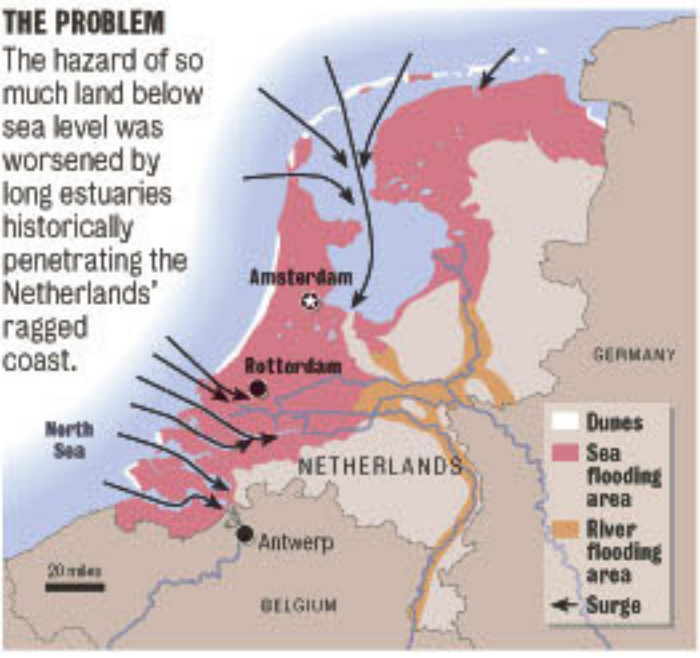
BATTLE AGAINST THE SEA

Much of the Netherlands is below sea level, in some places 20 feet below, a vast outwash where three major European rivers wind their way to an often violent North Sea. Not surprisingly, water management is a national religion, and today the Netherlands is the global gold standard in flood control.

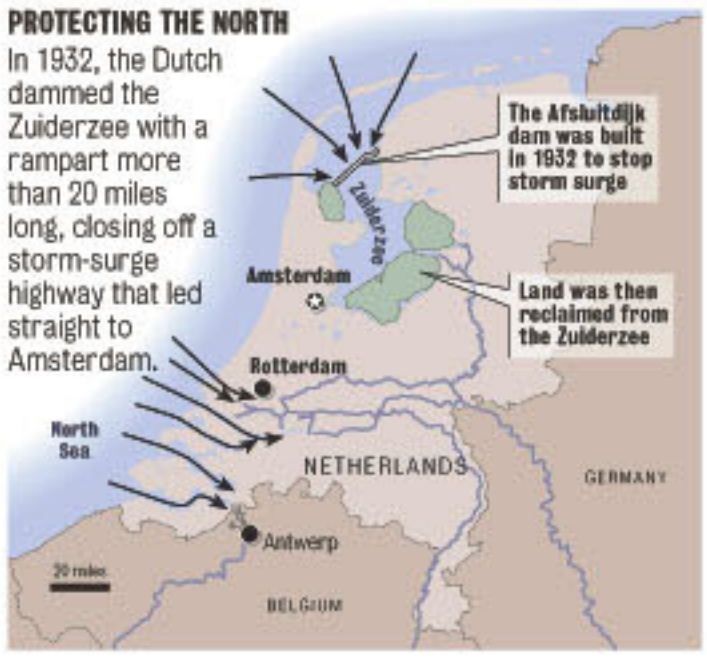
THE PROBLEM

The hazard of so much land below sea level was worsened by long estuaries historically penetrating the Netherlands' ragged coast.



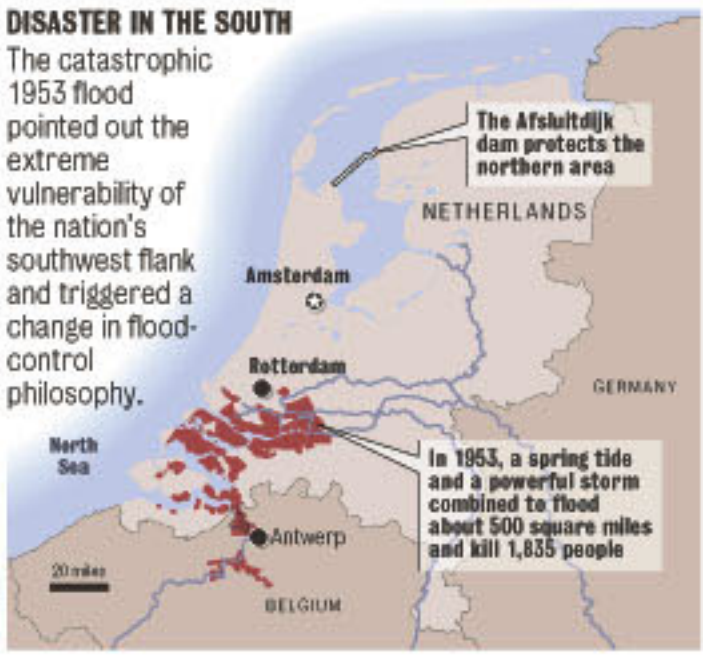
PROTECTING THE NORTH

In 1932, the Dutch dammed the Zuiderzee with a rampart more than 20 miles long, closing off a storm-surge highway that led straight to Amsterdam.



DISASTER IN THE SOUTH

The catastrophic 1953 flood pointed out the extreme vulnerability of the nation's southwest flank and triggered a change in flood-control philosophy.



THE SOLUTION

To secure southwest Netherlands against flooding, the Dutch opted to cut off key waterways and thus block storm surge at the source rather than continually having to raise the height of the levees. The Delta Works Project led to a variety of innovative barriers placed at the mouths of estuaries that cut deep into the nation's interior.

ZUIDERZEE WORKS PROJECT

DELTA WORKS PROJECT

1 HOLLANDSE IJSSEL STORM SURGE BARRIER

Storm surge barrier protects the lowest region of the Netherlands. Two enormous doors span the 260-foot wide structure, suspended between two towers. When water levels rise too high, the doors are lowered and dam the river.
Completed: 1958

2 MAESLANT STORM SURGE BARRIER

Storm surge barrier protects Rotterdam. Huge gates — each nearly as wide as three football fields — sink into the shipping channel after they swing shut. Generally, though, they stay open. The structure is expected to be used once or twice a decade.
Completed: 1997

3 HARINGVLIET DAM

Open dam prevents flooding while also allowing drainage between two key rivers and the North Sea. When levels near Rotterdam get too high, drainage sluices remove excess water. The structure includes tunnels to allow fish to swim to and from the North Sea, even when the dam is closed.
Completed: 1970

4 VOLKERAK DAM

Dam built primarily to aid in the creation of other dams. It prevents too much freshwater from flowing into the brackish waters of the Zeeland and includes a lock to facilitate shipping between Antwerp, Belgium, and Rotterdam.
Completed: 1969

5 BROUWERS DAM

To create the dam, sandbars were enlarged, giant caissons were sunk then filled with sand, plus more than 660,000 tons of enormous concrete blocks were plunged into the sea. The dam, however, blocked tidal flow, destroying the area's character. In 1978, a sluice was built into the dam to restore salinity levels.
Completed: 1971

6 GREVELINGEN DAM

Nearly 4-mile dam created across sandbars to facilitate construction of other dams in the area and to prevent water from manmade lakes created by the other dams from flowing back toward the sea.
Completed: 1965

7 EASTERN SCHELDT STORM SURGE BARRIER

Originally envisioned as a dam, plans were completely revised, partly because of unintended environmental changes wrought by the Brouwers project. The dam would have destroyed oyster farming and decimated the fishing industry. The partially built structure was modified into a barrier with a series of giant doors that slide shut during a storm.
Completed: 1986

8 VEERSE GAT DAM

9 ZANDKREEK DAM

Dams designed to connect islands and block key flood pathways. A brackish lake, the Veerse Meer, between two islands was created upon completion of the dams.
Veerse Gat completed: 1961
Zandkreek completed: 1960

Staff graphic by Dan Swenson and Emmett Mayer III

STAFF PHOTOS BY MICHAEL DEMOCKER WITH CONTRIBUTIONS BY DUTCH MINISTRY OF TRANSPORT, PUBLIC WORKS AND WATER MANAGEMENT

Sources: "Water in the Netherlands," "The Delta Project," Deltawerken, staff research