

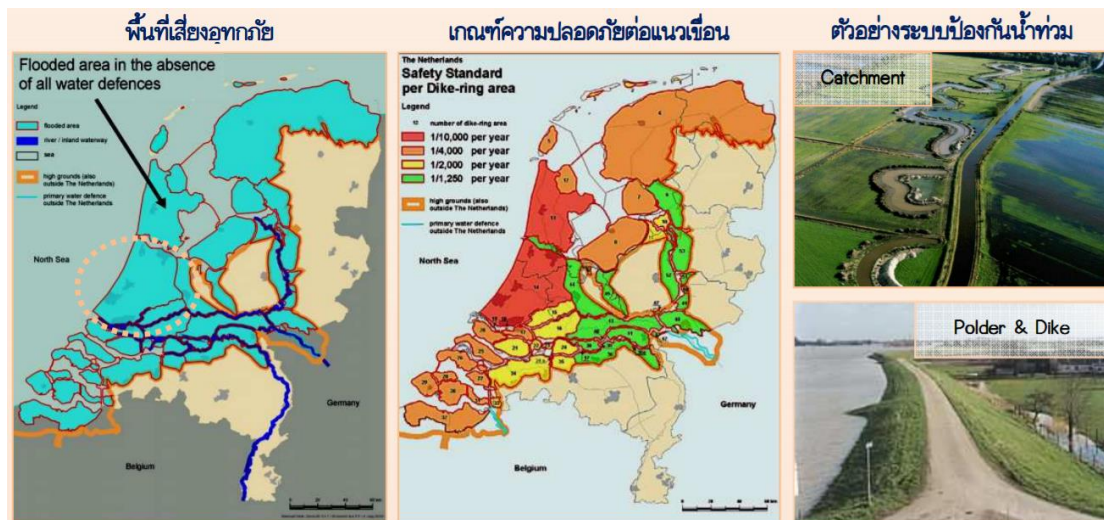
## Case Study of Flood Control in the Netherlands

Natural disasters have become much more violent, causing excessive damage to humankind. Among the most common and frequent natural disasters are inundations or floods. Many countries lack the capacity to deal with the destructive power of overflowing water, but the Netherlands has managed to exert control over its flooding situations. In fact, this small country is known for having the world's best flood control system, in which advanced technologies and innovations have been integrated into the fight against inundations.

The name Netherlands—meaning low countries—is befitting, since most of its landmass is below sea level. More than 60% of the country's surface area are at risk of being inundated, including its international airport, which is 5 meters below mean sea level.

The region that is now the Netherlands has dealt with floods for more than 2,000 years, but the Dutch have never given up. Their saying “God created the world but the Dutch created the Netherlands” is exemplary of their ability to cope with natural disasters.

Flooded Area in the Absence of All Water Defences  
Safety Standard per Dike-Ring Area  
Water Defenses

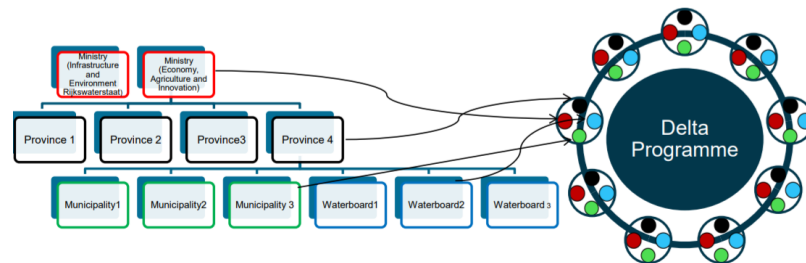


Images depicting the Netherlands's flood-risk area and flood control solutions

During the historic North Sea Flood of 1953, the storm and sea waves of 16 feet obliterated the shorelines of Scotland, Belgium, England, and the Netherlands. Among over 2,000 casualties were 1,835 Dutch citizens, and more than 70,000 people were displaced. About 150,000 hectares of the surface area or 9% of the entire country was under water. Over 3,000 households and more than 3,000 farms were catastrophically damaged. The severity of the situation compelled the Dutch to find sustainable solutions to the problem of inundation. The Delta Commission was formed to tackle the issue. The organization now deals with water-

related problems and lays down systematic water management plans. Its objectives are to prevent flooding, both in-land and along the shorelines, as well as to ensure that the Netherlands has a sufficient supply of fresh water. The commission provides the Dutch government with water-related data every year.

### Multi-level governance steering committees for sub-programmes



The commission initiated a series of national projects known as Delta Works with a goal to develop the country's water management system and to mitigate the effects of water-related disasters. This series of 16 projects include the construction of dams, sluices, storm surge barriers, and dikes, which require an investment of 1.2–1.6 billion euros each year from its inception through to 2050. The structures built separate sea water from fresh water at estuaries. As a result, the shorelines have been pushed out further into the sea and away from residential areas. The water stored behind these defences is fresh water suitable for agricultural purposes. The sluices open and close at a whim. They are typically closed in bad weather as a pre-emptive measure to prevent the sea from inundating residential areas.



Delta Works Sluices

Delta Works began in 1958 with the construction of a storm surge barrier at the Hollandse IJssel estuary to prevent future floods. Upon completion of the construction three years later, the area became a large body of fresh water known as Veerse Meer or the Lake of Veere.



Haringvliet Sluices and Brouwers Dam

Additionally, sluices were built to close off the estuary of the Haringvliet and to help carry the overflow from the Rhine into the sea. In winter, these sluices are open to let the water mass flow into the ocean to prevent it from freezing over. Upon completion of the Haringvliet

sluices in 1971, the water in the inlet slowly turned into fresh water. The Brouwers Dam to the south of the Haringvliet was finished a year later.



The Eastern Scheldt

The plan to build a closed dam at the Scheldt River had to change because the locals objected to the initial design. They argued that building a closed dam would create a body of still watering, turning it from brackish water into fresh water, and effecting devastating results for the local fishery-dependent economy. The government listened and built a movable storm surge barrier with 62 openings of 40 meters each instead. These openings are normally open to let the fish and the local biodiversity thrive. The movable gates, however, close in severe storms with formidable waves. This barrier is one of the largest structures in the world and it is quite costly to operate.



Delta Works' water management is crucial to the development of the Netherlands in the following ways:

- Delta Works' structures and water management have increased the volume of fresh water and made the available water more suitable for agriculture.
- The projects have maintained water at desirable levels throughout the country. Water management has become easier thanks to the sluices, which give them control over the level of salinity and over the drainage of excess water.
- Delta Works' structures, such as the Zeeland Bridge and the Western Scheldt Tunnel, allow the Dutch maritime transport to become more effective. The many islands and

capex of Zeeland, a southwestern province whose name befittingly translates to Sea Land, are more connected than ever.

- The projects have improved international maritime transport. For instance, the Netherlands and Belgium signed an agreement in 1976 to facilitate shipments of goods between Rotterdam and Antwerp, encouraging private maritime commercial activities and trade between the two countries.
- The projects have contributed to the development of the delta area into natural tourist attractions. The Delta Works themselves have come to be attractions, further contributing to the national income.

Moreover, Delta Works are a long-term commitment under constant development, expansion, and maintenance due to the ever changing climate condition. Towards the end of the twentieth century, Delta Works built a large fan-shaped, digitally-controlled storm surge barrier called the Maeslant Barrier. Its two gates come together in an embrace to protect the river from the effects of climate change.

Undeniably, Delta Works have improved the quality of life for the Dutch and enhanced their safety. The projects prevent further loss of lives and resources, as well as serves as a model of sustainable water management for many countries around the world.

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