Flood Prevention and Mitigation in Dutch Land Use Planning

Jeroen Neuvel
Land Use Planning Group
Wageningen University, *jeroen.neuvel@wur.nl*
+31-317-483-995

Adri van den Brink
Land Use Planning Group
Wageningen University, *adri.vandenbrink@wur.nl*
+31-317-482-784

Abstract

An examination of Dutch local and regional spatial plans adopted in 2005 has shown that water safety is hardly an issue in Dutch local and regional planning practices. In the light of Dutch climate change scenarios, projecting sea level rise, land subsidence in the peat areas and an increase in extremely high river discharges of the largest Dutch river systems this is at the very least striking. In this paper, it was explored why flooding from the sea or rivers is not considered in Dutch spatial planning at the local and regional level. Dutch flood management policy turned out to be mainly focused on flood prevention through the construction and maintenance of water defences. If the water defences meet the legal safety criteria, spatial developments within the dike-ring, the area protected by water defences, are formally legitimate and additional spatial planning measures to mitigate the residual risk are not compulsory. As a result, flood risk issues are hardly considered in spatial planning practices. In the light of this established prevention practices, it was a striking finding that another discourse appeared in spatial planning practices. In this discourse, additional spatial flood mitigation measures in the dike-ring area were considered to reduce the residual flood risk in the dike-ring area. Four factors have been distinguished that lead to this different consideration of flood risks in spatial planning practices: the conceptualisation of flood risks, the felt public concerns, the felt responsibilities and the felt necessity to legitimise spatial developments.

Keywords: spatial planning; flood management; risks management; planning practices;

1. Introduction

Spatial planning can be seen as one of the means to prevent and mitigate man-made and natural risks (Burby 2006; Burby et al. 2000; Cutter 1993; Godschalk et al. 1999; Immink 2005; Mileti 1999). For example, if local authorities had paid more attention to the regulation of urban developments in the most flood prone areas or had constructed houses that were more flood-resistant, the damage of hurricane Katrina in New Orleans might have been considerably less severe. In this light in can be argued that spatial planning can contribute to a further reduction of the consequences of flood risks.

An examination of Dutch local and regional spatial plans adopted in 2005, however, has shown that water safety is hardly an issue in Dutch local and regional planning practices (Rijkswaterstaat RIZA 2006). In the Netherlands, the initiator of new spatial plans (e.g. a municipality or province) is obliged to ask the water manager (often the water board) to address and advise on the relevant water management issues within the plan area. Even though in most of the analyzed planning processes, this water advice was made by the water manager, the analysis of 108 available water advices has shown that only 8% of them called attention to water safety issues (Rijkswaterstaat RIZA 2006). Furthermore, the analysis of 183 spatial plans showed that water safety was

only considered in 6% of these plans (Rijkswaterstaat RIZA 2006). Even allowing for the fact that water safety is not relevant to every spatial plan (e.g. for the one third of the Netherlands which would not be flooded without dikes), we can conclude that water safety is hardly an issue in local and regional spatial planning practices in the Netherlands. Moreover, we can conclude that during these spatial planning processes, water managers provide little or no information about water safety issues within their water advices.

In the light of Dutch climate change scenarios, projecting sea level rise, land subsidence in the peat areas and an increase in extremely high river discharges of the largest Dutch river systems (Milieu en Natuurplanbureau 2005), it is at the very least striking that flood risks are hardly mentioned and dealt with in recent spatial plans at the local and regional level. Moreover, the population in flood prone areas in the Netherlands as well as the economic value of the infrastructure in these areas has increased over the last decades.

In this paper, we will explore why flood risks are not considered in Dutch spatial planning at the local and regional level. This exploration is based on an interpretative policy analysis approach, which assumes that existing discourse coalitions in planning practices highly shape the way in which flood risks are dealt with. In this light, we will first describe the Dutch policy framework on flood management. We then go on to identify and describe discourses in spatial planning practices that can explain the lack of attention for flood risks in spatial planning. The description of the policy framework was derived from a study of policy documents and related literature. The discourses and discourse coalitions were derived from a case study, in which local and regional spatial planning practices in one selected flood-prone area were studied by a literature study and thirteen interviews: eleven interviews with spatial planners within the area, one interview with a representative from the water board in the case area and one interview with the regional fire department in the case area. We discussed how flood risks were dealt with within the spatial planning process and how flood information was used within this process. The interviews were semi-structured with open-ended questions.

2. Theoretical perspective

For the analysis of current flood management policies in the Netherlands we have chosen an interpretative policy analysis approach. Interpretative policy analysis can be understood as a reaction to the ideas and concepts used in what Fischer (2003a; 2003b) describes as neo-positivist policy analysis. Neo-positivist policy analysts assume that reality can be discovered with analytical precision by natural scientific methods such as empirical measurements. Moreover, they regard positivist natural scientific methods as the only valid means of distinguishing facts from values and of obtaining ‘true knowledge’ (Fischer 1990). Consequently, the objective of neo-positivist policy analysis can be seen as “speaking truth to power” (Wildavsky 1980) by providing policy makers and decision makers with natural scientific facts about, for example, policy problems and the expected effects of policy measures.

In the Netherlands, flood risks are also conceptualised in a natural scientific way. Natural scientific weather models, hydrologic models and models of dike strengths are used to calculate the probability of flooding. The weather models and the hydrologic models give insight into the frequency of high water levels. Subsequently, the models of dike strength give insight into the likelihood of a flood at a particular high water level scenario. The potential damage caused by a flood is assessed by flood models that combine the calculated likelihood of a flood with economic models that can calculate the expected economic damage and/or the number of victims. Based on this quantitative risk assessment, flood risks can be presented in an average number of victims caused by flooding per year at a certain place or of the average damage in euros per year. Based on a cost-benefit analysis, the costs of risk reduction measures can be compared with the expected benefits of risks reduction.

The main criticism of neo-positivist policy analysis is that it has over-relied on and misused scientific knowledge, because of its adherence to a positivist conception of knowledge (Fischer 1990). In contrast to positivist perceptions of knowledge, post-positivists take a more complex view of the superiority of scientific knowledge over other ways of knowing. They recognize the value-rational aspects of scientific knowledge by arguing that realities are constructed rather than discovered. As explained by Van Assche, (…) ‘realities are produced by human thought in cultures (and therefore), there cannot be one truth that is universal, objective, necessary (Van Assche 2004:31). Because realities are constructed by human, facts and interpretations are inextricable from each other (Latour 2004)

A term often used in this tradition is discourse. Hajer (2005: 448; 1995: 44) defines a discourse as ‘a specific ensemble of ideas, concepts and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is allocated to social and physical phenomena.’ In his conception of discourse, a discourse makes a part of reality accessible to human thought by constructing it. Simultaneously a discourse gives meaning to this constructed reality by the way it is constructed (Van Assche 2004).

People can construct reality in several ways and simultaneously give meaning to it. Moreover, different ways of constructing reality will lead to different perceptions of policy problems, to different strategies to address the problem and to different information needs and uses. The discursive dimension of interpretative policy analysis is mainly focussed on the analysis of the way reality is conceptualised and how this conceptualisation orders the way in which policy actors perceive reality, define problems and choose to pursue

solutions in a particular direction (Hajer and Laws 2006). Therefore, this discursive dimension of policies is relevant for understanding the way flood risks are dealt with within spatial planning practices.

Because different aspects of policies mean different things to different people, interpretative analysis typically begins with the question: what does a proposed policy mean, and for whom does it have meaning (Yanow 2003: 235)? Therefore, an important step in our policy analysis is to identify discourse coalitions in spatial planning practices. Hajer (2003; 2005) defines a discourse coalition as the ensemble of particular story lines, the actors that employ them and the practices through which the discourses involved exert their power (Hajer 2005: 448). To capture and analyse policy discourses a bit more precisely, Hajer distinguishes three layers within a policy discourse (Hajer 2003). The first layer consists of the analysis of story lines. Story telling can be seen as a principle way of ordering, of constructing shared meaning and organizational realities. Therefore story lines are perceived as an important layer within a policy discourse. The second layer comprises the analysis of vocabularies. Policy vocabularies often consist of sets of concepts of reality accompanied by (sometimes hidden) assumptions that structure a particular policy. For example a specific conceptualization of flood risks as the chance that water levels exceed dike heights structures flood problems and prevention policies.

The third layer of a policy discourse focuses on the epistemic notions within a policy: certain rules of formation that underpin theories/policies (Hajer 2003: 104). These notions are not formulated in their own right, but are embedded in the social context. Within this paper, we will distinguish these three layers to analyse the flood models and calculations as well as the flood management policies.

Values or beliefs embedded in a conceptualisation of reality greatly influence the way people perceive risk information and greatly influence their actions. The influence of these belief systems on the perception of new information, like flood risk information, is even larger than the influence of these new research results on the values and belief systems themselves. People or groups of people will resist information suggesting that their values or basic beliefs may be invalid or unattainable (In 't Veld 2000; Sabatier and Jenkins-Smith 1993). Moreover, the flood calculations and flood models themselves are not value free. They also conceptualise reality in a particular way, based on numerous assumptions and beliefs about the best way to construct flood risks.

As a result, this interpretative policy analysis can broaden the view of neo-positivist policy analysis by presenting insights into the diversity of views and values in spatial planning practices. These insights can be used for an evaluation and reconsideration of current flood management and spatial planning policies.

In this paper, we will use a discursive approach to analyse the management of flood risks in spatial planning practices. Within this analysis, we will particularly focus on the values that are embedded in problem definitions and the strategies used to deal with flood risks. Our objective is to reflect on the construction of truths and to highlight the values and underlying assumptions in Dutch spatial planning practices, since these values and assumptions may help us to understand why spatial planners deal with flood risks in a particular way.

3. Dutch flood management policy

Dutch flood management policy is mainly focused on flood prevention by the construction and maintenance of water defences. These water defences, such as dikes or dunes, should protect the hinterland against floods from the sea or major rivers. The area that is protected by a water defence is referred to as a dike-ring area. A dike-ring area is an area encircled by an uninterrupted ring of water defences and high ground: ground which will not be flooded, even under the most unlikely circumstances (Eijgenraam 2006). In the Netherlands, 95 dike ring areas can be distinguished. These dike rings are found in the north-western half of the country, along Lake IJssel and along the rivers Rhine and Meuse. Water defences that directly protect a dike-ring area against flooding from the sea or major rivers are called primary water defences. Safety standards for these primary water defences are legally established in the Dutch Flood Defences Act. Within this act, the safety standard is defined as: “the average exceedance probability - per year - of the highest water level which the primary water defence must be capable of withstanding from the outside, while taking into account other factors which determine the water defensive capability”.

The height of the safety standards and consequently the level of protection that should be provided by a primary water defence is based on both the economic value of the dike-ring area and the possibilities for evacuation of the dike-ring area (Brinke and Bannink 2004) In the 1950’s the Delta Committee, the committee that advised about the flood prevention measures needed after the last major flood in the Netherlands, the storm-tide disaster in 1953, carried out a risk assessment. This risk assessment showed that the coastal dike-ring areas in the west of the Netherlands, including cities such as Amsterdam, Rotterdam, and The Hague, had the highest economic value and consequently had the highest damage potential. Moreover, evacuation of the population of these dike-ring areas turned out to be extremely difficult, since it is not possible to predict water levels in the North Sea well in advance, whereas peak discharges in the major rivers can be forecast up to a couple of days in advance (Brinke and Bannink 2004). Accordingly, the Delta Committee concluded that water defences in the coastal region in the western part of the Netherlands should meet the highest safety standards. Based on the expected economic damage and the costs of water defences, the Delta Committee suggested that water defences protecting the densely populated coastal areas should be capable of resisting high water levels of the kind that can be expected once in 10,000 years. Based on these safety standards for the coastal areas and on the

assessment of the economic damage potential of other dike-ring areas, standards have been attributed to other water defences (see figure 1).

Coastal water defences that protect less densely populated areas should meet the safety standards of once in 4,000 years, whereas water defences adjacent to the major rivers are designed to resist peak discharges that may occur once in 1,250 years. These areas are relatively sparsely populated. Furthermore, peak discharges can be predicted well in advance, which offers opportunities for evacuation. Because the water levels in the river mouth area are the result of an interaction between more or less foreseeable peak discharges and less predictable sea water levels, water defences adjacent to these parts of the river should meet the safety standard of once in 2,000 years (Brinke and Bannink 2004; Ministerie van Verkeer en Waterstaat 2005a). In 1996, these safety standards have been implemented in the Flood Defences act.

The Dutch Ministry of Transport, Public works and Water management attributes safety standards to water defences. In addition, this ministry is formally responsible for the maintenance of the water defences. In practice, water boards maintain the water defences under supervision of the ministry. In addition, the water board has an important advisory role in the spatial planning process. In the Netherlands, the initiator of new spatial plans (e.g. a municipality or province) is obliged to ask the water manager (often the water board) to address and advise on the relevant water management issues within the plan area, such as flood risk issues. As a consequence, responsibilities for flood prevention and mitigation are highly attributed to water managers.

The construction of water defences in the Netherlands has reduced the likelihood of flooding. In spite of these water defences, there will always be a small statistical chance of a flood for two reasons. First, if water defences are constructed to resist high water levels of the kind that can be expected once in 1,250 years for example, higher water levels that are expected only once in 5,000 or once in 15,000 years may still occur and may generate a flood. Secondly, even during less extreme high water levels a dike may collapse due to bad maintenance. An assessment of the Dutch primary water defences showed that only 44% of the Dutch primary water defences meet the safety standards. 24% of the primary water defences do not meet the safety standards and for 32% of the water defences, there is no appropriate information available to make the assessment (Ministerie van Verkeer en Waterstaat and Inspectie Verkeer en Waterstaat 2006). Finally, a dike may collapse due to or other unforeseen or unexpected causes like a terrorist attack or a shipping disaster. Clearly then, floods cannot entirely be prevented by water defences. The statistical probability of a flood that is not covered by the water defences is called the residual flood risk.

Within spatial planning, numerous spatial measures can be taken to deal with these residual flood risks, such as zoning or building codes. By zoning, spatial developments in these area can be regulated. Nevertheless, there are no formal guidelines for flood-risk based zoning in dike-ring areas, even though the application of such ways of zoning is considered (Pols et al. 2007). In addition, there are no legislative statutory requirements, such as building codes, that force specific design requirements for flood-resistant or flood-resilient construction of buildings within a dike ring area (Adviescommissie water 2006).

We may conclude that the formal policy framework hardly stimulates the consideration of flood risk in spatial planning practices in dike-ring areas. If the water defences meet the safety criteria, spatial developments within the dike-ring are formally legitimate in the light of flood risks. Specific zoning regulations related to flood management in dike-ring areas are missing and building codes for flood-resistant and flood resilient building are lacking. Consequently, the actual Dutch flood management policy framework already very much explains why flood risks are not considered in spatial planning practices at the local and regional level.

4. Case study

Even though the actual formal flood management framework hardly stimulates the consideration of flood risks in dike-ring areas, strategies may be reformulated during the implementation process (Majone and Wildavsky 1984). Furthermore, the identification of values and assumptions embedded in planning practices may explain in more detail why flood risks are not considered in planning practices, We therefore studied a particular case area to explore how flood risks are dealt with within local spatial planning practices. Dike ring 16: Alblasserwaard and Vijfheerenlanden was selected as our case area. This dike ring of 39,000 hectares is located east of Rotterdam and is inhabited by 197,000 people. The water defences should be able to resist water levels that are expected once in 2,000 years. However, the actual likelihood was recently estimated at once in 400 years[1] (Ministerie van Verkeer en Waterstaat 2005b). Moreover, the dike-ring area is very flat and therefore, water levels in the dike-ring may rise quickly if there is a breach in a dike, which may potentially lead to a high number of victims (Jonkman 2007). Therefore, flood risks may be regarded as relevant for this area.

[1] The report stresses that the method is not yet seen as robust enough and that these figures are only an indication and should not be regarded as authoritative.

Nonetheless, numerous house building projects were proposed. In the next decade, approximately 2,000 houses will be build within this area.

Our interviews with spatial planners and the water board revealed two different discourse coalitions related to flood management in this areas. We have described and compared these discourses. We've labelled the first discourse coalition as the prevention discourse. This discourse was represented by nine interviewed municipalities and the interviewed water board. This discourse also seems to represent the established Dutch flood management policies.

In the light of this established discourse in both policy and practice, it is striking that another discourse appeared from our case study. The second discourse coalition was labelled as the mitigation discourse, which was only represented by two municipalities and the regional fire department. In this discourse, additional spatial flood mitigation measures in the dike-ring area are considered to reduce the residual flood risk in the dike-ring area. Because this consideration was not required from national policies, we tried to identify the factors that lead to the consideration of flood risks in spatial planning practices in dike-ring areas.

4.1 The prevention discourse

Epistemological characteristics of the established prevention discourse in current Dutch flood management policies and practices are that flood risks are approached in a natural scientific way. From a natural science perspective on flood risks, flood risks are regarded as measurable cause-effect relations (Immink 2005). Flood risks are conceptualised in a quantitative way.

The discourse is often hazard oriented i.e. mainly focussed on the natural phenomena that may trigger or generate a disaster and less focussed on social phenomena and conditions that may increase the vulnerability of a community to damage and disruption (Immink 2005; Wiering and Immink 2006). Furthermore, the approach is risk based; it does consider both the probability of a flood and the possible consequences of a flood.

Flood management strategies within this discourse are strongly prevention oriented. The concepts of safety criteria and water defences turned out to be key concept within these strategies. Flood risks should be eliminated by water defences. Design criteria for these water defences are established in safety criteria that prescribe the expected strength of the water defence. Flood risks are managed adequately if the water defences meet the safety criteria. Spatial development is then legitimate in the light of flood risks and additional measures are unnecessary. If the safety criteria are not met, the weakest section in the dike-ring should be strengthened. Alternatively, the river bed may be broadened or deepened to give more space to the river, which may reduce high water levels and the likelihood of flooding. Extra spatial measures within the dike-ring area to reduce the residual risks and to mitigate the consequences in case a flood may occur, such as evacuation routes are not regarded as required, even though the spatial planners were aware of the information that showed that a flood in dike-ring 16 may cause severe damage. Consequently, flood risks are not mentioned in spatial plans as illustrated by an interviewed spatial planner at one of the municipalities:

"Flood safety is not mentioned in our spatial plans. The weak dike sections have been strengthened, whereas the other weak dike section will be improved in the near future. Therefore, we assume that the dikes will resist water levels and that the area will not be flooded. Consequently, we do not mention and address flood risks in our spatial plans…"

Another spatial planner at another municipality explains:

"Legally the safety criteria for the primary water defences in this area are determined at once in 2,000 years. Within the dike-ring area we do not take extra spatial measures to deal with flood risks."

Clearly then, we may conclude that the residual risks, the flood risk that is not covered by the water defences, is accepted in spatial planning practices or not covered by additional measures in this discourse coalition.

This spatial planner goes on to explain that the municipality is not fully responsible for the consideration of flood risks in spatial planning. The choice of the location of building sites, which is often established at the provincial structure plan[2], already implies an acceptance of the flood risks. Subsequently, the spatial planners at the municipality argued that not the municipality, but the water board should indicate how to deal with flood risks:

"The water board should indicate how to deal with flood risks at a proposed building site. They should indicate this in their water advice in which they advise the municipality how to deal with water issues in the municipal spatial plans".

[2] Structure plans can be seen as strategic plans that contain the important spatial planning principles and guidelines for future spatial developments. Structure plans are made on local, provincial and national level.

The representative of the water board told us that the water board does not advise on the consequences of new spatial developments within dike-ring areas:

"We do not have detailed flood risk information for the dike-ring area. Therefore, we do not advise municipalities about the possible consequences of a flood yet. Moreover, we do not advise about how to deal with these flood risks within spatial plans in the dike-ring area since these kinds of advice are ahead of the current flood management policies. At the national level, there is a taskforce that reconsiders the current flood management regime. (…) Detailed flood information will become available at the end of 2007. We will first use this information for the development and preparation of contingency plans. At a later stage, we will consider whether this information will be used for advising the initiators of spatial plans, such as the municipalities".

According this representative, the water board does not have detailed information about flood risks. Furthermore, the water board does not give advice about the consequences of spatial plans on flood risks and nor about possible measures that can be taken to mitigate the consequences of flood risks since this would be ahead of the current policy framework.

4.2 The mitigation discourse

Some municipalities in the case area decided to take additional measures to deal with flood risks or to adapt their current spatial plans in the light of flood risks. These respondents used other story lines and vocabularies to explain how flood risks were considered in the spatial plan. Interestingly, there were also other epistemic notions behind these story lines and vocabularies. We have labelled this discourse as the mitigation discourse.

In contrast with the prevention discourse, there was much less emphasis on quantitative risk assessment. Our respondents used a more qualitative description of the area, to indicate which areas would fill up fast in case of a flood. Selection of these areas was mainly based on possible flood consequences and not necessarily on the likelihood of a flood. This conceptualisation was also used in one water advice about a municipal structure plan:

"some areas within the municipality are enclosed by high constructions such as roads, dykes and railroad lines. This brings about an increased flood risk"

The spatial planner working at this municipality described these areas by using the metaphor of a bathtub. As a result of the enclosure by high constructions, the area will fill up quickly if there is a breach in a dike, leading water levels within the area to rise quickly. Consequently, people will hardly have any time to leave the area and because of the high water levels, the damage will be severe. Even though the safety norms for the dike section that protected the particular development site were equal to other sections in the dike ring area, i.e. once in 2,000 years, the water board regarded the area as a dangerous site.

The spatial planner of the municipality felt that additional measures to mitigate flood risks were needed to legitimate the proposed spatial developments, since the province examines whether the municipality has carefully considered the issues addressed by the water manger. As explained by our respondent: "To get the approval of the province, we decided in advance to deliberate with the water board".

Originally, the municipal governors were not in favour of changes in the proposed local structure plan. In their view, proposed developments should continue, even in those areas which the water board characterised as bathtubs. In their opinion, high water levels can be forecast and subsequently, the area may be evacuated if necessary. However, in 1995, the area in which the houses were planned was evacuated due to an imminent flood caused by high water levels in the river Rhine. This evacuation had a great impact on the local population. Referring to this event, the governors felt that flood risks had become a subject of public concern in their municipality. Flood risks were then not only seen as firm objective entities that can be presented in a number as in the natural science approach. There was also attention for the psycho-cultural impacts of a flood.

Based on the felt public concern, the governors decided to compromise with the water board. In one 'bathtub' area, the municipality decided to build fewer houses to reduce damage potential. In the other area, the municipality still desired development, since a view of the river was regarded as an important quality for housing. To compensate for flood risks in the plans for this area, extra attention was paid to mitigation measures, such as artificial hills or evacuation routes. The province approved these proposed developments, because the municipality had compromised with the water board. Clearly then, this discourse coalition regarded spatial planning within a dike-ring area as one of the means to mitigate flood risks.

5. Conclusions

Flood risk issues are not addressed in spatial planning practices at the regional and local level because there is little emphasis in the formal policy framework for flood management on addressing flood risk in spatial planning practices in dike-ring areas. Dutch flood management policy is mainly focused on flood prevention through the construction and maintenance of water defences. If the water defences meet the legal safety criteria, spatial developments within the dike-ring are formally legitimate and additional spatial planning measures to mitigate the residual risk are not compulsory.

In recent spatial planning practices, flood risks were mainly conceptualised according to this formal policy framework. The spatial planners assumed that the water defences met the legal safety criteria or will do so in the near future. Because these respondents believe that flood risks are adequately covered by these water defences, additional spatial planning measures to deal with the residual risk were regarded as unnecessary. As a consequence, flood risks are hardly addressed in spatial planning practices.

In the light of this established prevention discourse in both policy and practice, it is striking that another discourse appeared from our case study: the mitigation discourse. In this discourse, additional spatial flood mitigation measures in the dike-ring area are considered to reduce the residual flood risk in the dike-ring area. Based on this discourse, we distinguished four factors that lead to the consideration of flood risks in spatial planning practices in dike-ring areas.

First, the way flood risks are conceptualised is important. Our findings showed that flood mitigation measures are sometimes considered in spatial planning practices if these flood risks are conceptualised not in the formal way, but in an alternative way. In one municipality, the water board mainly focussed on the risk consequences instead of the formal flood risk criteria, based on the idea that there is still a small statistical chance of a flood. Because the flood risks were conceptualised in this way, the water board regarded some proposed building sites as dangerous sites, because flood consequences may be severe. Therefore, the water board suggested additional mitigation measures, even though the formal safety criteria had been met.

Second, as shown in the case study, the municipality that took extra precautionary measures based its decision not only on scientific data, but also on felt public concern about flood risks. This public concern was the result of the threat of a flood in 1995, when the area in which extra houses were planned was evacuated. These experiences may also have influenced the chosen conceptualisation of flood risks. Based on the awareness that a flood may happen, potential flood consequences were emphasised. Within the other discourse coalition, where the conceptualisation of flood risks was based on the formal policy network, public concern was not mentioned.

Third, additional mitigation measures to minimise flood risks were considered in the spatial planning process because local governors felt a responsibility for the mitigation of flood risks. The felt public concern was mentioned as an important reason for this felt responsibility. Instead of holding the water boards responsible for flood management by water defences, as in the prevention discourse, the municipality felt that they should take additional measures as well, for example by implementing spatial planning measures in the dike-ring area.

Finally, mitigation measures were considered to legitimise spatial developments. Because the water board characterised the proposed building sites as dangerous sites, the municipality argued that they should consider extra measures; otherwise, the province might withhold its approval for the municipal structure plan. To avoid a situation in which the province withholds approval, the municipality decided to include additional regulations to compensate for flood risks.

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