

**Case Studies: Rotterdam and New York**

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Peter van Veelen

## CASE STUDIES: ROTTERDAM AND NEW YORK

### DIFFERENT STRATEGIES TO COMMUNITY BASED ADAPTATION TO FLOOD RISK

Although storm at the North Sea produces moderate flood levels compared to the hurricane-impacted storm surge flood levels at the East Coast, Rotterdam and New York show comparable flood characteristics (see Figures at top next page). The majority of the urbanized waterfront areas in New York City and Rotterdam are mostly exposed to slow rising storm surge flooding that causes relatively shallow and short-lived inundations.

The New York - New Jersey estuary is particularly vulnerable for storm surge flooding because of the orientation of Long Island Sound and the wedge-shaped entrance to the New York Harbor bay, which creates two natural funnels that drive sea water into the Western Sound and Upper East River, and up to the Battery in New York City during storms (Bowman et al., 2005). Also, the effects of climate change are felt more intensively at the New York City-New Jersey coast. This is not only because of differences in expected storm intensity and higher expected sea level rise, but also because New York City lacks storm surge protection that reduces the impact of high-energy waves and extreme water levels before it reaches the urbanised coasts.

This is a contrast with Rotterdam, where the Maeslant barrier and Haringvlietdam strongly reduce the effect of storm surge flooding in the upstream areas. Additionally, the effect of increased river discharge is a more dominant factor in waterfront flooding, particularly for the upstream cities as Dordrecht. Both metropolitan regions share the need for adapting their coastal urban waterfronts to increasing flood risks in the near future and to developing flexible strategies that allow responding to future conditions and opportunities when they unfold.

Despite clear similarities in flood risk, the flood risk management approaches differ considerably. The US flood risk management model is based on individual building resilience and disaster management (short-term relief programmes and evacuation strategies) and recovery after a flood, less on disaster avoidance and prevention as is the dominant approach in the Netherlands.

An essential part of the US flood management strategy is the federally operated National Flood Insurance Program (NFIP). This program enables property owners in flood prone areas to insure damage of flood risk, as long as they meet the basic requirements for constructions in flood prone areas. In the Netherlands, the unembanked areas are considered part of the river's flood plain. Consequently, the property owners do not enjoy flood protection and are bearing the full economic consequences of flood risk. Currently, it lacks a comprehensive flood risk policy for flood protection of existing buildings in the flood prone areas. There is no disaster management plan in effect and, in addition, flood risk is not available in regular home insurance. Additionally, both approaches lack a comprehensive risk approach, covering all aspects of local flood risk and ignore the flood risks arising from critical systems vulnerability.

**Community based adaptation**  
Notwithstanding the differences in response to increasing flood risk, we also see a comparative adaptation approach developing: both cities reach out to the community level.

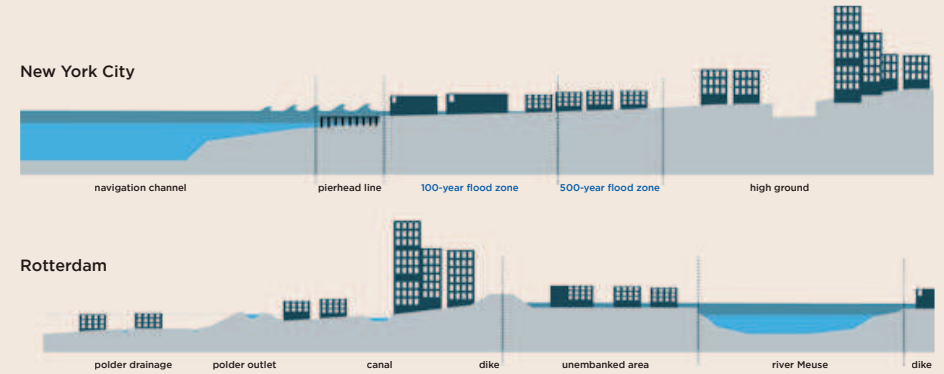
To stimulate homeowners to invest in flood resilience, the New York City Department of City Planning recently updated the zoning ordinance and the City's building codes (NYCDP, 2013). One of the adjustments

made is an extension of the opportunities to recapture lost floor space due to wet-flood proofing actions, by adding an equivalent amount of floor area to the building. Furthermore, inspired by the Rebuild by Design competition that was launched in 2013, several areas in New York currently have integrated flood-protection schemes under development. In these projects, close collaboration with the needs of the local community is sought.

In Rotterdam, alternative adaptation measures are developed as well; such as dry-proofing buildings, or district-wide flood protection integrated in urban renewal and waterfront renovation programs. The city of Rotterdam developed together with nearby city of Dordrecht a community information program to raise flood risk awareness and to stimulate homeowners to invest in flood resilience.

Both cities show that widening the portfolio of potential adaptation responses improves resilience of waterfront communities and opens opportunities for tailor-made approaches that better align with local dynamics and agendas.

*This text is an adapted version of chapter 5 of the dissertation 'Adaptive planning for resilient coastal waterfronts', Peter van Veelen (2016).*



### ROTTERDAM, RHINE ESTUARY REGION: A DELTA LANDSCAPE IN REVERSE

The urbanized area of Rotterdam (image above, below) is located at the confluence of the rivers Meuse and Rhine into the North Sea making this area vulnerable for both coastal and fluvial floods (Delta Program Rijnmond-Drechtsteden, 2014). A large network of dunes, primary dikes, walls and locks protects the low-lying urbanised polders of Rotterdam from flooding.

However, a considerable part of the Rhine Estuary Region has large unembanked alluvial areas that are almost entirely urbanized and not protected by the primary flood defence system. In the larger metropolitan Rijnmond-Drechtsteden region more than 2.020 ha of land is located in the 100-year flood zone between the North Sea and the city of Dordrecht (RWS, 2009), of which a large part is urbanized or in use for industrial activities. Approx. 65,000 people live in the unembanked area of some 200 ha. (Veerbeek et al., 2010).

The former port areas and historic merchant districts of Rotterdam and the adjacent cities of Dordrecht and Vlaardingen are exposed to tidal and seasonal flooding. The majority of these unembanked areas are built on higher ground, or were elevated over time to above high tide. In the next decades the risk of flooding is expected to increase due to rising sea levels and subsidence, as well because of these port areas, due to their position close to the city and river are attractive places for urban development.

### NEW YORK, NEW JERSEY ESTUARY: A LARGE FLOOD PRONE WATERFRONT.

Although the major part of New York- New Jersey metropolitan region is built on higher grounds (top image), the city has a 520-mile-long low-lying waterfront area that lies less than 2.5 m above mean sea level making these areas vulnerable to coastal flooding during major storm events (Rosenzweig et al., 2010).

The most vulnerable area for flooding is the waterfront of Lower Manhattan, including the financial and business district, but also parts of the Brooklyn waterfront, Long Island City in Queens and the coastal zones of Staten Island, Jersey City and Hoboken. In fact, about 60,000 buildings with over 250,000 residential units are located in the 100-year floodplain and an additional 35,000 buildings with 145,000 residential units are located in the 500-year floodplain in New York City alone (Findlan et al., 2014). In these areas a considerable amount of vital assets, among which the La Guardia Airport, subway entrances, wastewater treatment plants and tunnels, are located in the 100-year flood zone (Aerts & Botzen 2011).

New York City's population is growing and is expected to grow in the future (NYC, 2011). The city's housing strategy is encouraging growth within the existing city boundaries by intensifying neighbourhoods: encourage transit-oriented development, and transforming underutilised formerly industrial zones (NYC, 2011). Particularly the formerly industrial sites in Brooklyn along the East River and waterfront areas in Jersey City and Hoboken offer opportunities for large-scale, high-density development, most of them located in flood prone areas.