Water and Spatial Planning in the Netherlands

The Latent Potential of Spatial Planning for Flood Resilience

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Water and Spatial Planning in the Netherlands: The Latent Potential of Spatial Planning for Flood Resilience

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Summary

In February 1953, an extremely powerful northwest storm surge combined with spring tide led to serious floods in a number of countries around the North Sea. No country was hit as badly as the Netherlands. In the southwest of the country, dozens of dikes were breached, leading to over 1,800 casualties. At the time of the 1953 disaster, a government-appointed committee was working on an advisory report about the desired future spatial development of the most urbanized western part of the country, a region largely below sea level. Responding to the 1953 disaster, the committee discussed whether urban development in deep polders should be avoided. The conclusion was that what is best in terms of the desired urban morphology should prevail. This is indeed what happened when the government had to make a choice about where to develop new towns (1960s–1980s) and, in the next stage, where to locate new housing estates in and around cities (1990s–2000s). Near floods along the main rivers of the country in 1992 and 1995 opened a window of opportunity for a series of major changes in flood risk management and in spatial planning and design, respectively. A massive program called Room for the River was carried out, which included more than 30 projects designed by multidisciplinary teams of civil engineers, planners, and spatial designers. Parallel and follow-up programs were carried out in which spatial design again played a role. The concept of risk was redefined in law, leading to more stringent protection norms for densely populated areas—again, a spatial turn in flood risk management. When flood risk management started to take a decisive spatial turn in the 1990s, spatial planning began to change as well, becoming more sensitive to issues related to water management and flood risks. One of these changes involved the mandatory use of a water test in (local) plan making. The continuation of the trend to give greater weight to flood risks became interrupted as the multilevel arrangement of planning in the Netherlands started to change from 2010 onward. This was largely the result of the neoliberal ambition to decentralize and deregulate planning. One main effect was that the government no longer took a leading role in locational choices regarding where to build new housing estates outside cities and towns. By the end of 2021, the government-appointed Delta commissioner issued a stark warning that over 80% of the houses that will be built by 2030 are situated in less desirable locations. This and other effects of the downscaling of planning competencies made the government decide to start a trajectory to partly recentralize planning. There are two contradictory objectives, however, claimed by different government departments: the production of new homes as quickly as possible and the ambition to make water and soil leading in future choices. Bringing flood risk management and spatial planning together means that locational choices and the spatial design of localities have to move in tandem.

Keywords: Delta Programme, flood risk management, landscape architecture, locational choice, material and process norms, resilience, spatial design, spatial planning, urban design

Subjects: Environmental Issues and Problems, Management and Planning

Introduction

As a case, the Netherlands is a textbook example of both flood risk management and spatial planning. This brings opportunities as well as challenges for the support of flood resilience, a concept that is considered here as *the ability of a spatial community to bounce back from and adapt to the shocks and stresses associated with flooding*. In this contribution, the latent potential of spatial planning for flood resilience in low-lying deltas worldwide is explored (Figure 1 shows the Dutch delta) by demonstrating the changes over time in the relationship between spatial planning and flood risk management in the Netherlands. First, key concepts and their cross-connections in international spatial planning literature are sketched, followed by an analysis of the parallel evolution of spatial planning and flood risk management in the Netherlands. This article contains a table that shows the rather complex organizational landscape of spatial planning and flood risk management of the early 21st century. The contribution concludes with the prospects of flood resilience via spatial planning.

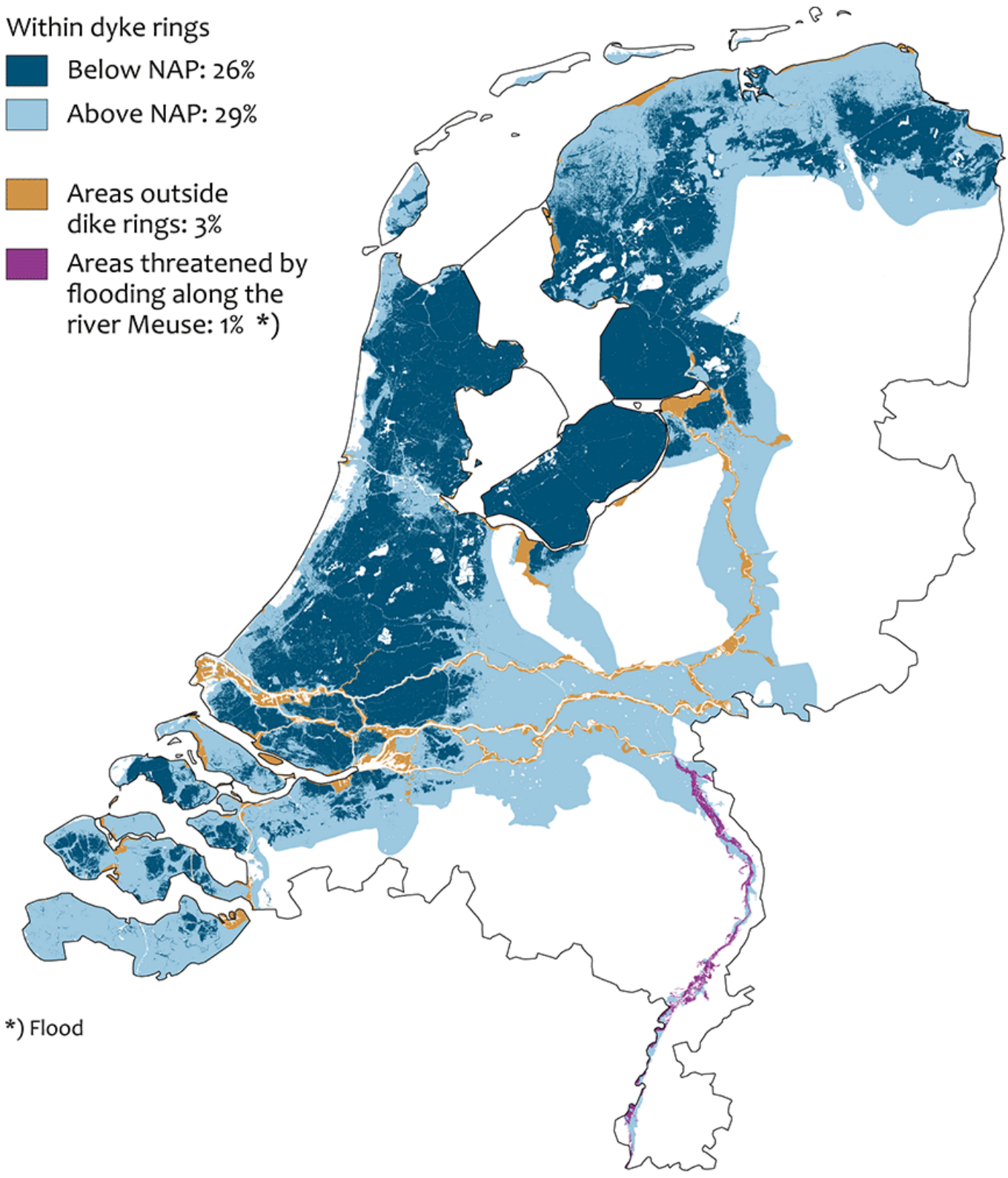


Figure 1. Flood-prone areas in the Netherlands.

Note: NAP = Normal Amsterdam Level; * = actual floods in 1993

Source: PBL Netherlands Environmental Assessment Agency.

Making the Case for Spatial Planning and Flood Resilience

The Netherlands is globally known as a leading country in successful flood risk management; Figure 1 shows the urgency of such management as 59% of the land surface is liable to flooding. The country also boasts one of the world's most ambitious spatial planning systems, giving it the reputation of a planners' paradise. It is also one of the very few countries with an intervention-orientated national planning approach, at least until 2010. Strikingly, both sophisticated policy domains have rarely operated in tandem, while an argument can be made that spatial planning can play a key role in the support of flood resilience particularly through the careful selection of locations for urban development as well as the resilient and adaptive design of these locations. To make the case for spatial planning as an effective tool to build resilience to flooding, a proper understanding of what spatial planning is and how it relates to disaster management and resilience is required.

Key Traits of Spatial Planning

"Spatial planning" or "land-use planning" has been a common phenomenon for governing land use and development (Berke et al., 2015) that takes many forms throughout the globe. In his seminal paper "There Is No Planning—Only Planning Practice," Alexander (2016) convincingly makes the case that no shared definition for planning exists and any attempt to do so is futile: Many universal definitions are true yet remain too abstract for closure in real-world practice. The realistic capture of practice on the ground requires the naming of a specifier in the form of the object of the practice (space, land use), context, and tools. While in the United States, "land use," "urban," or "regional" are common specifiers, in the Netherlands, the more generic "spatial" is used and, for 7–8 years, has often been connected to the broader concept of (physical) environment. In the United Kingdom, the specifier "spatial" as a specifier gained traction over the more traditional "land use," for its broader potential for application.

Between those practices, a great variance between tools appears to exist even when space is shared as the object of planning. In Dutch planning practice, for example, the main tool is the land use plan or *bestemmingsplan/omgevingsplan*), while in U.S. planning practice, the main tool is zoning (Hirt, 2012). Key differences may also be found in the goals or doctrines behind different planning practices. For example, for Dutch planning practice, much has been made of a "doctrine" formed by an enduring national consensus on a set of interrelated notions on spatial configurations and development strategies and how they should be handled (Faludi & Van der Valk, 1994, p. 18).

To a certain extent, differences between planning practices can be understood by looking at families of planning traditions as these are called in the 1997 EU Compendium of Spatial Planning Systems (Nadin et al., 1997). Nadin and Stead (2013) have described these in four archetypes that, in reality, present as blended forms: "regional economic planning," "comprehensive integrated," "land-use management," and "urbanism." The Dutch planning system is considered the archetype of the comprehensive integrated form, whereby a formal, systematic

hierarchy of plans from the national to the local level emphasizes spatial coordination over economic development and where considerable political commitment and mature, sophisticated planning institutions exist. Overall, large differences between planning traditions exist regarding political commitment, maturity, a balance between economic and broader spatial objectives, and the degree and form of national-tier government involvement. Research on changes in the planning systems of 32 European countries over the 2000–2015 period unveiled sometimes drastic changes due to combined processes of neoliberalization and decentralization of planning competencies (ESPON, 2018). For the Netherlands, this means that the planning system has become far less an outspoken example of a comprehensive-integrated approach (see the section "The Parallel Evolution of Spatial Planning and Flood Risk Management in the Netherlands").

Despite differences between national planning systems, a few key shared traits exist across different spatial planning practices that make the case for universal potential for flood resilience. The first common feature associated with spatial planning practices is mediation between competing claims for land use. In an effort to capture the specificities of planning practice in European countries, ESPON (2018, p. 113) described planning systems as "a collection of institutions that mediate competition of the use of land and property." The twin notions of competition and mediation also appear in Berke et al.'s (2006) definition for the United States, which describes "land use planning" as a multi-actor policy domain with strong competition between various interests although in need for cooperation to arrive at a shared vision for the future of a community or region. A second common feature—more or less profound across examples—is its need to operate across spatial scales, touching on the competencies of different tiers and forms of government and their tools. A third and final common feature of spatial planning practices is the capacity to look forward. Berke et al. (2015), as well as Mileti (1999), have pointed to the "integrative scope" of "strategic planning," in combination with "forward looking design-approaches." Alexander also stressed "controlling the future" and "guidance for future action" as central to multiple forms of planning. This anticipatory element, and the capacity for integration, provides the relation to disaster management and, ultimately, resilience.

The Link Between Spatial Planning and Resilience

Since 2000, spatial planning has increasingly come into scope as a means to reduce disaster vulnerability and boost resilience to a variety of shocks and stresses, including flooding (Berke et al., 2015; Mileti, 1999). It seems obvious that this relationship with disaster management and resilience runs via "mitigation," the first out of four steps in the so-called disaster chain that also includes "preparedness," "response" and "recovery." That the governing of land use and development, and the mediation of competition for these, made spatial planning practices a suitable means for disaster management and hazard mitigation was a point made by Mileti (1999), and, later, Berke et al. (2006) in the United States. On the global stage, a move from recovery and all-inclusive prevention toward preparation and (hazard) mitigation in disaster management emerged after the 1st decade of the 21st century. The Sendai Framework specifically advised "to promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, land degradation assessments and informal and non-permanent housing" (UN General Assembly, 2015, p. 24).

In the face of mounting disaster losses, the notion of resilience has captured interest across disciplines, actors, and scales, making the term ubiquitous in academic and policy discourse. It is commonly assumed that the origins of modern resilience theory lie in Holling's 1973 paper on ecological systems. In a key publication on the definition and evolution of resilience, Meerow et al. (2016) point out that resilience moves from the (socio-)ecological systems field to numerous other fields in the early 2000s, including those of natural disasters and risk management, hazards, climate change adaptation, and *planning* (Ahern, 2011; Davoudi et al., 2012).

Key to the understanding of resilience is to which shocks and stresses it applies and of what phenomenon it is a feature (Meerow et al., 2016). Even within the domain of spatial planning practice, resilience can be operationalized differently depending on the shock or stress and the entity it applies to. In Europe, Davoudi et al. (2012) and, in the United States, Berke et al. (2015) made the case for spatial planning as a means for building resilience, and flood resilience in particular, with the latter introducing a method—the Plan Integration for Resilience Scorecard (PIRS)—to assess the contribution of so-called *networks of plans* for resilience (Masterson et al., 2017, see also Malecha et al., 2022). PIRS has been applied to multiple case studies not only in the United States—noting strong degrees of conflict between plans in networks, thus undermining resilience (Berke et al., 2015)—but also in the Netherlands (see Box 1).

Box 1. Assessing the Resilience Potential of Plans: The Plan Integration for Resilience Scorecard Method.

In the Netherlands, like in many other countries, there are all sorts of spatial as well as water management plans. But how to compare such plans in particular in relation to the resilience potential that these plans may offer? Do spatial plans with their focus on land use and territorial organization form a relevant tool to increase resilience? The Plan Integration for Resilience Scorecard (PIRS) is a method to assess the potential contribution of networks of spatial plans to resilience (Masterson et al., 2017).

PIRS was developed by Berke et al. (2015) in response to a suggestion of the U.S. National Research Council in 2015 (Masterson et al., 2017). It was designed to allow U.S. communities to track their progress to greater resilience from natural disasters, by scoring the anticipated impact of policies from a *network* of spatial plans at the neighborhood level. In the United States, a single community can adopt multiple plans, which together constitute a network that guides future development patterns. These often include a comprehensive or general plan but also particular sector- (or place-)specific plans focused on land use, housing, transportation, and hazard mitigation (Malecha et al., 2018). Poor coordination of these plans can lead to conflicting policy guidance, reduced efficacy, and increased hazard vulnerability.

To assess their potential concerted effect, policies are extracted by hand from the spatial plans and scored independently by planning researchers with a -1 (increases vulnerability), 0 (neutral effect), or +1 (reduces vulnerability) from natural disasters. The composite policy scores of the selected plans are consequently calculated and depicted on a map. PIRS thus not only identifies *in detail* which plans may have an anticipated effect on vulnerability and where, but it also produces a cross section of the network of spatial plans and *an estimation of their likely performance regarding resilience* for a case study of a specific territory. It also identifies clearly which plans add or build "community vulnerability"—a term the method uses as the counterpart of "community resilience."

The vulnerability content is given shape by distinguishing between hazard zones and flagging concentrations of communities that may be considered vulnerable from a socioeconomic perspective. Hazard zones are taken over from the 100-year floodplain: delineated areas by the federal government where flood insurance is mandatory. Vulnerable communities are identified using criteria from the Centers for Disease Control and Prevention. To translate the PIRS method to the Dutch situation, hazard zones need to be delineated by distinguishing between embanked (area protected by dikes and/or natural levees, often below sea level) and unembanked areas (protected by elevation, often by landfill). Vulnerable communities can be identified using criteria from CBS Statistics Netherlands.

The findings of PIRS have limitations. One main reason is that PIRS only scores the *intention* of plans, while plans are known for remaining what they are: plans, not reality. However, PIRS still provides evidence of how a sample of a network of spatial plans may perform regarding resilience: increasing or reducing vulnerability for a particular natural hazard. Additionally, it allows identifying plans and policies that can be improved and therefore leverage points for building resilience.

In the Netherlands, PIRS has been applied to the districts of Feijenoord in Rotterdam (Malecha et al., 2018), Stadswerven in Dordrecht (Roy et al., 2018), and the City of Nijmegen (Yu et al., 2020).

Rotterdam: Feijenoord district

Feijenoord is a densely populated district of 70,000 residents located south of the river Nieuwe Maas in Rotterdam, the second-largest city in the Netherlands. All of Feijenoord's nine neighborhoods (considered socioeconomically vulnerable) are located in at least one hazard zone, with two straddling both zones. The largest part of the district is located below sea level but is "embanked": protected from riverine flooding by an extensive dike system. The remainder is "unembanked": areas directly exposed to the river but protected from flooding by elevation.

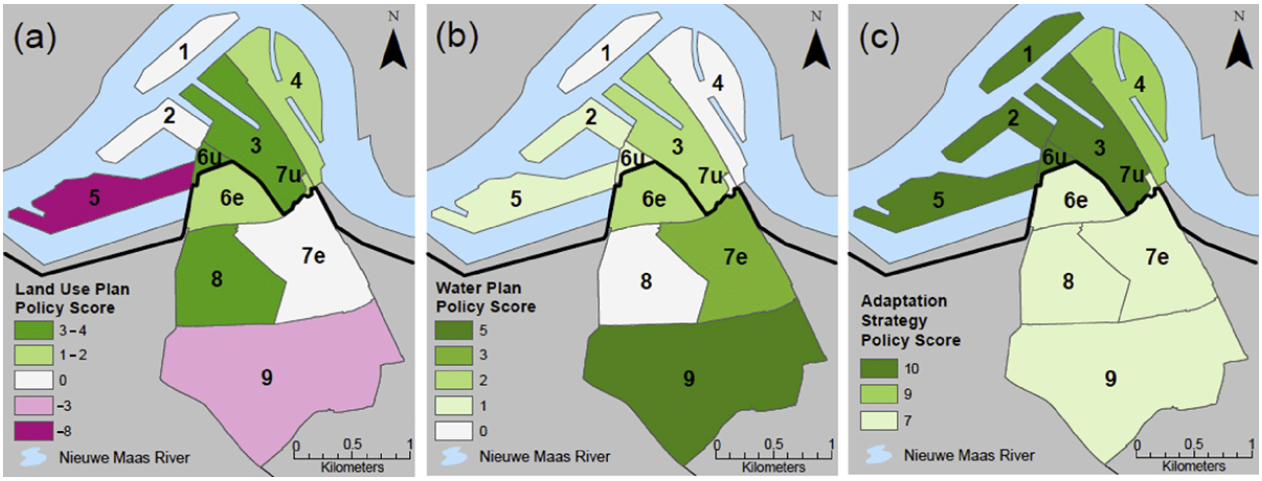


Figure 1. Policy scores by plan type in Feijenoord District neighborhoods (pink = negative; green = positive): (a) land use plans (all shown on one map); (b) sub-municipal water plan; (c) Rotterdam climate change adaptation strategy.

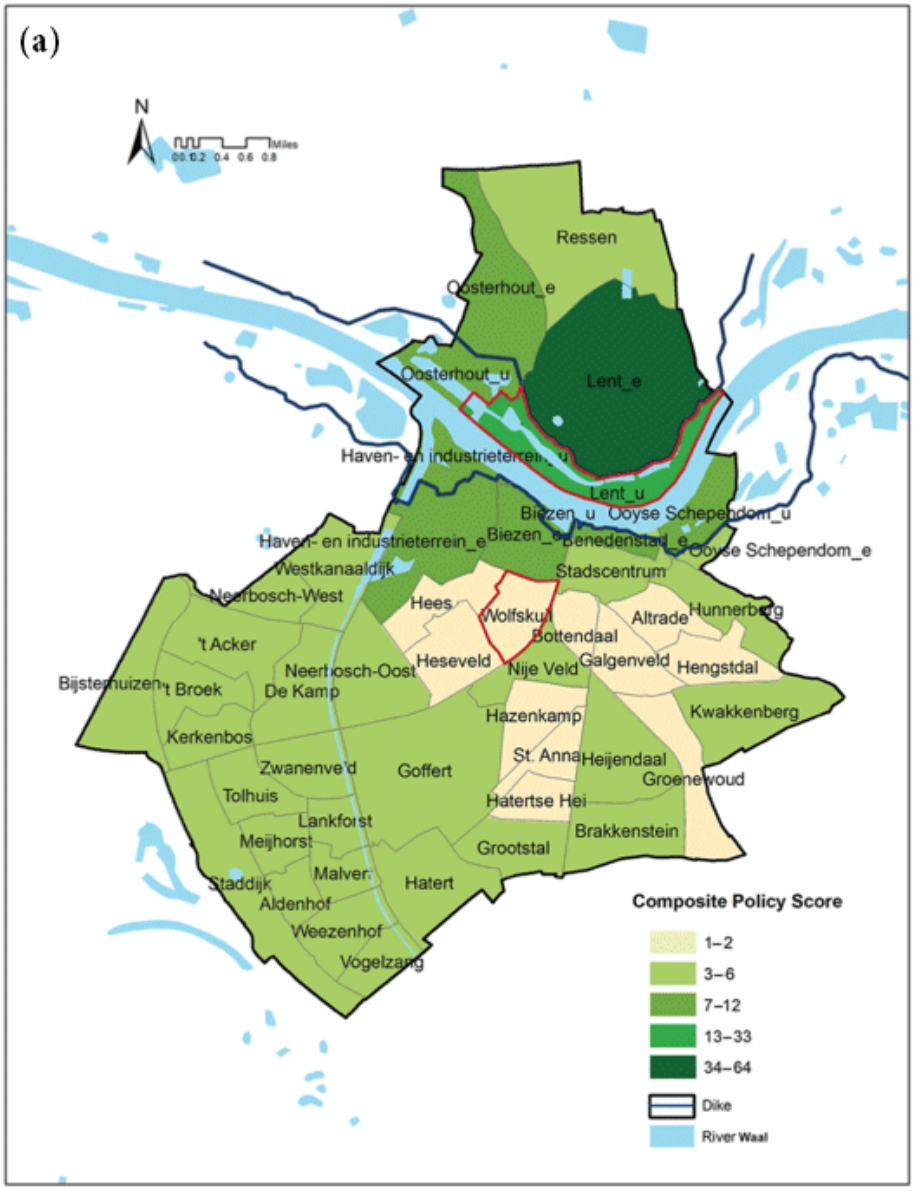
Source: Malecha et al. (2018, p. 154).

The network of plans for Feijenoord District includes 10 neighborhood land-use plans (*bestemmingsplannen*), the Sub-municipal Water Plan for the districts of Charlois and Feijenoord (Deelgemeentelijk waterplan Charlois en Feijenoord 2011–2016), and Rotterdam's Climate Change Adaptation Strategy (Rotterdamse Adaptatiestrategie). In the PIRS analysis, all neighborhood-hazard zones received positive overall policy scores (overall mean = 10.4; unembanked mean = 10.4; embanked mean = 10.3), indicating that the network of plans emphasizes vulnerability reduction across the entire district. Disaggregating the scorecard findings spatially and by plan type reveals that, in particular, the land-use plans reflect development pressures. The unembanked part of Feijenoord was the focus of a city-led push to attract middle- and upper income residents by converting former ports and brownfields into residential areas. For especially district 5 (Katendrecht), this resulted in a negative overall score. The sub-municipal water plan (Figure 1b) and climate change adaptation strategy (Figure 1c) should lead to a reduction of flood risk, but this may affect neighborhoods differently. Focusing primarily on the embanked neighborhoods, the water plan appears to fill policy gaps in the land use plans related to flooding—compare Figure 1b to Figure 1a. Rotterdam's climate change adaptation strategy builds flood resilience throughout the district but especially in unembanked neighborhoods. Like the water plan, the adaptation strategy is generally concerned with flooding, but it is more focused on the threats posed by impending climate change and from the Nieuwe Maas. This emphasis on unembanked neighborhoods again may represent an attempt to fill policy gaps: Rotterdam uses the adaptation strategy to strengthen flood resilience in the increasingly vulnerable unembanked areas, which receives relatively little attention from the water plan. The different focus on resilience between the plans may reflect a rather ambiguous responsibility in relation to the

unembanked areas: the traditional spatial planning toolbox (land-use plans) emphasizes vulnerability rather than resilience. Special purpose plans, like the Waterplan and the Resilience Strategy, fill the gap.

Nijmegen

The city of Nijmegen (population of 164,223) is located on both banks of the Waal River and houses the so-called Room for the Waal project, a flagship project from the national Room for the River program (see the "Room for the River" section). The twin goal of the program (that expands the riverbeds to facilitate higher peak discharges) was to increase the flood safety of the city while simultaneously enhancing spatial quality. To expand the floodplain, the northern river dike was relocated. Besides reducing flood risks there were other gains as well, like a new park and new nature reserves. In contrast with the Feijenoord case, the entire city was subjected to the PIRS analysis, consisting of 44 planning districts (rather than 9) in the city of Nijmegen (see Figure 2a), with the hazard zones of the unembanked areas straggling along both river banks.



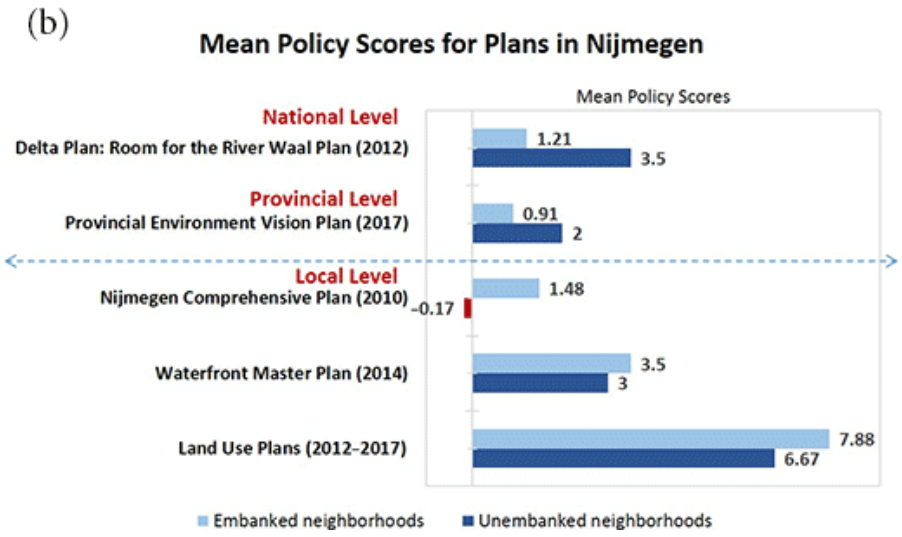


Figure 2. Composite policy scores in neighborhoods (a) of 14 plans collected at national, provincial, and local levels in the city of Nijmegen. Mean policy scores for 14 plans at the national, provincial, and local levels in Nijmegen (b).

Source: Yu et al. (2020, p. 424).

The network consisted of 14 plans, including those at the local tier like 10 land-use plans (2012–2017), not only the waterfront master plan (2014) and the city's comprehensive plan (2010) but also at the provincial (Environment Vision Plan, 2017) and the national tier (Room for the River Waal, 2012). The expanded analysis was performed due to the fact that Room for the Waal was a technical intervention issued from the national level that had to be accommodated by provincial and local-tier plans. Overall policy scores (Figure 2b) indicate that the network of plans generally supports vulnerability reduction but with high variability in the overall mean policy scores between the embanked and unembanked neighborhoods: The respective overall mean policy score for embanked areas is 5.18, set off against 13.00 for the unembanked areas. It appears that vulnerability reduction received more attention in the unembanked areas; national and provincial-level plans generally give greater attention to such areas by protecting natural riparian networks and focusing on safeguarding flood resilience in the enlarged unembanked neighborhoods that were created by the Room for the River program. Municipal plans place greater emphasis on embanked neighborhoods, focusing on building flood resilience to accompany development. Thus, higher tier plans appear to be making up for the development push in local plans. While land-use plans again may lead to higher levels of built vulnerability in the unembanked areas by pushing development, provincial plans and national programs compensate for this. For resilience planning, the results raise an additional observation: It suggests that a community's network of plans can successfully accommodate both a national need for flood safety and a regional demand for residential development in a harmonious manner. This is perhaps due again to the comprehensive nature of the Dutch planning system but may also point to a larger question about the potential of the dual goal of safety and spatial quality for resilience planning in general.

Dordrecht: De Staart/Stadswerven

Dordrecht is a city located in the southwestern delta, close to Rotterdam, and is the single municipality in the Netherlands that applies a novel, proactive flood risk management approach called multilayered safety (*meerlaagse veiligheid*; see the section"Further Spatial Differentiation of Flood Risk Management" for explanation). Plans based on this approach design for flooding, incorporating wet- and dry-proofing measures and evacuation routes.

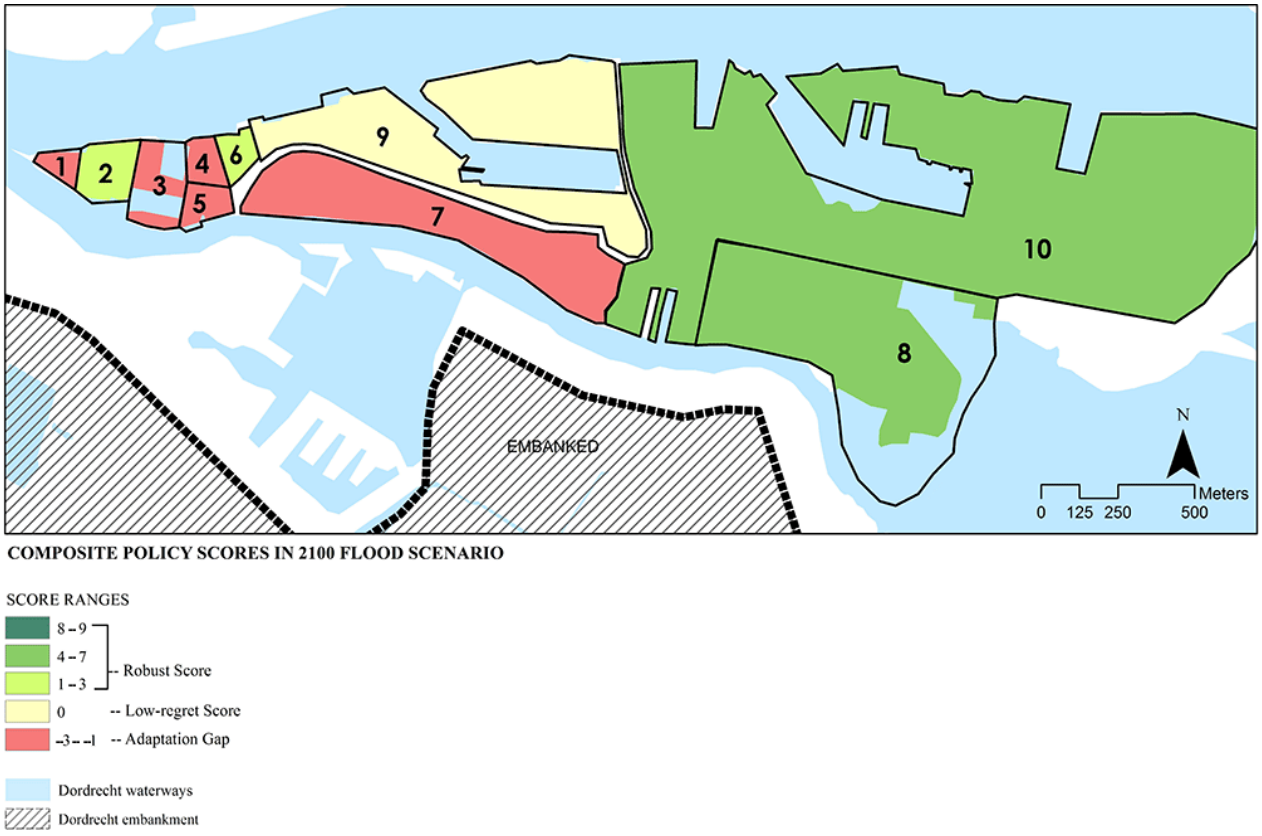


Figure 3. Dordrecht, De Staart/Stadswerven. Composite scores for 2100.

Source: Roy et al. (2018, p. 8).

Multilayered safety is considered as a principle for developing neighborhoods on a peninsula called De Staart. De Staart, in contrast with the PIRS analyses of Feijenoord district and Nijmegen (city), is a relatively small part of the city that is completely unembanked. In other words, the PIRS analysis does not allow for differentiating between hazard areas since the entire peninsula is considered to be at risk. While most of Dordrecht is protected by dikes and polders, De Staart is unembanked and its primary flood defense is elevation (average 3 m above Normal Amsterdam Level or NAL—NAP in Dutch, roughly the average North Sea level, rendering most areas safe against a 1:2000 chance flood event). Since the early 2000s, this once industrial neighborhood has seen large residential developments in its western parts (Stadswerven) and has been identified as a possible site for evacuation in case of a flood event in the embanked parts of the city. Only five local-tier plans were considered as part of the network, including two land-use plans (De Staart, 2013; Stadswerven, 2016), the local water plan (Dordrecht Waterplan 2009–2015), the Stadswerven masterplan and the city comprehensive plan. The research method for this analysis was adapted to track the performance of the network of plans in 2050 and (see Figure 3) 2100, when more extreme flood risk scenarios are expected. Composite policy scores throughout De Staart Peninsula remain positive, indicating that despite the push for redevelopment in the Stadswerven area, policies throughout the network score positive. In

2050 and 2100, however, in particular, the districts that are part of the Stadswerven redevelopment demonstrate negative scores (called adaptation gaps in the analysis). Negative scores are mainly driven not only by the comprehensive plan (11 out of 27 negative scores) but also by the Stadswerven-masterplan (10 out of 27), and, to a far lesser extent, by the De Staart land-use plan (4 out of 27 negative scores). Several sites at De Staart (2, 6, 8, and 10) remain robust in both the 2024 and future flood scenarios. As of 2024, new development planned in hazard zones in districts 1–6 has been adequately complemented by buffers along the river, designing multipurpose open spaces, and elevating the main thoroughfare (an evacuation route). However, some of these flood-resilience strategies become less effective in future flood risk scenarios. New commercial and multi-family residential clusters that are recommended by the Stadswerven Master Plan (districts 1, 3, 4, and 5) are elevated above the inundation level as of 2024 but are exposed to 2050 and 2100 inundation levels—leading to adaptation gaps. Apparently, a network of plans can jointly build flood resilience—in particular, when a sophisticated approach like multilayered safety is applied, even when development is encouraged. However, the long-term performance of this approach (that relies, to a large extent, on elevation) relies on future inundation levels.

The Parallel Evolution of Spatial Planning and Flood Risk Management in the Netherlands

The 1965 Foundation of Dutch Spatial Planning

A Multilevel Spatial Planning System

Spatial plans in the Netherlands strongly emerged in the early 20th century to organize the quick expansion of cities. While such plans initially took the shape of relatively simple “street plans” in the vicinity of the built-up area, a temporary planning law came into effect during the 1940s and 1950s that focused on reconstruction after the Second World War. After years of discussion, an elaborate dedicated Spatial Planning Act (WRO: Wet op de Ruimtelijke Ordening) came into force in 1965. This act firmly established the three levels of the Dutch planning system that tied back into the three tiers of government: national, provincial, and municipal.

The 1965 law gave an enormous boost to plan making at the provincial and municipal levels. A critical role was played by a new ministry that provided an authoritative argumentative basis for planning at all levels through the making of planning reports at intervals of roughly 10 years, each having a future time horizon of about 30 years. While only a handful of provincial plans (*streekplannen*) were finalized during the 1950s and early 1960s, within a period of less than 10 years, the entire country was covered with such plans. These plans contained policy frameworks in relation to land use, which municipalities were supposed to translate in their plans, most notably the land-use plan (*bestemmingsplan*). National planning policy, provincial plans, and

land-use plans together constituted a multilevel system, with distinct competencies at all three levels. The municipal land-use plan remained the only *legally binding* plan up to 2008 when a revised version of the planning act came into force.

Deliberation and Consultation Between Spatial Planning and Sectoral Interests

The 1965 Spatial Planning Act provided handles and levers to safeguard interests from *outside* spatial planning. A critical tool was known as preliminary deliberation (*vooroverleg*) during the early stages of the making of a local land-use plan. This sort of deliberation took place between the municipal executive and all relevant government bodies, which in practice or theoretically may be affected by a local land-use plan, water authorities included.

Although the Spatial Planning Act puts a particular emphasis on municipal planning competencies, tools to safeguard regional as well as national interests are part of the law. For instance, the Planning Act gives the provinces the right of approval (*goedkeuringsrecht*) regarding supra-local interests. Also, both provinces and the national government have the competence to issue directives (*aanwijzingen*) imposing the "obligation to do something" (Needham, 2007, p. 264). For instance, the national government as well as the province may issue a directive to change a municipal land use plan. Over time, this directive competence worked as a deterrent as in practice it was seldom used. In Dutch planning practice, the solution for planning conflicts is usually found through extensive discussions, horizontally between different sectoral domains and vertically across administrative levels. Preliminary deliberation ex Spatial Planning Act is a tool to do exactly that. The Dutch planning system was and still is to a fairly great extent not a straightforward hierarchical system as the connections within the Dutch *network of spatial plans* are more subtle, to a fairly large extent based on multilevel and inter-sectoral deliberation and the argumentative force of visions and spatial concepts.

Flood Risk Management: A Millennium-Old History

Dutch spatial planning has a history of 120 years, starting with the first legal provision in a 1901 law on housing. The history of water management and flood safety goes back much further. The first water boards (*waterschappen*; the term dates from the 19th century and has been used since) were created bottom up about 1,000 years ago, while the first formal board dates from 1255. For centuries the geographical area covered by individual water authorities (their official name in English) remained rather small. In fact, there were thousands of them, even during the largest part of the previous century (see Table 1). Since 1789, they have been accompanied by a national executive agency for larger flood defenses. Since the 1848 version of the Constitution (Grondwet), this agency is known as Rijkswaterstaat (see Table 1).

Enshrined in the Constitution since 1848 as an intrinsic yet independent part of the Dutch government, water authorities have an important legal tool: the by-law or ordnance (*keur*). It contains orders and bans in relation to flood defenses and water courses. Highly detailed maps (*leggers*) show where these are located. The 2024 legal basis for the water ordnance is provided by the 1991 Water Authority Act (Waterschapswet) as well as the 2009 Water Act (Waterwet). When a

water authority assesses a draft local land-use plan (or any project based on such a plan) both *keur* and *leggers* are on the table. The water authority by-law also imposes constraints and directives that are legally binding.

The Dominance of Morphological Thinking in Spatial Planning

Urban Morphology and Locational Choice

Next to the systematic hierarchy of plans and considerable political commitment, the use of substantive concepts was important to understand Dutch planning. Key to these concepts were notions of urban morphology and locational choice. In 1958, a government-appointed special committee published an advisory report on the desired future spatial development of the most urbanized part of the country the so-called Randstad, a region that is largely below sea level, at some locations up to 7 meters. This report was published only 5 years after a disastrous storm flood caused over 1,800 casualties in the southwest of the country. Reacting on this event, the committee explicitly asked itself whether building in deep polders should be avoided due to flood risks and relatively high building costs (i.e., expensive foundations for buildings and infrastructural constructions). The conclusion was that where to build the one million homes needed in the period up to 1980—a critical *locational* choice—should be connected to "what is best in terms of the desired urban morphology of the Randstad" (Werkcommissie Westen des Lands, 1958, p. 58, authors' translation). Flood safety, let alone resilience *avant la lettre*, was not considered as a decisive factor when deciding on the location of future urban development. In the 1960s and 1970s, the final selection of these towns by the national government, under the name of growth centers (*groeikernen*), was an almost exact copy of the 1958 Randstad plan.

All national spatial planning policy frameworks published from the 1960s (subsequently 1960, 1966, 1974, 1976) to the early 1990s basically followed the 1958 advisory report, as these do not show an explicit serious concern of flood risks in the low-lying parts of the country or along main rivers. Therefore, there is general agreement in the literature that in the history of Dutch spatial planning, an explicit concern for the structural role of water in spatial planning is largely absent. This did not change when around 1990 major decisions were made concerning the follow-up of the growth center policy. Again, new locations for large new housing estates were decided, based on deliberations across the three tiers of government. The spatial rationale was different though as these estates were to be located within cities (mostly on brownfield sites) and as close to cities as possible. The underlying spatial rationale can be summarized as a compact city (*compacte stad*), again a spatial concept based on concerns related to the desired urban morphology of the country. This approach was spelled out in a government report publicly known as VINEX, the Dutch acronym of the 1991 Fourth Report Extra. However, with the 1988 main Fourth Report and its 1991 addendum, water came within the scope of planning, albeit in a rather modest manner.

Integrative Thinking and Acting Based on a Layer Approach

The arrival of water as a novel spatial planning concern in the late 1980s is related to growing concerns about sustainability, ecology, and spatial quality. In particular, landscape architects, and urban designers, as well as professionals with a background in ecology, took the lead in the debate, overall outside government offices. A major source of inspiration came from abroad: the 1969 book *Design With Nature* by Ian McHarg. His rather complex layer-cake model was translated into a lean and therefore applicable research and design principle: the layer approach (*lagenbenadering*). The synthesized layers are (a) substratum (*ondergrond*), including soil and water systems; (b) networks (*netwerken*), basically infrastructure above- and belowground; (c) occupation (*occupatie*), primarily land use and the built environment. McHarg's interest in time was incorporated: the different timescales on which layers tend to change and what this means for planning and planning interventions. While the *occupational layer* was always of critical concern for spatial planning, hence the dominance of spatial concepts related to urban morphology, the layer approach gave a rather fundamental role, some would even say an emancipatory role, to the other two layers.

The most influential application of the layer approach was the 1987 Plan Stork (Plan Ooievaar), the winning entry of a regional design competition that focused on the floodplains of the large rivers at the heart of the Netherlands. Plan Stork sought to combine *nature development* with *flood protection*. The central idea was to create the possibility of spontaneous development of river woodlands on carefully selected sites. Negative impacts on river discharge should be compensated by digging out certain parts of the forelands. The plan also proposed a solution for the never-ending cycle of dike enlargement, needed to combat the continued rise of the riverbed due to the deposit of silt. Plan Stork proposes to remove the top layer of clay deposited along the rivers at critical locations every 100 years or so.

Plan Stork, in particular the idea of a substratum layer underlying urban morphology, was picked up by many urban designers and landscape architects involved in the design of VINEX locations and other new urban sites. In fact, the "emancipation" of water in urban design is in fact a continuation of what Hooimeijer (2014) calls "a fine Dutch tradition" of centuries in the making of polder cities. The advocated restoration of a biotic river system where Plan Stork was about, was not accepted easily in civic engineering, however (Wesselink, 2007; Wesselink et al., 2007). An initial 1993 response would not go further as "landscape-friendly dike constructions." The (near) floods of the 1990s, and especially the 1995 one, which resulted in the evacuation of a quarter of a million people, opened a window of opportunity for a dramatic change in fluvial flood risk management: The Room for the River program, discussed in the "Room for the River" section, can be regarded to a fairly great extent as the application of key proposals of Plan Stork.

National Spatial Planning Adopts the Layer Approach

The 1988 Fourth Report and particularly its 1991 addendum was fairly traditional regarding the relevance of flood risks for critical spatial decision-making. Although the Fourth Report became almost totally eclipsed by its addendum, it nevertheless includes a novelty. One out of its seven "central themes" was a development perspective called *Nederland Waterland*, emphasizing the

necessity to interconnect issues like water supply, nature development, tourism, leisure, and transport. Waterland also pointed out the necessity to address the effects of sea-level rise and climate change. The latter did not dominate the major concrete policy output of the Waterland theme: the implementation of a policy program focusing on the main rivers of the country, the Further Elaboration River Area (NURG: Nadere Uitwerking Rivierengebied). NURG focused predominantly on nature development, at some locations combined with measures to increase water safety through a lowering of water levels via dredging. Next to NURG water management was also addressed in some so-called Exemplary Plans (Voorbeeldplannen) of the Fourth Report. These were plans largely made on the local level with local stakeholders and experts to bring forward some of the central themes of the report. Possibly one of the most well-known examples was an early 1990s experimental plan made for Morra Park in the city of Drachten, based on the ladder principle of retain–store–discharge water. This plan became highly influential in the design of major new housing estates like Leidsche Rijn near Utrecht (around 30,000 new homes) or the restructuring of existing urban districts like Haarlem Schalkwijk. In other cases, the Morra experience was regarded as too experimental and too far away from existing practices.

At the national level, decisive steps, at least on a conceptual level, were made in the follow-up of the Fourth and VINEX reports: the 2006 National Spatial Strategy (Nota Ruimte). In this report, the layer approach is introduced as a major component of the governance philosophy (*sturingsfilosofie*) underlying national planning. Although the layers are mapped, these maps do not have the status of, according to planning law, so-called national planning key decisions. They are mere illustrations of what the country looks like through the lens of the three layers.

The application of the layer approach was not entirely conceptual, however; the layers were connected to basic qualities (*basiskwaliteiten*) which for a part have the status of legal norms either in Dutch or in European law. This counts particularly for the substratum layer. Salet (2018) calls these norms *material norms*, for instance related to compensation rules when building in a riverbed. Spatial planning application strongly relies on *process norms*. A highly relevant example concerns how the policy goal "concentration of urban development," is made operational in the 2006 Spatial Strategy. Decision-makers are expected to apply a preferential ladder when searching for new locations for urban development: (a) First, look at possibilities within the existing perimeter of the built-up area (these are not defined by the government, and there is also no requirement for provinces to define these to get a grip on municipal government); (b) if that is not (fully) possible, locations immediately adjacent can be selected; (c) in case this is not possible or insufficient, locations farther away may come into the picture.

In 2008, this so-called ladder of sustainable development (*ladder voor duurzame verstedelijking*) became a formal process requirement for municipalities when deciding on a land-use plan. In fact, the 2006 Strategy is the first national planning report since the mid-1970s without quantitative "distance to city" norms (either travel time or geographical distance) in relation to the location of greenfield sites for new major urban development. However, the 2006 Spatial Strategy mentions safety against flood risks for the very first time as a prime goal of national spatial planning. At that time, flood risk management had already become a dominant planning issue on its own as the next section makes clear.

Table 1. The Organizational Landscape of Spatial Planning and Flood Risk Management

Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat)	- Responsible for (among others) water management in general and flood protection in particular. Relevant organizational units: - Directorate-General for Water and Soil Affairs, responsible for policy development in the fields of water and flood risk management, climate adaptation, water projects in specific areas, and water and soil issues. - Directorate General for Public Works and Water Management (see the following entry). - PBL Netherlands Environmental Assessment Agency (see the following entry)
Directorate General for Public Works and Water Management (RWS: Rijkswaterstaat)	- Executive agency of the Ministry of Infrastructure and Water Management. - Responsibilities: main road network, main waterway network, main water systems, and the environment in which they are embedded. - Tasks include supervision of implementation of water policy by provinces and water authorities. - Created in 1798, originally focused on flood risk management only. Staff: around 9,000.
PBL Netherlands Environmental Assessment Agency (PBL: Planbureau voor de Leefomgeving)	- National institute for strategic policy analysis on environment, nature, and spatial planning; operates under political responsibility of Ministry of Infrastructure and Water Management. - Independence of PBL and its two partner agencies is safeguarded in the Protocol for the Policy Assessment Agencies (Aanwijzingen voor de Planbureaus). Staff: around 200.
Rli Council for the Environment and Infrastructuur (Rli: Raad voor de leefomgeving en infrastructuur)	- Primary strategic advisory board for the Dutch government and parliament in matters relating to the physical environment and infrastructure. - Legal basis: Advisory Boards Framework Act (Kaderwet adviescolleges). - Various advisory reports on climate and water management policies. - Staff bureau: 28; council members: 13 (including 3 junior members).
Delta Commissioner (Deltacommissaris)	- Government commissioner, position anchored in the 2012 Delta Act on Water Safety and Fresh Water Supply (Deltawet waterveiligheid en zoetwatervoorziening). - First Commissioner appointed by Council of Ministers, November 2009. Political responsibility: Minister of Infrastructure and Water Management. -

	Main tasks: to draw up an annual Delta Programme; to ensure its progress; liaison between government, provinces, water authorities and municipalities. - Staff: around 15.
Special Envoy for Water (Watergezant)	- Appointed by Dutch government; works on behalf of Ministries of Foreign Affairs; Infrastructure and Water Management; Economic Affairs and Climate Policy; Agriculture, Nature and Food Quality. - Position in civil service government: Office for the Senior Civil Service (Algemene Bestuursdienst) - Role: thematic ambassador = to strengthen the Dutch international water ambition at home and abroad for the entire sector. - Staff: unknown.
Deltares	- Independent knowledge institute for applied research in the field of water and subsurface. - Status: non-profit organization under government interference (*overheidsbemoeienis*). Legal form: trust. Staff: around 850.
Minister for Housing and Spatial Planning (Minister voor Volkshuisvesting en Ruimtelijke Ordening)	- Minister without portfolio appointed in 2021; works under political responsibility of the Ministry of the Interior and Kingdom Relations (BZK: Ministerie van Binnenlandse Zaken en Koninkrijksrelaties). - Main tasks: accelerate house building due to main national shortages; partial retake control of main spatial developments, lost due to the 2010 abolishment of the Ministry of Housing, Spatial Planning and the Environment (*VROM*). - Staff: approximately 30. Is heavily dependent on private consultancies and non-profit organizations like Deltametropolis Association.
Province (*Provincie*)	- General organization and tasks of the 12 provinces determined by the Constitution (Grondwet) and the Province Act (Provinciewet). - Administrative structure: Governor (government appointed); Council (elected once every 4 years); Executive (appointed by Council). - Income: mainly national government (Provincial Fund/Provinciefonds) plus taxes and charges for specific duties. - Spatial planning competences (2008 Spatial Planning Act): structure vision (*Structuurvisie/Omgevingsvisie*), i.e., framework which politically and legally binds the province only; general provincial bye law (*Verordening*): rules with binding power toward municipalities/water authorities; specific integration plans (*inpassingsplan*) in case of key provincial interests. -

	According to planning law: provinces decide if towns and villages are allowed to grow and where business parks may be built. - Dutch provinces differ in the application of their planning competences as constitutionally they are not executive branches of government. - Supervision by provincial executive (*Gedeputeerde Staten*) of municipalities and water authorities, e.g., 2012 Generic Supervision Act/ Wet Revitalisering Generiek Toezicht, plus 2009 Water Act (Waterwet) and Water Authorities Act (Waterschapswet). - Interprovincial Platform (IPO: Interprovinciaal Overleg): advocacy and lobbying and innovation and knowledge exchange. Legal status: association. Staff bureau: around 50.
Municipality (*Gemeente*)	- General organization and tasks of the 342 municipalities determined by the Constitution and the Municipalities Act (*Gemeentewet*). - Administrative structure: Mayor (appointed by government based on recommendation by Council); Council (elected once every 4 years) and Aldermen (appointed by Council). - Income: mainly national government (Municipal Fund/Gemeentefonds plus earmarked specific funds) and local taxes, limitatively described by the Municipalities Act. - Spatial planning competences (2008 Spatial Planning Act): structure vision (*Structuurvisie/Omgevingsvisie*), i.e., framework which legally binds the municipality only; binding land-use plan (*bestemmingsplan/ omgevingsplan*). - Water management task limited to management of sewerage system and mandatory ex ante use of Water Test (WatertoetsI) in plan making processes. - Association of Netherlands Municipalities (VNG: Vereniging van Nederlandse Gemeenten): advocacy; development of products and services. Staff bureau: around 280 fte.
Water Authority (Waterschap)	- First legal water authority established in 1255; possibly hundreds of self-organized bodies created from ± 1000 CE. Number of water authorities: 1946: 2,500; 1969: 1,000; 1990: 129; 2004: 37; 2022: 21. - Statutory position as the sole water management body at local level arranged in 1848 constitution. - Legal basis at operational level: 1991 Water Authorities Act (Waterschapswet). - Competences: water quality and quantity; flood protection; water ways. - Main source of income: taxes (*waterschapsbelasting*).

	- Main regulatory tool: water authority by-law (*keur*): system of orders and bans in relation to flood defenses and water courses, mapped in great detail (*leggers*). - General council (Algemeen bestuur; between 18 and 30 members) decided through local elections except for four seats reserved for landowners and nature/landscape organizations. - National umbrella organization: Dutch Water Authorities (Unie van Waterschappen): advocacy and lobbying and national and international knowledge exchange. Legal status: Association. Staff bureau: around 75. - Staff all 21 water authorities: about 11,250. - Length of primary flood defenses being managed: 3,600 km; other defenses: 14,100 km. - Expertise center: STOWA. Legal status: foundation/trust. Board: water authorities; provinces (IPO); national government (Rijkswaterstaat).
European Union and European Commission	- European Union: Treaty based legal position in water management and flood protection - Main directives: WFD Water Framework Directive; Directive on the Assessment and Management of Flood Risks (Floods Directive). - Underlying principle: solidarity—countries/regions may not transfer the burden of flood risks/poor water quality downstream. - Obligation EU Member States: creation of river basin districts as management units, i.e., Intergovernmental Commissions. - European Commission oversees mandatory transposition of directives in national law as well as implementation in practice according to time schedules.
Intergovernmental Commissions Water Basin Districts	- Legal basis: convention between participating countries plus regions/ *gewesten* in the Belgium case. - Main objective: sustainable and comprehensive water management cf. EU directives and goals of underlying convention. - ICPR KSR CIPR ICBR: International Commission for the Protection of the Rhine. Established: 1950. Legal basis as of 2024: 1999 Convention (iksr.org). - CIM IMC IMK: International Meuse Commission. Legal basis as of 2024: 2002 Ghent Agreement. In force: December 1, 2006 (meuse-maase.be) - ISC CIE: Internationale Scheldecommisie/La Commission Internationale de l’Escaut. Legal basis as of 2024: 2002 Ghent Agreement. In force: December 1, 2006 (isc-cie.org).

Source: Huisman (2004), Organization for Economic Cooperation and Development [OECD], 2014), Hobma and Jong (2016), helpdeskwater.nl, infomil.nl <http://www.infomil.nl/>, iplo.nl, ipo.nl, waterschappen.nl, dutchwaterauthorities.com, government.nl, overheid.nl, consultancy.nl.

A "Spatial Turn" in Flood Safety

Room for the River

Critical periods of near flooding in 1993 and 1995 combined with emerging problems resulting from excessive rainfall created momentum for a new approach, based on the notion of resilient and adaptive water management. This approach became known as Room for Water (*Ruimte voor Water*), addressing both the need to retain and store water. This can be understood by the fact that, historically, the amount of land available for water in the Netherlands has sharply decreased over time, due to land reclamation, the narrowing down effect of dikes on riverbeds, and factors such as the building of urban areas in the forelands of rivers. The approach led to a major revision of policies on the management of a particular area in the center of the country: the bundle of (large) rivers known as the River Area (Rivierengebied). The new handy motto was Room for the River (Ruimte voor de Rivier).

Room for the River started with a policy decree (*beleidslijn*), jointly prepared by the ministry responsible for water management and the ministry responsible for spatial planning. This 1996 directive (revised in 1997) can be regarded as an integration of both sectors. Its main components are (Silva et al., 2004)

1. new developments such as housing, buildings, or flow-obstructing infrastructure in the floodplains are no longer allowed; this also holds for the extension of existing buildings;
2. a system of construction permits is needed for all activities that may hinder the draining of water or that may cause a decrease in water storage capacity; and
3. embankments and the zones they protect will be assigned a land use. Land that is part of a winter bed (the area that often floods during winter and is shielded by a dike) will be assigned to "public works." In the case of more than one land-use assignment, the principal land use is to protect against high water, so this is given priority.

In short, water management moved sideways in the land-use management system provided by the Spatial Planning Act. Such an integrative approach, internationally known as Integrated Water Resources Management, was already advocated in the 1998 Fourth National Water Management Report (Vierde Nota Waterhuishouding), prepared by the Ministry of Infrastructure and Water Management. The fact that it was possible to gain political acceptance for such a novel approach, and moreover in a binding form with principles and material norms to which spatial planning should comply, can only be explained in view of the window of opportunity opened by the events of 1993 and 1995: a "technocratic-scientific period" gave way to an "integral and interactive" approach (Lintsen, 2002, pp. 551, 567).

The components of the Room for the River directive were included in the 2007 "Spatial Planning Key Decision Room for the River" (such a key decision is co-decided by parliament while the Spatial Planning Act is the legal basis). This report was the very first (as well as the last) *integrated* spatial as well as flood risk management plan, prepared by three ministries, including the ministry responsible for spatial planning. The report provided the basis for a large, €2.3 billion policy program bearing the same name and finalized in 2019. In 34 locations, projects were carried out that gave space for the river to flood safely. Measures include "depoldering," the lowering of groynes, the creation of (temporary) water storage areas, dike relocation to enlarge the riverbed, the construction of secondary channels to lower high-water tables in the main riverbed and, wherever possible, the creation of new nature areas in the spirit of the Plan Stork.

The Room for the River program was not just a sectoral water management strategy with some sort of spatial planning component added to it. The aim was to design measures in such a way that they would improve the *spatial quality* of the immediate surroundings, for instance through a renewal of urban waterfronts as well as the creation of new recreational areas. The emphasis on spatial quality took a particular organizational form across the entire population of projects: the establishment of a so-called quality team. This team was commissioned to coach planners, designers, and engineers to peer review the designs and plans and report to the minister about the spatial quality achieved across the entire program (see Klijn et al., 2013). In individual projects in particular, landscape architects operated as so-called boundary spanners, connecting and integrating the various professional domains that come together in the implementation of projects (Van den Brink et al., 2019).

The Delta Programme

The Room for the River program was not the only program dealing with flood risks and seeking to combine the strengthening of defenses with higher levels of spatial quality compared with the past. Parallel to the Room for the River program a highly comparable program along the Meuse was (and still is) carried out: The Meuse Works (Maaswerken). Completion is expected to take place in 2027. Later programs include the High Water Protection Programs (HWB: Hoogwaterbeschermingsprogramma's), focusing on so-called weak links (*zwakke schakels*) in coastal protection. Due to the involvement of spatial designers, some striking innovative projects were carried out. These programs and other programs and projects are brought together under one single meta-plan: the Delta Programme.

Obviously, the various programs discussed earlier resulted in a rather comprehensive approach not only targeting the entire country but also widening the scope: (a) water safety, (b) the supply of fresh water, and (c) spatial adaptation. To firmly ground future programs and projects, a dedicated law passed parliament, taking effect by the end of 2011. To express urgency, this act has the same name as its 1958 predecessor, which formed the legal umbrella for the giant engineering projects in the southwest of the country as a response to the disastrous 1953 flood: the Delta Act (in full in English: the Delta Act on Water Safety and Freshwater Supply). According to this act, each year, an updated version of the Delta Programme will be sent to parliament (the first one dates from 2011). The time horizon of the entire program is 2050. Three ministries are politically

responsible including the Ministry for Spatial Planning, with the Ministry of Infrastructure and Water Management in the lead. Projects are financed from a dedicated budget: the Delta Fund (Deltafonds). The average annual budget over the period 2023–2036 is €1.5 billion. There are seven sub-programs, each focusing on a particular part of the country. There is also a Delta Plan Freshwater (Deltaplan Zoetwater), with a particular focus on drought, which is increasingly affecting large parts of the country. Included are low-lying areas in the west and north of the country that face the salination of soil and groundwater while extensive periods of droughts can also lead to instability of dikes, which largely consist of peat (the first plan covers the 2022–2027 period).

The making, as well as implementing the Delta Programme, is the responsibility of a new figure in the water management landscape: the independent Delta commissioner (*Deltacommissaris*), placed outside the regular administrative apparatus and supported by a small bureau of about 15 staff members. Officially, the commissioner is allowed to act like a sort of "thorn in the side," which he occasionally does. The main task of the commissioner is to draw up the annual Delta Programme (which includes the Delta Plan Freshwater) and act as a liaison between the government, the provinces, the water authorities, and the municipalities. To illustrate the political weight of the annual Delta Programme, the document is sent to parliament, together with the budget proposals of the Ministry of Infrastructure and Water Management, the latter forming part of the massive budget package sent to parliament every third Tuesday of September.

Further Spatial Differentiation of Flood Risk Management

The fact that the Delta Programme is carried out via regional sub-programs can be regarded as the recognition that even in a small country like the Netherlands there is spatial diversity in the nature of flood risks and a thematic issue like drought. Spatial differentiation also characterizes a novel approach which gained foot since 2015. This is the risk approach (*risicobenadering*). In this approach, the level of protection is not solely related to flood probability but also to the potential effects in case a flood occurs. Expressed in a formula the approach looks like this: flood risk = flood probability × consequences. The flood probability is determined by factors like water level and the strength and height of a defense structure like a dike. Consequences are determined by demographic factors, economic effects, and the likely evacuation rate. Safety norms are lower for sparsely populated areas and (much) higher for densely populated areas (mortality) with a high economic value, for instance real estate (damage). The material norms per dike trajectory (there are six classes) became part of the Water Act in 2017 and shifted to the Environment and Planning Act in 2024.

Connected to the risk approach is another novel approach known as multilayered safety (*meerlaagse veiligheid*). It was introduced in the first National Water Plan (NWP; Nationaal Waterplan) published in 2009 and covering the period up to 2015 (the making of NWPs is the shared responsibility of three ministries, the Ministry of Infrastructure and Water Management in the lead). The first level is known as *prevention* through, for instance, defensive structures like dikes or the lowering of hydraulic force on a dike. The second level is determined by the sustainability level of the *spatial design* of an area. Measures may include compartmentalization

of an area (in the case of a flood, the entire area will not be flooded), adaptive building forms like the situation of buildings on mounds, and the creation of evacuation routes. The third level deals with *disaster management*, such as how to get people out of a flooded area.

A range of pilots have been carried out since its 2009 introduction to test its assumptions as well as its feasibility in practice. Since then, the approach has been applied in a wide range of cases. The response overall is positive. Feasibility seems to be regarded as rather challenging as the number of actors involved in all the layers is rather high, due to the comprehensive nature of the method. Possibly the major weakness is situated in the definition of the layers. Level 2 is regarded as the domain of spatial planning and design. The choice for a location—a critical meta-decision—is regarded as given and therefore not included in the methodology. The method as a whole can, however, lead to the conclusion that multilayered safety cannot be realized as the location of a new urban development is highly problematic. Prevention may then lead to the decision to abstain from development.

The Role of Spatial Design

Spatial design has always played a major role in planning in the Netherlands. For instance, about a third of the staff of the National Planning Agency (established in 1965 and dismantled in 2001 as part of a major restructuring of the directorate-general) was formed by professionals having a degree in one of the design disciplines, urban design, and landscape architecture in particular. Provinces and municipalities also make use of designers, as either members of the permanent staff or designers hired from private offices.

In water and flood risk management, civil engineering was and still is the most important discipline. Matters started to change though during the 1990s as design and planning professionals and academics started to get involved in programs and projects, particularly the Room for the River program. Designers and planners were either involved in projects or as members of the external advisory Q-team. An evaluation of the role of design in projects led to the conclusion that the spatial quality ambition overall "has led to balanced projects" (Hulsker et al., 2011, p. 55, authors' translation), although in the future the balance could be improved if designers and other professionals "could get a more explicit role" (Hulsker et al., 2011, p. 113, authors' translation).

In 2019, the Deltares research institute made an inventory of all the proposals for adapting flood water protection and main water systems since the start of the Delta Programme in 2009. The total number is quite staggering: 180. Most of these are multidisciplinary albeit in various degrees. Some proposals have been carried out, like the Sand Engine in front of the South Holland coast (a prime example of the dynamic coastal management approach, also the title of a dedicated program: *dynamisch kustbeheer*) or Weak Links projects. Other proposals can be regarded as an idea on a rather small scale or a vision covering the entire country. Many proposals are the result of initiatives outside government like the 2-year (2011–2013) Coastal Quality Design Studio. Quite a number of proposals, particularly the ones covering the entire country, go far beyond the 2050 horizon of the Delta Programme. The fact that there are so many proposals with a time horizon beyond 2050 or propose a next generation of major works that, in the Netherlands, often take

decades until realization has led to pressure on the Delta commissioner to make use of his independent position to stretch the horizon of the Delta Programme to 2100. See the section "The Capacity to Look Forward."

Decentralization of the Spatial Planning System

While water management in general (and flood safety in particular) took a decisive spatial turn, the Dutch spatial planning system also underwent drastic changes from the late 1990s onward. This reorientation of spatial planning can be summarized under two headings: legal changes and substantive changes.

Legal Changes

Changes in the legal basis of the planning system arrived in two stages. The first stage is formed by a drastic revision of the 1965 Spatial Planning Act, which took effect in 2008. The second change is the introduction of an entirely new, comprehensive act.

The decision to revise the 1965 Spatial Planning Act was motivated by the desire to clean up a host of smaller changes to make the act easier to handle and introduce more effective tools for provinces as well as the government to directly intervene in planning. The latter took the form of integration plans (*inpassingsplannen*), highly comparable with a municipal land-use plan. This novel competence can only be used in case there are provincial or national interests at stake.

Like its predecessor, the new act does not include substantive planning objectives or spatial principles, let alone material norms but only establishes responsibilities, procedures, and instruments of the planning system. The 2008 act replaces "a weak hierarchical plan structure with one in which all three governmental tiers . . . have access to the same legal instruments—including the binding local land-use plan" (Zonneveld & Evers, 2014, p. 73). Another important change to make the planning system "less complex" is the abolition of the evaluation of land-use plans by provinces and the national government. Higher tiers of government are instead expected to act proactively by establishing general rules in a legally binding ordinance beforehand. If a local plan conforms to the stated requirements, it gains the rule of law as soon as it is approved by the municipal council: no approval is needed from a higher tier of government.

A specific consequence of the move to decentralize spatial planning was a drastic revision of the work package of the (national) Human Environment and Transport Inspectorate (ILT; Inspectie Leefomgeving en Transport). ILT used to employ about 50 people to scrutinize land-use plans and make objections in case of a conflict with national planning and environmental norms. This activity was discontinued in 2012. According to one of the former inspectors, this opened the door for the violation of (material) norms related to for instance noise and external safety (Kuijpers, 2022).

To avoid regrettable decisions from a water management perspective a new tool was already introduced in 2001, in line with the 1998 Fourth National Water Management Report mentioned earlier: the water test (*watertoets*). The water test became included in the 2008 planning act. It imposes two obligations on initiators of land-use plans: (a) involvement of water management authorities in the early stages of plan making and (b) the local land-use plan should make explicitly clear what has been done with the input of the water management authorities: the consequences of the plan for the water regime and how these are handled. By and large, the first obligation was already part of the practice of (mandatory) preliminary deliberation. Combined with the second obligation, the weight of water interests was strengthened considerably. Nonetheless, a municipality is not obliged to conform to the advice of the water authority. Water authorities can formally object if the latter turns out to be the case up to the (national) Administrative Jurisdiction Division of the Council of State (Afdeling Bestuursrechtspraak Raad van State). Overall, the water test was intended to lead to "an interactive process" (Jong & Hobma, 2011, p. 5) between municipalities and water authorities and not simply to the production of documents and notes.

The second major change in the legal basis of the planning system is formed by the Omgevingswet (Environment and Planning Act). This act is considered the biggest change in the Dutch legal system since the making of the 1848 Constitution. The numbers are staggering (there is no full consensus in the literature about the exact number): 26 different acts will be fully (20) or partially (6) integrated into one single law; about 5,000 articles will be replaced by a mere 350 (sub-articles included); instead of 120 Royal Decrees (Algemene Maatregelen van Bestuur) there will be only 4; 120 Ministerial Regulations (Ministeriële Regelingen) will be reduced to about 10.

Next to decentralization, simplification of regulation is the goal of the Environment and Planning Act. Some consider the position of spatial planning as severely weakened (see Korthals Altes, 2016). Somewhat paradoxically the simplification objective created a rather serious complexity issue. The integrative nature of the Environment and Planning Act requires a highly sophisticated digital system that provinces, municipalities, and water authorities have to use. Designing, testing, and training of personnel do not run as anticipated. In October 2022, the expected entry date had to be postponed for the seventh time to January 2023. In 2024 the act finally came into force.

For the interface of spatial planning and flood resilience, two issues are particularly important: the integration of the water test procedure and various parts of the Water Act. The water test is supposed to play a role in several other procedures and decisions like provincial regulations (*verordeningen*) and project decisions (*projectbesluiten*), a competence of provinces, government, and water authorities to realize complex projects where there is a public interest at stake. For the Water Act, the main parts are integrated into the new Environment and Planning Act. Excluded are rules that are specific to the Delta Programme and the way it is financed through the Delta Fund, plus the formal position of the Delta commissioner. The setting of flood risk norms for primary flood defenses (broadly, coastal defenses and dikes along main rivers and the IJsselmeer/Markermeer) will be radically altered. As of 2024, this material norm-setting is part of the Water Act and therefore a parliamentary competence as parliament is co-legislator. Under the new act,

it will be the subject of a royal decree, which is an executive decision and therefore a governmental competency. This may be regarded as undesirable from the perspective of public accountability.

Substantive Changes

Next to major legal changes, the content matter of spatial planning has radically changed. Especially important is the dramatic overhaul of key concerns of (national) spatial planning: a decentralization of planning concerns toward provinces and municipalities and a much stronger focus on sectoral spatial claims for which the national government thinks it has a key responsibility. There is obviously a strong relation with changes in the Spatial Planning Act as this connects to what is of critical provincial or national interest.

With the 2006 Spatial Planning Strategy, the government embarked on a trajectory of decentralization of spatial planning as discussed earlier. Decentralization accelerated with the dismantling of the Ministry of Housing, Spatial Planning and the Environment in 2010, followed by the 2012 National Policy Strategy for Infrastructure and Spatial Planning (SVIR; Structuurvisie Infrastructuur en Ruimte). In a strict interpretation of the letter and spirit of the 2008 Spatial Planning Act, the SVIR was based on a sharp distinction between issues of national interest and issues to be placed in the hands of provinces or municipalities. Thirty-nine national interests were reduced to a mere 13. All concepts related to how and where to localize urban development like concentration, the Randstad, the Green Heart, or the use of buffer zones were withdrawn. The layer approach was also abandoned. Interests related to the water system remain as national interest no. 9: "room for flood protection, sustainable drinking water supply and frameworks for climate-ready urban (re)development" (Ministry of Infrastructure and the Environment, 2011, p. 12).

In response to the anticipated integrative Environment and Planning Act, a new broad policy framework was finalized in 2021, called the "National Strategy on Spatial Planning and the Environment" (NOVI; Nationale Omgevingsvisie). NOVI replaces the 2012 SVIR and a range of (parts of) other national policy frameworks, including the NWP (this plan will be revoked the moment the Environment and Planning Act goes into force). Due to its integrated objectives, NOVI identified 21 rather than 13 national interests, including housing returns as a national interest to ensure that the housing stock matches housing demand. The spatial match between supply and demand of housing—so "where"—is not mentioned as a national task, which implies that this is up to provinces and municipalities to decide. Nevertheless, locational choice regarding flood safety is indirectly addressed under national interest 14 ("Guaranteeing water safety and climate resilience") via a specific governmental task: "Mitigating the consequences of flooding via smart spatial planning and good contingency planning" (Rijksoverheid, 2020, p. 57). This can be interpreted as: do not (or: no longer) locate new urban areas at locations where substantial flood risk exists in the early 21st century or in the future. Reality is different, however, as the next sub-section makes clear.

Serious Doubts About Locational Choices: Toward as a Recentralization of Planning?

Especially in 2020 and 2021, house prices skyrocketed due to a vast difference between the supply and demand for housing. According to rough estimates, there is a need to build “1 million homes” up to 2030. According to some observers, there are enough locations available for housing projects, but the main problem is the speed with which houses can be built. So the Dutch spatial plan machinery has done a proper job if only plan capacity is looked at. There are clear signs, however, that at least some processes that have led to locational decisions are flawed. At the end of 2021, the Delta commissioner issued a stark warning about the majority of locations selected by provinces and municipalities: About 820,000 new homes are projected in locations with either a high water table or weak soils: areas vulnerable to the effects of climate change, including heat and drought. About the same time, the Netherlands Environmental Assessment Agency came to a similar conclusion, albeit from a somewhat broader perspective as the PBL Netherlands Environmental Assessment Agency includedcultural heritage values of landscapes, that is, World Heritage areas.

These verdicts suggest that the historical decision of the 1958 Working Commission for the Western Netherlands still holds true: flood risk probabilities cannot be decisive for locational choices about urban development. In late 2022, matters changed, however, albeit in a rather chaotic manner. The minister responsible for spatial planning has embarked on the making of an addendum to the 2020 NOVI: the NOVEX, focusing on 16 NOVEX areas together covering about half of the country. The objective of the minister is to partly recentralize spatial planning competencies. When it comes to the problems identified by the Delta commissioner and that can be neatly summarized under the heading of water and soil, another minister is in the lead, however: the minister of infrastructure and water management (I&W). In a policy letter send to parliament by the end of November 2022, he claims that water and soil will (basically the substratum layer of the otherwise defunct layer approach) be leading, in short the WBS (Water en Bodem Sturend). In an ex ante evaluation, the Directorate General for Public Works and Water Management, the executive arm of I&W concluded that the legal tools to enforce the WBS are not there yet as due to the decentralization of the hierarchical tools of the planning system almost completely vanished.

Evaluating the late 2022 events, a novel sort of national spatial planning seems to be under construction from at least two directions. There is in fact a third direction, where the Ministry of Agriculture, Nature and Food Quality is in the lead. Water is an issue here as well as keeping water tables in the polders in the west and the north of the country artificially low to make modern agriculture possible; it does not seem to be sustainable any longer due to soil subsiding (mainly the result of peat oxidation) and salinization. The umbrella organization Dutch Water Authorities made the claim that a heightening of the water table in vast areas can no longer be avoided. The chairman of LTO Netherlands, which represents about 35,000 farmers, reacted furiously. The wickedness of the problem situation in the domain of planning, environment, and water management is even bigger: Agriculture is responsible for a massive deposition of nitrogen that,

among other elements, has serious repercussions for water quality. About 95% of Dutch surface water bodies do not meet the legal standards while the time horizon of derogation to meet the criteria of the European Water Framework Directive is rapidly approaching: 2027.

Prospects for Flood Resilience in the Dutch Delta: Unlocking the Potential

The introduction explained that (national) spatial planning systems—at least across Europe—can contain three traits that allow them to build flood resilience: (a) mediation between competing claims for land use; (b) the need to operate across spatial scales which, expressed through multilevel arrangements that connect the administrative tiers at these spatial scales; and (c) the capacity to look forward. Considering this, how can the contemporary relationship between spatial planning and flood risk management be defined? And what potential exists for building flood resilience?

Mediation Between Competing Land-Use Claims

In the mediation between competing land-use claims regarding flooding, factors initiating changes toward creating flood resilience were largely contextual: coming from outside the spatial planning domain. Spatial planning and flood risk management initially developed as policy silos. The gradual adoption of the *layer approach* contributed to a widening of the scope of spatial planning from the late 1980s onward to include (in particular) the substratum layer. This included the water system and allowed spatial planning to look beyond the occupation layer and land use in a narrow sense.

Far more decisive changes were caused by the near floods of 1992 and 1995, which offered a window of opportunity for policy changes, first in relation to the *balance* between spatial planning and flood risk management and, second in relation to dominant flood risk management *approaches*. Yet again, the push for change came from outside of spatial planning, this time from the domain of flood risk management. A change in the balance between both domains was realized largely through a strengthening of *legal ties*. This was done through the introduction of the water test tool in 2001 (focus on the capacity of an area to store water), mandatory for all local land-use plans. Strengthening of the legal foundation of flood risk management also took place via the 2009 Water Act and the 2012 Delta Act and the material norms based on these acts. These acts specifically seek to prevent building in river forelands.

The near floods of the 1990s also led to a *spatial turn in flood risk management*. This turn became known as Room for Water. Various programs have been carried out since 1995, of which the Room for the River program is the largest and the High Water Protection Program is still ongoing. The new so-called risk approach in combination with the multilayered safety approach also gives a further spatial twist to flood protection as the level of (future) protection will be linked to characteristics of specific areas in terms of potential damage. The fact that the Delta Programme is carried out via programs targeting specific parts of the Dutch territory with their unique characteristics of flood (and drought) risks means that delta management is based on the notion of territorial diversity, again a spatial rationale.

The Need to Operate Across Spatial Scales

Comparing spatial planning internationally, one feature of Dutch spatial planning from the perspective of spatial scales and multi-level governance is the strong role played by the national government for quite a long period of time. For decades, roughly from the late 1960s/early 1970s to the 2000s, the national government played a strong role in the production of houses in locations chosen through multilevel deliberation and decision-making. Flood risk management, however, did not play a decisive role in relation to these *locational choices*, nor was this imposed on provinces or municipalities in their plan-making. As a result, some (very) large housing estates have been built in deep-lying polders or on subsiding soil types. Flood vulnerabilities at the locational level were to be resolved by spatial design, assuming that flood defenses continue to offer sufficient protection in the future.

This points to what can be seen as the most striking and weakest aspect of the early 21st-century link between spatial planning and flood risk management as well as resilience at large. Based on neoliberal thinking, the national government since 2010 has embarked on a trajectory of deregulation and decentralization of spatial planning. The choice of locations for new housing estates over a period of about 40 years (roughly 1970–2010) can be questioned. However, the national government was highly involved in these locational choices and therefore could defend supra-local and national interests. This "fine tradition" has evaporated. Evaluations of locations that municipalities and provinces have selected for the realization of future housing programs (the proverbial 1 million homes up to 2030) have shown that many of these locations do not stand the test when it comes to flood risks and other risks like subsidence. Instead of taking no-regret decisions in situations of uncertainty, there is a serious threat of *regret decisions*. By the end of 2022, a move toward partial recentralization seems to have started to avoid this. As discussed earlier, a wide set of interconnected issues have to be dealt with in a rather fractured governance landscape.

The Capacity to Look Forward

It appears that *locational choice*—what land uses are facilitated and where in the competition for space—as well as their concrete *spatial design* forms the biggest leverage point to unleash the potential for flood risk–resilient spatial planning in the future. A key question is if the planning system in 2024 can operate effectively enough in the context of climate change, given the move to a highly decentralized system in the years since 2010. It remains to be seen whether the national government will be able to realize its ambition for a partial recentralization of planning competencies. Trying to get the genie back into the bottle seems rather difficult particularly in a situation in which local politicians are propagating the creation of housing estates in areas well below (up to -7 m) sea level. There is (again) an apparent great trust in the *design* to mitigate flood risk weaknesses of the location.

Dutch strategic spatial plans like the national planning reports and strategies usually have a time horizon between 25 and 30 years. The horizon of the Delta Programme is highly comparable: 2050. Politically, it may feel highly comfortable to work gradually toward such a fixed time

horizon. But the uncertainties surrounding climate change and particularly the possibility of accelerating sea-level rise make it necessary to look beyond 2050. The turn of the 22nd century comes to mind then. Around that year, the blue areas in Figure 1 might have become substantially bigger. This is exactly what two professors from Delft University of Technology had in mind in their open letter sent to the Delta commissioner by the end of November 2022 bearing this title: "It's about time for a clear strategy: the country should prepare itself for the consequences of climate change and accelerating sea level rise through the making of elaborate regional plans" (Jonkman & Meyer, 2022, authors' translation). Their argumentation is like this: There is an abundance of plans, ideas, and visions, developed by teams of academics, spatial designers, and civil engineers. Together, there is enough material to look in the direction of 2100. This is even more urgent as large, complex projects like novel storm barriers need decades to prepare and decide. The letter was not particularly welcomed in The Hague as the comfort of having a plan with a 2050 horizon might get disturbed by uncertainty after this date.

Table 2. Spatial Planning and Flood Risk Management Compared

1. Flood risk management is highly **interventionist** as well as **programmatic**, making use of massive, earmarked funds in the range of €2.5 billion per year. Steering spatial development through planning is highly dependent on the authoritative capacity of **substantive frameworks** and therefore on the "power of spatial concepts." Spatial planning has limited funds (except budgets to stimulate house production) and is strongly dependent on budgets from policy sectors and the willingness of the private sector to invest.
2. Flood risk management is based on **quantitative norms and rules** (material norms) laid down in acts and royal decrees. Planning primarily works via **open, soft norms** (process norms) like "sound spatial development" (2008 Spatial Planning Act) or "a safe and healthy physical environment and good environmental quality" (the novel Environment and Planning Act)
3. Flood risk management since the late 1990s takes place in a **highly stable governance structure** (also internationally) and practice and therefore appears to be less susceptible to change. Planning has a respectable tradition but became, in comparison, **susceptible for political changes in the 2,000 years and beyond**. At the national level, spatial planning is no longer moved by a stable and lasting vision on the desired spatial structure of the country and how planning could contribute while decentralization of competences has led to policy fragmentation: municipal planning decisions with regional, and sometimes even a national, impact. In 2022, the government expressed the intention to partly recentralize planning, which may require legal changes. The intention is to publish a National Spatial Strategy (Nota Ruimte) in 2024.

Assessing Spatial Planning: Leveraging Location Choice in the Passive Mode

Overall, the previous sections show that the contemporary relationship between spatial planning and flood resilience can be characterized as having two modes: a relatively passive mode, where land-use and comprehensive plans may or may not consider flood risk seriously, and a relatively active one, that facilitates interventions that do consider flood risk and ultimately build flood resilience. It also demonstrates that spatial planning and flood risk management continue to

operate mainly as silos with some key differences that were touched on in the previous sections (see Table 2). This is not highly surprising, since spatial planning was created historically to deal with development pressures, particularly in relation to housing and starting at the lower tiers of government during the early decades of the previous century and centralizing over time. A tradition thus appeared, where flood resilience is pursued based on engineering and landscape design via active interventions rather than via planning (and locational choice in particular). This tradition also appears to revolve around a multidisciplinary division of labor, whereby engineering disciplines, such as hydraulic engineering and landscape design, intervene on behalf of flood resilience and are facilitated by planning in the active mode, but in the passive mode, spatial planners (and plan lawyers) do not seem to anticipate future flood events in spite of a clear move to integrate spatial planning and flood risk management at the national level, albeit largely limited to policy objectives and governance novelties like a Delta commissioner.

This tradition is likely the reason why the more passive yet dominant plans (the land-use plans) that rely on future initiatives—that may or may not happen—do little to build flood resilience while "interventionist" plans in contrast may take on that role (see Box 1, which shows the results of a comparison of plans). Those are also plans in which urban, landscape, and engineering-design expertise are leading. Basically, flood resilience is sought after via intervention, rather than anticipating competition for space in service of flood resilience. Ironically, this is at odds with the assumption that it is the anticipatory element of spatial planning (next to its capacity for integration) that makes it an ideal instrument for building flood resilience.

Although spatial planning and flood risk management over the course of decades have not moved in tandem, matters have changed somewhat. It is clear the impetus for these changes did not originate from within the spatial planning policy system but was highly contextual. A new tool like the *water test* and other legal requirements to which spatial planning has to comply are *imposed* on spatial and environmental planning: to keep the system on track in the direction of "flood-proof" spatial development. The latest batch of locational choices where to build large future housing estates, in fact, seems to indicate a serious relapse into old practice. It remains to be seen whether the planning system is to blame or the vicissitudes of local politics. On the positive side, in education, planning, spatial design, and civil engineering, new generations of practitioners are receiving integrative training.

Transferability of the "Dutch Approach" of Spatial Planning and Flood Risk Management

Literature on policy transfer often issues a clear warning that caution is needed to advocate that such a transfer is needed: the context on the receiving side might be rather different compared with the origin of a particular policy or policy tool. Also, geography matters. Against this background, 10 key features of the relationship between spatial planning and flood resilience in the Dutch case are identified that may inspire policy and practice elsewhere:

1.

Spatial planning matters: Locational choice, as well as spatial design, has an impact. In particular, in a period of high uncertainty regarding climate changes, sea-level rise, and river discharge, caution is needed. This ultimately may lead to *zoning*: designating areas where development is no longer allowed.

2. Locational choice forms the primary factor as major weaknesses of a location in terms of resilience may be impossible to compensate sufficiently enough (also in the long term) through innovative spatial design and flood risk engineering.
3. Decentralization in the spatial planning system tends to lead to a spatial downscaling of policy deliberation and decision-making, while reducing flood risks, as well as improving resilience, demands a focus on the scale of main water systems. Ultimately, this may lead to (re)centralization in spatial planning and give a larger political, as well as judicial, weight to the so-called substratum layer.
4. The rule of law gives strong, as well as stable, grounds for policymaking, implementation, surveillance, and enforcement. The law may include the Constitution and a clear definition of competencies of public bodies, as well as norms regarding safety and quality of life.
5. The combination of process norms (dominant in spatial planning) and material norms (dominant in flood risk management) form a potent combination and therefore need to be interconnected. Process norms like the (mandatory) use of policy ladders do not specify a particular outcome of decision-making and are therefore flexible. Material norms do not have this flexibility, which may block outcomes (in particular when norms are highly detailed) that are regarded as highly favorable from the perspective of flood risk management.
6. Civil engineering and spatial design (particularly urban design and landscape architecture), working in tandem, contribute to innovation concerning dealing with flood risks, both at the program (large areas) and the project level. This is basically a call for cross-disciplinarity.
7. Flood risk resilience requires thinking and acting across various temporal scales, for instance 30, 50, or 100 years. Long timescales may be very difficult to handle but are nevertheless needed to avoid regret decisions, while certain interventions like a replacement of technically highly complex and expensive flood prevention systems need decades of preparation time.
8. Flood risk resilience requires continuous funding for programs and projects especially in an era in which there does not seem to be a natural decrease in flood risks due to the effects of climate change. This is, in fact, the financial and budgetary consequence of the previous point. This may require a political consensus that is (much) longer than the periods between elections.
9. Due to spatial differentiation at various levels of scale, there is no one-size-fits-all solution. Adaptive water and flood risk management needs to be integrative in relation to local specificities, as well as being open-minded to the opinion and expertise of local stakeholders.
10.

Transnational cooperation and legislation may establish principles and norms for water-system levels, for instance river basins. This is particularly relevant for a country that (like the Netherlands) is situated in a delta of transnational river systems. In the Dutch case, this relates to the European Union Flood Directive and Water Framework Directive. In other (large) transnational areas across the globe, supranational or intergovernmental structures are absent, which may make cooperation rather difficult in spite of its necessity.

In the 10th proposition, the last sentence touches on the diversity across the globe in terms of a society's capacity to deal with flood risks. In this respect, many countries in the global South are in an extremely difficult situation while the effects of climate change expose these countries to ever-growing risks. Countries in the global North bear a great responsibility to support these countries generously, both with expertise and funding. Adaptation to climate change does not stop at country borders.

Links to Digital Materials

Deltares *<https://www.deltares.nl/en/>*

Delta Programme *<https://www.government.nl/topics/delta-programme>*

Expertise Network for Flood Protection *<https://www.enwinfo.nl/secundaire-navigatie/english/>*

Foundation for Applied Water Research STOWA *<https://www.stowa.nl/English>*

Helpdesk Water *<https://www.helpdeskwater.nl/secundaire-navigatie/english/>*

ICPR—International Commission for the Protection of the Rhine *<https://d.docs.live.net/a31273d2ceb1281e/Desktop/Batch-57/ESC-00815/iksr.org>*

Knowledge Centre InfoMil *<https://rwsenvironment.eu/>*

Netherlands Centre for River Studies *<https://ncr-web.org/>*

Rijkswaterstaat *<https://www.rijkswaterstaat.nl/water>* (partly in English)

Water Envoy *<https://www.government.nl/topics/water-management/waterenvoy>*

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