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Resilience unpacked – framing of 'uncertainty' and 'adaptability' in long-term flood risk management strategies for London and Rotterdam

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ABSTRACT

Resilience is held as a promising concept to produce a paradigm shift from traditional flood control to an integration of flood risk management and spatial planning. Central ideas to the resilience narrative are that 'nothing is certain except uncertainty itself' and 'adaptability' is key to 'governing the unknown'. However, this terminology is far from clear, yet increasingly used, which raises the question how it is made sense of in practice. To answer this question, we examine two long-term flood risk management strategies in the London and Rotterdam region with a policy framing perspective (i.e. the English Thames Estuary 2100 Plan and the Dutch Delta Programme). In both strategies, uncertainties are a key concern, leading to adaptive strategic plans. Reconstructing the framing processes shows that the English adopted a 'scientific pragmatism' frame and the Dutch a 'joint fact-finding' frame. While this led to different governance approaches, there are also striking parallels. Both cases use established methods such as scenario planning and monitoring to 'manage' uncertainties. Similarly to previous turns in flood risk management, the resilience narrative seems to be accommodated in a technical-rational way, resulting in policy strategies that are maintaining the status quo rather than bringing about a paradigm shift.

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1. Introduction

The concept of resilience has recently gained popularity in academic as well as policy discourses, in particular in relation to climate change and flood risk management (Davoudi, Brooks, & Mehmood, 2013; Scott, 2013; White, 2010). Evans and Reid (2014) speak of a 'resilience turn' in governmental thinking. The resilience concept brings a new narrative, namely that 'nothing is considered certain except uncertainty itself' (Davoudi, 2016, p. 158), raising the question why we should still plan at all (Campbell, 2010). But

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instead of declaring defeat for planning and management, resilience is often framed positively – more holistic and integrated management approaches aimed at 'adaptation' and building 'adaptive capacity' seem to be key to 'governing the unknown'. However, all this terminology is far from clear, yet increasingly used, which raises the question how it is made sense of in practice. Specifically, this paper examines how two key notions of the resilience narrative – 'uncertainties' and 'adaptability' – are operationalized in flood risk management strategies in the regions of London and Rotterdam.

This is interesting to study for two reasons. First, flood risk management is a policy field with a long-standing 'technocratic culture' (Lintsen, 2002; van den Brink, 2009), generally known for its 'predict and control' regime (Pahl-Wostl, 2006). Currently, however, flood risk management is shifting towards more integrated and adaptive modes of governance, accepting uncertainties as an 'unavoidable fact of life' (Brugnach, Dewulf, Pahl-Wostl, & Taillieu, 2008). Second, with a growing body of literature on resilience, the number of critiques and concerns regarding the actual usage of the concept in practice has also increased (e.g. Chandler, 2014; Cote & Nightingale, 2012; Davoudi, 2012; Davoudi, 2016; Evans & Reid, 2014; Porter & Davoudi, 2012; White & O'Hare, 2014). So far, however, most of these concerns are elaborated conceptually, instead of providing empirical proof. We aim to fill this gap in the literature by studying the meaning-making process in two specific flood risk management strategies (i.e. the Thames Estuary 2100 Plan and the Dutch Delta Programme).

In the regions of London and Rotterdam, key actors from governmental agencies have pioneered with long-term policy strategies in which dealing with uncertainties are a core concern. In the London region, the Thames Estuary 2100 Plan[1] aims at tackling tidal flood risk until 2100. In the Rotterdam Region, policy-makers have translated the national 'Adaptive Delta Management' approach into a regional strategy that aims at guaranteeing flood protection as well as freshwater supply until 2100. These policy strategies are novelties in themselves, as they span across a long time horizon (until 2100) and claim to be 'adaptive' to deal with uncertainties arising, amongst others factors, from climate change. These cases are interesting to compare, because they are similar in their ambition and their challenges, but differ in their institutional frameworks and cultures. Moreover, we can assess how the resilience narrative unfolds in two (national) contexts, and to what extent their interpretations indeed can be seen as a 'resilience turn' in flood risk management practice.

In analysing both strategies, we adopted a discursive approach, as they introduce a new policy language with terms such as 'adaptation pathways', 'tipping points' and 'route-map approach'. More precisely, we analysed the two strategic plans with a policy framing perspective. Framing emphasizes how people strategically make sense of ambiguous and complex situations; a policy frame sets out a course of action to address a problematic policy situation (Rein & Laws, 2000). We analysed policy documents, carried out interviews with key actors and observed some of their meetings to deconstruct the framing process in both cases, unravelling how uncertainties are framed in the first place and how this consequently shaped the course of action brought forward in the policies.

Prior to the empirical analysis, we discuss the implications of the resilience narrative for flood risk management. We then link resilience to policy framing, arguing that a critical unpacking of the resilience concept in flood risk management practice is needed. After reconstructing the framing processes in both cases, we discuss to what extent their operationalization of the resilience narrative actually fits to the idea of a paradigm shift usually

associated with flood resilience. Finally, we reflect on the added value of interpretative approaches for analysing the usage of resilience thinking in flood risk management practice.

2. Resilience and flood risk management: a paradigm shift or two worlds colliding?

In flood risk management, resilience is associated with the paradigm shift from technical flood protection to more holistic kinds of flood risk management, emphasizing spatial planning as a means to reduce the vulnerability of the hinterland (Restemeyer, Woltjer, & van den Brink, 2015; Scott, 2013; White, 2010). Resilience, however, is not a straightforward concept; it can be interpreted in multiple ways. Davoudi (2012) has categorized the different understandings of resilience in three strands, namely engineering, ecological and evolutionary resilience. Evolutionary resilience is held most promising to inform governance in general and planning and flood risk management in particular (Chandler, 2014; Davoudi, 2012; Scott, 2013; White & O'Hare, 2014). Contrary to the other resilience understandings, which assume the possibility of an equilibrium state that can be returned to, evolutionary resilience emphasizes the *dynamics* and complexity of the system, making a return to a previous state impossible, and therefore arguing for the need to *transform* in response to stresses and strains (Boschma, 2015; Davoudi, 2012; Simmie & Martin, 2010; White & O'Hare, 2014). For flood risk management, evolutionary resilience entails a new way of thinking evolving around four main points: (1) social-ecological systems thinking is introduced to flood risk management, (2) a key assumption is that uncertainties are inevitable, (3) strategies need to be flexible to respond to sudden changes as well as gradual long-term trends, (4) a diversity of flood risk management measures is required to prevent flood damages.

First, evolutionary resilience thinking emphasizes that social and ecological systems are strongly intertwined, forming *social-ecological systems* (Davoudi, 2012; Folke et al., 2010). Applied to flood risk management, social-ecological systems' thinking implies a broader scope than before. The considered system is not limited to the water system and the flood defences, but also includes floodplains and areas behind the flood defences. Flood risk management then takes into account physical as well as socio-economic aspects, such as the existence of embankments, elevation differences, soil characteristics, land use, the institutional and political system and population characteristics (de Bruijn, 2005).

Second, a key assumption related to social-ecological systems' thinking is the *inevitability of uncertainties*. Resilience thinking suggests that social-ecological systems are inherently complex, because all parts of the system are interrelated and continuously evolve, by themselves and by the interaction with each other (Folke et al., 2010; Goldstein, Wessells, Lejano, & Butler, 2015). The emergent character of all parts as well as their non-linear interlinkages make the system fundamentally unpredictable (Chandler, 2014; Davoudi, 2012; Mitchell, 2009). For flood risk management, this means that next to 'knowing too little' due to incomplete knowledge (e.g. 'To what level will this dike resist?') and 'knowing too differently' due to diverging stakeholder perceptions and interests, a third type of uncertainty arises, which requires 'accepting not to know' (Brugnach et al., 2008). This type of uncertainty can relate to the physical as well as the social system, e.g. the unknown effects of climate change on weather extremes or stakeholders' reactions to the next flood in a specific area (Brugnach et al., 2008).

Third, although deep uncertainties make it difficult to foresee the outcomes of any planning or policy attempt, the resilience narrative also includes a positive connotation: 'adaptability' or building 'adaptive capacity' is seen as promising solution to deal with the unknown (Fikret Berkes, 2007; Davoudi, 2016; Folke, Hahn, Olsson, & Norberg, 2005; Hurlbert & Gupta, 2016; Mcevoy, Fünfgeld, & Bosomworth, 2013). In relation to flood risk management, policy-makers can influence the adaptability of the social-ecological system in two ways: they can influence the process as well as the content of policy strategies. In terms of process, adaptability refers to the *flexibility of plans and strategies* (de Bruijn, 2005; Restemeyer, van den Brink, & Woltjer, 2016). Strategies can be made in such a way that they are adaptable to sudden changes as well as gradual long-term trends (de Bruijn, 2005); for example, by choosing first for 'no-regret measures', keeping various options open and leaving room for learning along the way (Haasnoot, Kwakkel, Walker, & ter Maat, 2013; Pahl-Wostl et al., 2008). A long-term perspective is needed to make sure that future options are not compromised by short-term actions. The flexibility of strategies therefore also depends much on the type and timing of flood risk management measures.

Fourth, in terms of content, a flood resilience approach generally implies a *diversity of flood risk management measures*, aimed at the social as well as the ecological side of the system (Aerts, Botzen, van der Veen, Krywkow, & Werners, 2008; Mees, Driessen, & Runhaar, 2013; Wardekker, de Jong, Knoop, & van der Sluijs, 2010). The adaptive capacity of a specific area can be increased by stimulating a holistic set of flood risk management measures, trying to reduce the probability as well as the consequences of flooding (Liao, 2014). The probability of flooding can be reduced by traditional flood control measures such as dikes, dams and sluices as well as providing more space for water (Meijerink & Dicke, 2008). The consequences of flooding can be reduced by making adjustments in the hinterland. For example, by keeping vulnerable functions out of flood prone areas, flood-proofing individual houses or building them as floatable structures in the first place, and raising flood risk awareness among the population (Restemeyer et al., 2015).

However, many of these ideas are new and require a fundamental shift of a rather technical policy field with long-standing institutions and established objectives. First doubts are arising whether a diversification of flood risk management measures is necessarily better; different geographical and institutional characteristics might make one type of flood risk management measure more important than another (Hegger et al., 2016). Additionally, a valid question is if a region can really be good at everything. The idea of 'adaptability' and how it can be achieved is also contested, manifested in a growing body of literature surrounding terms such as 'adaptive governance' (e.g. Folke et al., 2005), 'adaptive planning' (e.g. Wilkinson, 2012), 'adaptive management' (e.g. Allen, Fontaine, Pope, & Garmestani, 2011) and 'adaptive co-management' (e.g. Berkes, Armitage, & Doubleday, 2007). Nonetheless, many related terms, including resilience, adaptive capacity and complex systems, are taken up quickly by policy-makers, even though they are multi-interpretable and difficult to operationalize.

Therefore, a more practice-based approach is needed, examining how practitioners make sense of 'the system' and 'uncertainties' in their everyday practice, and how they give meaning to the idea of 'adaptability' as the potential solution for these uncertainties. Language is crucial in this process, because, as White and O'Hare (2014, p. 945) point out in relation to the different understandings of resilience: 'Even where more "adaptive"

language is used, it may also be enveloped within an engineered understanding'. While an engineering understanding of resilience is more in line with maintaining the status quo, an evolutionary understanding builds on the need for transformation (White & O'Hare, 2014). Considering the different interpretations of resilience, it is important to grasp which interpretations are used in new flood risk management strategies.

3. The importance of policy framing

Framing is about language in use; a process of meaning-making among various actors to understand a certain event, process or occurrence (Mcevoy et al., 2013; Schön & Rein, 1994). Weick (1995) therefore calls frames 'sense-making devices'. Language can shape our understanding of certain topics, in particular if these topics are complex and ambiguous (Hajer, 2011). The framing of a problem will ultimately shape the course of action that is set out. Hence, framing affects politics and human behaviour.

Linkages between resilience and framing have been made before (e.g. Aldunce, Beilin, Handmer, & Howden, 2014; Mcevoy et al., 2013). Due to the multi-interpretable nature of the resilience concept, various authors have stressed the need for critically unpacking how the resilience concept is used in practice (Cote & Nightingale, 2012; Davoudi, 2012; Hare & White, 2013; Porter & Davoudi, 2012). Above all, this critical unpacking is needed because of potential frictions between the evolutionary resilience narrative and the narratives used in long-standing institutions; i.e. long-standing institutions will less likely embrace a highly transformative concept such as evolutionary resilience (White & O'Hare, 2014). Coming from the natural sciences, the resilience concept bears the risk of 'depoliticizing' social structures and power relations (Keck & Sakdapolrak, 2013; Pelling & Manuel-Navarrete, 2011). Other authors have hinted at the potential danger of using the resilience narrative to justify austerity measures and government's retreat (Chandler, 2014; Davoudi, 2016; Evans & Reid, 2014).

We specifically focus on policy framing (Schön & Rein, 1994). Policy framing originally refers to diverging frames of involved stakeholders, explaining the mismatch between policy implementation and policy intent (Schön & Rein, 1994). Over the last decades, though, policy framing has further developed from a rather static understanding of frames as 'knowledge structures' or 'mental schemes' to a more interactional, dynamic and political approach to framing (Dewulf et al., 2009; van Hulst & Yanow, 2016; van Lieshout, Dewulf, Aarts, & Termeer, 2012). Besides, framing can have an 'agenda-setting character' (Mcevoy et al., 2013), usually taking place at a strategic level (van den Brink, 2009). The latter fits with our object of analysis, as the two flood risk management strategies are in an early stage attempting to manage flood risk over a long time period. We are therefore interested in how a group of key actors, in an interactive process, arrive at a shared meaning of a certain problem and define a new course of action.

During a framing process certain aspects will be highlighted, while others are downplayed to get a grasp on an otherwise overwhelmingly complex reality. Entman (1993, p. 52) calls this a process of 'selection' and 'salience'. Framing also entails 'narrating', binding all salient features together in a coherent story (van Hulst & Yanow, 2016). Common narrating elements are how the present situation has been shaped by the past and what needs to be done in the future. By narrating, an energizing and enacting frame is created, which can be understood as a socially constructed guide for doing and

acting (van den Brink, 2009). Rein and Laws (2000, p. 93) have defined a policy frame more specifically as 'a normative-prescriptive story that sets out a problematic policy problem and a course of action to be taken to address the problematic situation' (from 'is' to 'ought').

Linking the conceptualization of a policy frame to the resilience narrative, two elements are crucial for our analysis. First, how the problem is defined in the strategic plans, that is, how the system is interpreted, how uncertainties are understood and which uncertainties are made most salient. Second, which course of action is set out in the strategies, in particular how key actors involved in these strategies interpret and operationalize an adaptive management approach. As a course of action usually sets out a process (how to do it?) as well as potential measures (what to do?), we will pay attention to what extent the strategies are adaptive to changing circumstances (process) and to what extent they attempt to build adaptive capacity on land (content).

4. Methodology: analysis of policy frames

We chose to study the Thames Estuary 2100 Plan (TE2100 Plan) in England and the Delta Programme (DP) in the Netherlands. Both make dealing with uncertainties a central theme, leading to an 'adaptable plan' in the English case and the 'Adaptive Delta Management' (ADM) approach in the Dutch case. However, the two plans have been realized in different national contexts, each with their own institutional frameworks and cultures. A comparison of both approaches is interesting, as it can show the influence of two different national and regional contexts on the operationalization of an adaptive strategic plan.

Similarities are assumed because the DP was inspired by the TE2100 Plan (Jeuken & Reeder, 2011). The TE 2100 Project started in 2002, led by the Environment Agency (EA). The DP was launched only in 2010. Before that, Dutch policy-makers had the chance to visit various water management practices in different countries. England's TE2100 Plan has left a lasting impression and therefore influenced the Dutch ADM approach. The current DP is actually a follow-up of the first DP, which was established after the storm surge of 1953, leading to the so-called Delta Works.

A difference between the two cases is that the Dutch case is a programme, whereas the English case is a plan. They are still comparable, though, because both can be considered strategic policies. Both are a statement of intent, setting out a strategic course of action coordinating several policy actions and interventions over a time horizon until 2100. The strategic courses of action developed in both regions are signed by the respective national government, making them the guiding frameworks for future decisions. Still, there were slight differences, which we had to take into account in our analysis.

On the one hand, the DP is a national policy programme whereas the English case only spans across the Thames Estuary. On the other hand, the DP pursues to ensure flood protection and freshwater supply, whereas the TE2100 Plan predominantly attempts to manage tidal flood risk. To make the two cases comparable, we merely focussed on the flood risk element in the Dutch case. Moreover, we specifically studied the regional sub-programme Rijnmond-Drechtsteden which comprises the Rotterdam region, to ensure that we could compare potential regional/local implications. We also chose for the Rotterdam region, because it is to a large degree comparable to the London region in terms of flood risk and socio-economic significance.

In both cases, we used three methods to deconstruct the framing processes: policy document analysis (published as well as unpublished), semi-structured interviews and participatory observation. We chose to study policy documents as they capture the results of the preceding negotiation processes among the policy-makers. In the English case, we examined the TE2100 Plan as well as the publicly unavailable Technical Report (387 pages) and all its appendices. In the Dutch case, the national level set some major guidelines, while the regional level was responsible for substantiating and applying these in the sub-programme Rijnmond-Drechtsteden. Therefore, we examined the national guideline for implementing ADM, yearly progress reports from the national DP as well as yearly reports from the regional subprogramme Rijnmond-Drechtsteden (see appendix for overview of policy documents).

Supplementary to the document analysis, the semi-structured interviews with key actors involved in the strategic policy processes provided a deeper understanding of the underlying process and mechanism of the policies. Particularly, because the interviews gave us an insight into the specific meaning of certain words and the backgrounds and beliefs of the actors involved in the policy processes. . In the English case, we interviewed six key actors: two central persons in the 'EA in-house team' involved in making the TE 2100 Plan (one from the EA, one from an external consultancy agency), three working on the implementation of the TE2100 Plan at that time (all from the EA, one particularly on asset management, one on floodplain management, and another one working as planning advisor for the local boroughs) and one representative from the Greater London Authority who had regularly been consulted during the development phase of the plan. In the Dutch case, we interviewed eight key actors: two from the national DP (the founder of the ADM concept working at the Ministry for Infrastructure and Environment and the external advisor for ADM from a consultancy agency) and six from the regional programme team (the regional programme director and five programme team members who were involved in the ADM strategy of the subprogramme, either working at the Ministry of Infrastructure and Environment, the executive water management agency 'Rijkswaterstaat' or at a consultancy agency).

The participatory observation in both cases helped us to understand how the more general ideas were translated to and 'made sense of' among government officials on a regional/local level. For the Dutch case, because the strategy development phase was still ongoing, we attended several working sessions of the regional programme team between December 2013 and May 2014, during which we could observe how the meaning-making process actually took place. For the English case, we attended a workshop organized by the EA in July 2015, observing how the EA explained the implications of the TE2100 Plan to the local boroughs of London and how the boroughs reacted to the plan's implications. Our level of participation in both cases can be considered 'moderate' (see Hennink, Hutter, & Bailey, 2011). In both cases our role as a researcher was known. We were sitting at the same table as the other participants. In the Dutch case, we became part of the programme team's email list and therefore received all documents and minutes of their meetings. In the English case, we received the minutes of the workshop and related documents (such as the results of a survey among the local boroughs regarding the implementation of the TE2100 Plan). However, we did not actively participate in the discussions to keep enough distance to our object of analysis and thus ensure our objectivity as a researcher. During the interviews as well as the observations, we profited from our role

as an 'outsider' to the policy process, because we were in the position to ask people for clarifications of certain words, abbreviations and metaphors, which had become 'everyday jargon' for them. That way, the interviews and the observations helped to better understand and contextualize specific contents of the document analysis.

In our analysis, we followed a two-step procedure. First, we started coding the policy documents and the interview transcripts with the help of Atlas.TI. In this phase, we first selected those text passages that either described the 'system' or addressed 'uncertainties'. Moreover, we selected those text segments that said something about 'adaptability', paying attention to the adaptability of the strategies in terms of process as well as content. Subsequently, we studied the selected text segments in depth, paying attention to the specific choice of words, relation between words and which elements are made most salient. By distilling the main story line, we identified the underlying policy frames. In both cases, the reconstructed policy frame stems from the common denominator in these strategies for how to achieve adaptability.

5. The TE2100 Plan: the 'scientific pragmatism' frame

The TE2100 Plan was signed by the central government, namely by the Department for the Environment, Food and Rural Affairs (DEFRA) and the Treasury. It was officially adopted in 2012. Since then, it is one of the many plans concerning flood risk in the Thames Estuary. It has the same strategic character as a Catchment Management Plan, yet it entails more detailed strategies and explicit links with spatial planning initiatives. In pursuit of an adaptable TE2100 plan, a 'scientific pragmatism' frame was adopted, as we will show in the remainder of this section.

5.1. Managing uncertainties by 'sound science'?

The Thames Estuary is described as 'a dynamic, ever-changing system which through this century will face increasing and new challenges' (TE2100 Plan, p. 25). The plan presents five challenges, namely climate change, future socio-economic developments, the deterioration rate of existing flood defences, changes in the physical environment (e.g. soil subsidence), and a low public awareness of flood risks. At the same time, these challenges represent the main uncertainties mentioned in the plan.

On the one hand, the TE2100 Plan highlights that uncertainties are inevitable. For example, the technical report of the TE2100 Plan (p. 4) stresses that 'the fact remains that any people and property in the floodplain will always remain at risk of flooding however solid and extensive the defences may be'. Moreover, the Thames Estuary is described in terms of a social-ecological system. Besides mentioning its dynamic and emerging character, the Thames Estuary is labelled as 'a successful compromise of a thriving man-made landscape coexisting with a rich and diverse estuarine environment' (TE2100 Plan, p. 25), stressing the influence of human and ecological factors alike.

On the other hand, the TE2100 Plan also reassures that it is possible to deal with uncertainties: 'We cannot know what the future holds but we have assembled the evidence showing the demands that will be made on our flood risk management system through changing climate, socio economic change and the fragile natural environment' (TE2100 Plan, Technical Report, p. xxiv). Uncertainties about climate change and socio-economic developments are made

most salient, with climate change as 'the greatest challenge in terms of future uncertainty' (TE2100 Plan, p. 25). For both, working with scenarios is seen as a solution. Furthermore, the emphasis lies on 'sound science', building an 'evidence base', and carrying out 'studies' and 'investigations' to build a 'firm foundation' for the plan, which can be linked back to the technical nature of flood risk management: 'We have built up a comprehensive evidence base of data and results with over 300 studies and investigations. This evidence provides a firm foundation to our TE2100 Plan' (TE2100 Plan, p. 40).

The strong focus on generating more knowledge in the light of deep uncertainties is somewhat paradoxical (see section 2). This paradox becomes more clear when looking at how the involved actors aim to create an 'adaptable plan'.

5.2. An 'adaptable plan' – scientific pragmatism at its best?

The idea behind an 'adaptable plan' is that interventions to manage tidal flood risk can be adjusted to changing circumstances over the 100 year time span of the plan. For this purpose, the TE2100 Plan promotes several smaller interventions over a longer time period instead of one single intervention, e.g. a large-scale storm surge barrier at the opening of the Thames Estuary. That way, the plan is argued to be 'adaptable to a changing climate to ensure that the actions that are taken are the right ones, taken at the right time and will not waste money on over-engineered solutions' (TE2100 Plan, p. 29).

To recognize when intervention is needed, the plan suggests monitoring 'ten key indicators', also referred to as 'triggers for change'. These indicators comprise hard and soft indicators, ranging from 'mean sea level rise' to 'land use planning and development activities' and 'public/institutional attitudes to flood risk'. The outcomes from this monitoring programme should inform the regular reviews of the plan and trigger decision-making if rapid change occurs in one or more of the indicators. References to the technical nature of flood risk management are made. The consultant involved in making the plan states: 'well, what happened was, we, being technical, basically it was a technical solution to a problem'.

The general idea of an adaptable plan has been specified in a decision-making tool, referred to as 'the route-map approach' and 'decision pathlines' by our interviewees. The plan itself shows this approach for two different flood risk management options in the Thames Estuary, called 'maintaining the existing system' and 'a new barrier' (see Figure 1). The 'decision pathlines' provide an overview of the interventions belonging to that particular option, how these interventions can be implemented in stages, and which indicators have to be kept track of to see when intervention is needed. For each intervention, the plan presents an implementation point (the moment in time when the intervention needs to be in place) and a decision point, which lies 10–20 years before the implementation point to cover for lengthy decision-making processes.

With respect to identifying the options, the consultant involved in making the decision pathlines explains, though, that 'in fact a lot of this is pragmatism'. Also the initiator of the plan considers himself a 'pragmatic scientist', thereby stressing both the need for pragmatism and the continuing importance of science. A major difficulty, though, is putting the monitoring system into practice. Some indicators, for example mean sea level rise, are easier to monitor than others (e.g. public/institutional attitudes to flood risk). The main consultant criticized: '[…] quite a lot of the information is around, but some of the

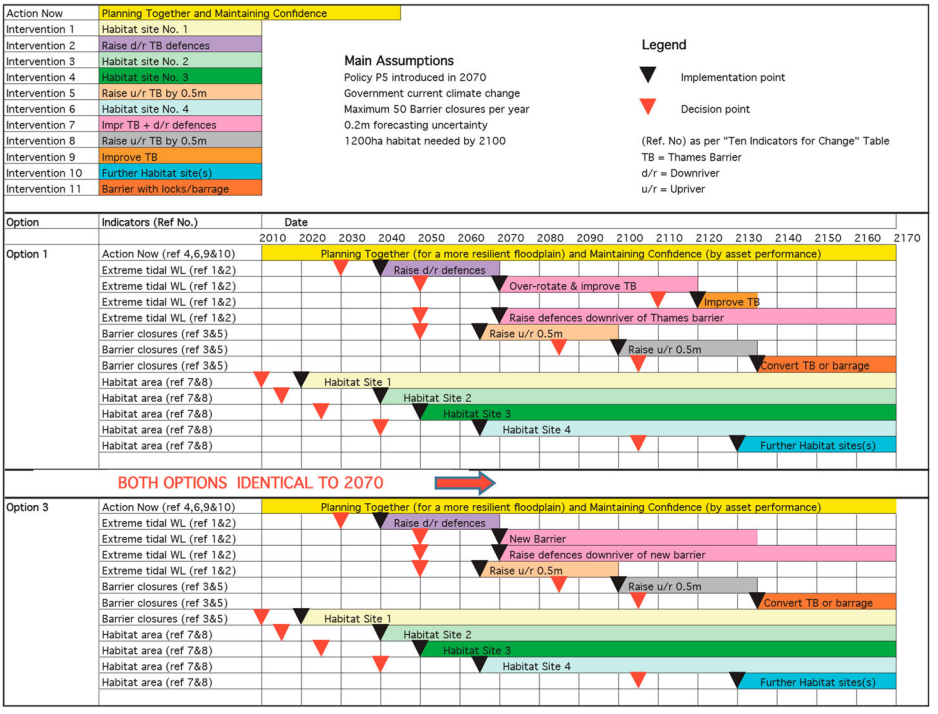

Figure 1. The 'route-map approach', comparing the 'frontrunner options' through the century (Source: TE2100 Plan, p. 38).

more difficult things are not being monitored, for example erosion deposition is not being monitored, and that's important for the defences'. Another challenge is that merely doing the monitoring does not yet tell you when to act. The initiator of the plan said: 'I always said the risk of this approach is, (…) you will take an optimistic view on the monitoring and you'll put off the decision'. In 2015, the EA was working on refining the monitoring system to define the 'bounds of acceptability' for each indicator. It also led to the conclusion that biophysical indicators (e.g. mean sea level rise) are more thoroughly and frequently monitored than socio-spatial ones (e.g. public/institutional attitudes to flood risk).

5.3. About 'estuary-wide options' and 'floodplain management'

According to the TE2100 Plan, adaptability is not only related to the timing of interventions, but also the ability to change between options, which refers to the actual content of the plan. Hinting at building adaptive capacity on land, the TE2100 Plan argues that both elements of flood risk – probability and consequences – need to be managed. Moreover, the plan states that they have been very successful in managing the probability of flooding, while having been less successful in managing the consequence of flooding. The TE2100 Plan then differentiated between estuary-wide options and floodplain management.

Searching for estuary-wide options, the EA in-house team identified 4 high-level options: (1) improve the existing defences, (2) tidal flood storage, (3) new barrier, (4) new barrier with locks. From these, option 1 and 3 are presented as 'frontrunner options'. Comparing both options (see Figure 1) shows that they are actually identical with the only difference

that option 1 suggests improving the Thames Barrier by 2070, whereas option 3 suggests building a new barrier by 2070. For the rest, both options suggest the same interventions and the same timing of these interventions, namely raising upstream and downstream river defences and using habitat sites for creating more space for river water. Option 4, building a barrier with locks, would be a more extreme version of option 3, building a barrage to block the tides out. Only option 2, using habitats for tidal flood storage, would be a more spatial instead of a technical approach to tidal flood risk. Interestingly, this option has already been ruled out; 'it is not very realistic' (interviewee EA, implementation team) and was eliminated because of doubts 'about the impact and effectiveness of this measure in times of long-lasting surge tides' (interviewee consultant, EA in-house team).

Next to the estuary-wide options, the plan emphasizes the importance of 'floodplain management' to keep the riverside free from development and leave room for adjustments in the future. For particular areas, the plan suggests an improved emergency response and building flood resilience, for instance by flood proofing buildings. However, emergency response and land use planning lie outside of EA control and depend on the capacities and willingness of local boroughs and local resilience fora comprising, amongst others, the fire department and the police. If, and to what extent, floodplain management will actually be implemented remains questionable. Local stakeholders, including the local boroughs, often lack the awareness and willingness, as the following quote from an interviewee from the EA shows:

> the boroughs just go 'well, I can't just put anything in there you know, I've got to pick and choose and I don't understand why this is that important, we've got the barrier, we're not worried'.

Local boroughs lack political 'buy-in', as flood risk is not a topic (local) politicians are very interested in. Keeping space free in a city where land and property prices are excelling is nearly impossible, in particular at the waterfront. Also within the EA, there is a considerable mismatch between 'asset management' (i.e. the hard infrastructure, flood defences side) and 'floodplain management' and other resilience-building measures such as raising awareness, spatial planning and improving emergency response to reduce flood risk. According to an interviewee from the EA (working for the floodplain management side), asset management is 'where the money is' and bringing floodplain management onto the EA agenda is 'a bit of a cultural shift for the agency in terms of how it works'.

Overall, the 'scientific pragmatism' frame led to a clear course of action, yet it did not generate sufficient support on local levels, making the implementation of floodplain management and other resilience-building measures more difficult.

6. The Dutch Delta Programme: the 'joint fact-finding' frame

The current DP was triggered by increasing concerns about climate change, flood risks and water shortages. Like the TE2100 Plan, it is an addition to existing policies. The content was developed in a parallel policy-making process on the national and regional level between 2010 and June 2014, resulting in national and regional policy strategies for flood protection and freshwater supply. Decisions from the DP were incorporated into existing policy instruments, such as the National Water Plan and the Flood Protection Programme. In developing strategies, a 'joint fact-finding' frame was adopted.

6.1. Managing uncertainties by 'joint fact-finding'?

Uncertainties surrounding climate change, future flood risk and potential water shortages stand central in the Dutch DP. Contrary to the TE2100 Plan, the DP (2010, p. 68) explicitly speaks of a complex system, stating that 'the system is complex and knowledge of many parts is, by definition, incomplete'. In that text segment, the system is not defined. In other parts, however, the word 'system' relates to the 'water system', which is 'interconnected' (DP, 2013, p. 32), as the main water system and the regional water systems form 'a cohesive whole' (DP, 2011, p. 13), put under pressure by climate change and spatial developments (DP, 2011, p. 68). The emphasis clearly lies on the biophysical side of the system: the 'key "controls" in this interconnected water system (…) determine the playing field of solutions' (DP, 2012, p. 32), with 'controls' referring to measures for discharge distribution.

The DP (2010, p. 68) explicitly states that 'uncertainty is unavoidable, but can be made manageable'. The DP followed the English example in making climate change and socio-economic developments the most salient uncertainties, which are then dealt with by the so-called 'Delta Scenarios'. Similarly to the TE2100 Plan, knowledge is seen as 'a key foundation' (DP, 2011, p. 45). The Netherland's position as 'world leader' in water management, building on 'expertise amassed over centuries' is frequently emphasized (DP, 2011, p. 7). However, the DP (2010, p. 44) also stresses that people might have different perspectives on uncertainties and therefore new knowledge needs to be created together:

> A collective approach to developing knowledge increases the quality and the support base of the solutions, which is why (…) considerable importance is attached to such methods as joint fact-finding.

The aim of joint fact-finding is then defined as optimizing 'the collection and use of knowledge from all stakeholders and to create a broad support base for newly generated knowledge' (DP, 2010, p.44). The focus on a collaborative effort can be found in the governance structure. In contrast to the English case, the Dutch DP chose to have several parallel working groups on the national as well as regional levels, developing strategies for different topics and areas. Joint fact-finding also meant that, for each region/topic, several public servants and organizations operating in the region were invited to several knowledge-sharing sessions.

6.2. 'Adaptive Delta Management'

The Dutch DP was inspired by the English 'route map approach', developing the 'Adaptive Delta Management' approach, with 'delta' to provide a clear Dutch connotation. ADM is supposed to be 'a transparent way of including uncertainty around future developments in decision making' (DP 2011, p. 48). Similarly to the English, the Dutch DP presented it as a financially responsible, down-to-earth approach, in which intervention should not be tailored to worst-case scenarios. According to the DP (2011, p.45), the approach entails 'doing what is necessary, neither too much nor too little, while not ruling out future options'.

Similarly to the English case, adaptability is linked to an economic argument; phasing strategies and measures is economically beneficial, as investments are spread over time. The ADM approach was developed by a small group of people on the national level.

The initiator of the ADM approach joined forces with two economists from different consultancy agencies. The consultants were asked to develop the ADM approach further, searching for methods to enable 'strategy and decision-making under deep uncertainty' (subtitle of Handreiking ADM, 2012), while 'considering the Delta Programme as investment issue' (title of the first explorative report from one of the consultancies). Economic methods to deal with uncertainties, in particular 'real options analysis', were tested, but there were too many unknowns to make this method work. They therefore used sophisticated cost–benefit-analyses to evaluate options, labelling it 'real options thinking' (interview consultant).

Based on the guidance from the national level, the sub-programmes were asked to apply ADM in their strategy development. The final 'deliverable' was to develop 'adaptation pathways', the Dutch equivalent to the English 'decision pathlines'. For this purpose, several strategic options were evaluated in terms of costs and benefits, and against a regional interpretation of the 'Delta Scenarios'. Strategies were supposed to be 'robust' (i.e. working under all scenarios) and 'flexible' (i.e. switching to another strategy possible). In developing the adaptation pathways, attention should also be paid to so-called 'tipping points'. Tipping points are moments in time when a measure reaches its 'sell-by date' and a new measure needs to be taken.

According to the initiator, ADM represents an attitudinal shift: 'what you actually do as a government, is, you do not emanate that you know everything, but you take the responsibility by portraying the challenge and by being transparent about the uncertainties and the reasons why you take or post-pone certain decisions'. A member of the programme team Rijnmond-Drechtsteden renders long-term thinking as the real change; thinking ahead 100 years gave a feeling of 'everything is possible', which 'broadened the options'. All interviewees confirmed that the general attitudinal shift made sense to the people in the sub-programmes; the whole methodology behind ADM, however, was experienced as 'difficult' and 'complicated'.

The sub-programme Rijnmond-Drechtsteden could not identify tipping points, concluding that 'today's system suffices' (Rijnmond-Drechtsteden, 2014); although everything can be done 'better, smarter, more efficient, more beautiful, and cheaper', there is 'no moment where you need to change your strategy fundamentally' (interviewee programme team member). The visualization of adaptation pathways changed over time from a more technical representation (similar to the English 'route-map approach') to something that resembles an 'implementation programme' (see Figure 2), something that 'can be explained to a policy maker within ten minutes' (interviewee Delta Staff member). Different to the English case, the Dutch have not yet specified a detailed monitoring system, but aim to do so in the future (DP, 2014).

To conclude, the Dutch DP attempted to develop a more generic ADM methodology based on the route-map approach from England, but because of the collaborative set-up of the DP, it stays closer to the policy-makers world. The top-down initiation of ADM led to a lack of ownership in applying ADM in the sub-programme Rijnmond-Drechtsteden.

6.3. About 'adaptive dikes' and 'dikes as spatial concepts'

Content-wise, the sub-programmes were asked to filter strategies over the years. Until 2012, the sub-programme Rijnmond-Drechtsteden developed five so-called 'possible

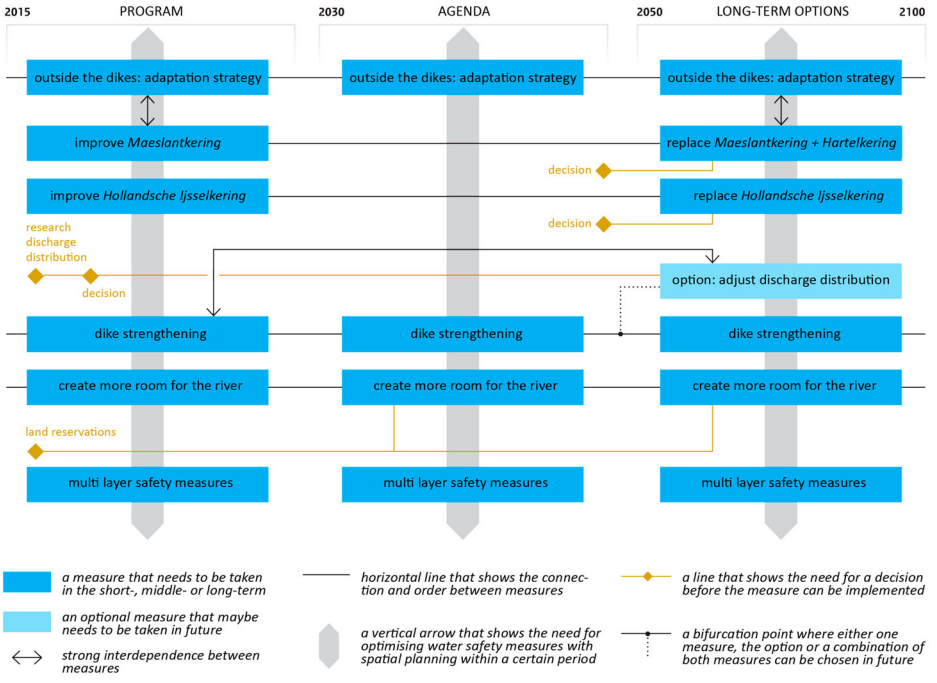

Figure 2. 'Adaptation pathway' from sub-programme Rijnmond-Drechtsteden (Source: translated from Rijnmond-Drechtsteden, 2014).

strategies' (Rijnmond-Drechtsteden, 2012). In 2013, they distilled two 'promising strategies' (Rijnmond-Drechtsteden, 2013), before presenting the final 'preferred strategy' in 2014. Accordingly, there was little time between thinking broad ('everything was possible', see section 2) and setting out a preferred course of action.

Large-scale engineering options (such as closing of the sea with a closed dam) and more ecology-friendly options (i.e. opening up parts of the defence line towards the sea) were quickly ruled out. Interestingly, only one of the five possible strategies (i.e. 'dealing differently with water') looked beyond merely the water system, focusing on reducing the consequences of flooding by spatial planning and disaster management measures. In that respect, the narrow definition of the system (as 'interconnected water system', see Section 6.1) clearly influenced the strategy development.

The preferred strategy for the Rotterdam region focusses on optimizing today's strategy, which implies first and foremost increasing protection levels. Dikes as well as sluices and barriers are supposed to be continuously improved. Creating more space for rivers is generally considered a useful measure, yet, within the preferred strategy, it is merely held effective in one part of the region (i.e. river *Merwede*). A stronger focus on reducing consequences through flood-adapted building and evacuation measures is suggested only for the few unembanked areas (e.g. Stadshavens in Rotterdam) and the Island of Dordrecht (the second biggest city in the Rijmond-Drechtsteden region). Unembanked areas lie outside of today's defence system, and the Island of Dordrecht had already started experimenting with a more holistic approach to water before the DP actually started (van Herk et al., 2011).

Still, the DP (2012, p. 11) emphasizes that 'flood risk management is a complex area and forms a linked issue with spatial planning'. This link is also emphasized in Rijnmond-Drechtsteden's final advice (2014, p. 6), although they start reasoning from dikes: 'We see every dike as a spatial concept and an opportunity to integrate the dike better into its spatial surrounding.' For example, most dikes in the city of Rotterdam shall become 'strong urban dikes' that enable waterfront development because the dike itself can include shops or parking garages. That way, they make a predominately preventive strategy sound more spatially contextualized. It will not increase the adaptive capacity of the hinterland, though. The flood risk management strategy remains basically the same, it is only decorated differently.

The preferred strategy is considered adaptive, because it requires only gradual adjustments to the existing system (Rijnmond-Drechtsteden, 2014). Following this line of reasoning, one of our interviewees from Rijnmond-Drechtsteden framed also dikes as being adaptive:

> I think the advantage of today's system is that it is already quite adaptive. A dike is vastly adaptive; (…) every year you add a layer of asphalt on top and it is already enough. Not extremely adaptive in that sense, (…) but with the dikes we have already adapted the last 300 years.

Overall, the 'joint fact-finding' frame in the Dutch case fostered a different governance approach than the TE2100 Plan, but there are striking parallels between the preferred strategies for the Rotterdam and London region. The variety of options got quickly narrowed down and optimizing the existing flood defence system eventually stood out as most promising and cost-efficient strategy in both cases. Interestingly, in the Rotterdam case the meaning-making process resulted in the conclusion that the existing system has been adaptive all along.

7. Discussion

Both cases show that the emergence of 'adaptive' long-term flood risk management strategies is accompanied by a new policy language, emphasizing 'uncertainties' and 'interconnected systems' and introducing terms such as the 'route-map approach' and 'adaptation pathways'. The Dutch DP uses language that can more clearly be related to evolutionary resilience (e.g. 'complex system' and 'tipping points'). In the English case, this terminology is less prevalent, but still detectable (notion of a 'social-ecological system', inevitability of uncertainties).

The framing of uncertainties differs slightly between the two cases. Although the same uncertainties are made salient (i.e. climate change and socio-economic development), the Dutch DP also stresses the existence of multiple perspectives and differing views, leading to a more collective governance approach than in the English case. This is likely to be culturally motivated, as it builds on the tradition of the 'Dutch polder model', emphasizing decision-making based on building consensus (Ashworth, Graham, & Tunbridge, 2007). The TE2100 Plan on the other hand puts stronger emphasis on additional studies and investigations to gain more knowledge about the estuary and improve the evidence base. This conceptualization fits well into the English policy-making context, with its general push for 'evidence-based policy-making' (Clarence, 2002), and into English

flood risk management, which has been characterized with 'lost knowledge' and 'outsourced expertise' (Haughton, Bankoff, & Coulthard, 2015, p. 375). In both cases, the interpretation of uncertainties hence depends on the national context and the respective flood risk management debates.

Strikingly, both cases return to scenario planning as a means to deal with uncertainties, which was already introduced to strategic planning in the 1970s (Chakraborty & McMillan, 2015). The power of scenarios is to think in multiple futures, and prepare different courses of action accordingly. In that sense, it is interesting that both cases have striven for a bandwidth of options, yet quickly narrowed them down to the option that keeps the existing strategy and system more or less in place. Although keeping the system in place might prove to be a good choice, it also begs the question if representatives from governmental authorities – being part of this existing system – are able to take a broader view. Gralepois et al. (2016) refer to this as the 'stickiness of the technocentric policy regime'.

Similarly, the framing of adaptability is more process- than content-oriented in both cases. Adaptability is mainly framed as phasing different interventions over time; these interventions, however, are mostly aimed at lowering the probability of flooding, less on managing the consequences of flooding. Building adaptive capacity behind the existing flood defence systems is rarely mentioned. The preferred strategies focus more on conversation instead of transformation. Notably, both cases assume that they can know when to switch to another intervention or even a fundamentally different course of action, postulating a certain degree of predictability. In the English case, this thought is given form in terms of a rather detailed monitoring system. However, this case also shows that operationalizing such a monitoring system is rather difficult (i.e. are the relevant indicators monitored in the right way?). Framed as a 'technical solution to a problem', it comes across rather 'depoliticized', although if and how monitoring results are acted upon remains a political choice.

Operationalizing adaptability in such a way offers several advantages. It builds on longstanding institutions and competencies. Moreover, flood risk management remains organized as a public good, providing 'protection for all'. On the other hand, postponing political choices leads to financial uncertainty: who guarantees that there will be enough money for future interventions? Eventually, the biggest uncertainty might actually stem from within the systems associated with the policy cases discussed, instead of outside of it.

Although we can see an adoption of resilience language in both policies, manifested in the emphasis on uncertainties and the emergence of 'adaptive' strategies, the changes in actual practice are so far less fundamental than evolutionary resilience would suggest. Up to now, the newly introduced 'resilience narrative' is accommodated in a rather technical-rational way, using established methods such as scenario planning and monitoring to 'manage' uncertainties. Interestingly, other authors have shown that previous 'turns' in flood risk management have been accommodated in a similar way. In relation to Dutch flood risk management, Lintsen (2002) showed that the 'ecological turn' during the 1960s was translated to ecological norms and standards, whereas van den Brink (2009, p. 245) concluded that the 'managerial turn' during the 1980s was incorporated through 'performance indicators, targets, norms, standards, service level agreements, benchmarks, assessments, accounting procedures'. In this light, the emergence of 'adaptive' flood risk management strategies as a marker of a 'resilience turn' shows similarities with previous turns.

8. Conclusions

Overall, we can conclude that while the resilience concept is gaining prominence, its conceptual fuzziness leaves enough room for policy-makers to interpret it in their own way. Analysing the framing processes of flood risk management strategies in the London and Rotterdam region shows that resilience is far from 'depoliticized', as other authors have already mentioned (Keck & Sakdapolrak, 2013; Pelling & Manuel-Navarrete, 2011). If and how resilience thinking is adopted, is influenced by a discursive process and often requires political choices. We therefore argue that interpretive policy analysis is an adequate method to unravel the meaning-making process in practice, paying attention to who has the power to exert influence, and also who stays in power.

Analysing the meaning-making process for two specific long-term flood risk management strategies reveals that, up to now, there is more an inclination towards maintaining and improving the existing system instead of transformating it. In that way, our findings are in line with White and O'Hare's (2014) statement that adaptive language can be enveloped in an engineered understanding. Moreover, based on these two cases, we conclude that the economic argument has gained importance. Both cases stress the importance to avoid over- and underinvestment; with the Dutch using economic thinking as a basis for the ADM approach. Although this 'economic turn' is not yet accompanied by government retreat, a concern raised by other authors (Chandler, 2014; Davoudi, 2016; Evans & Reid, 2014), this development needs to be closely monitored in the future. Especially considering the public value of flood risk management, it is interesting to examine to what extent this 'economic turn' occurs in other institutional and political contexts. In the English case, we can already see that 'floodplain management' and other resilience-building measures are downscaled to a lower level, although these lower tiers often lack the necessary knowledge, resources and power to implement these measures.

The above mentioned concerns raise the question to what extent the resilience concept is commensurable with flood risk management as a public good and value. An approach based more strongly on transformation seems to require a broader societal debate first: How much are institutions and societies able and willing to change? How can more adaptive capacity be built, while at the same time levelling out differences in capacities between individuals? What needs to be steered centrally, and what can be decentralized? To answer these questions, we encourage further research on unpacking the usage of the resilience concept in flood risk management practice, also in other European contexts. In doing so, we can learn from the regions of London and Rotterdam and apply 'sound science' and 'joint fact-finding' to better understand the meaning-making processes – preferably, this understanding should stem from collaboration between science and practice.

Note

1. The Thames Estuary 2100 Plan spans across the whole Thames Estuary, from Teddington in the west to Sheerness/Shoeburyness in the east. Administratively, it belongs to Greater London, Kent County and Essex County.

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Appendix: Overview policy documents

Thames Estuary 2100 Plan

Reference	Document name	Access	Date	Pages
TE2100 Plan	TE2100 Plan, Managing flood risk through London and the Thames Estuary	Public	Nov 2012	230
TE2100 Plan, Technical Report	TE2100 Plan, Technical Report	Not public, accessed via EA	Apr 2009	384
TE2100 Plan, Technical Report, Appendix A	TE2100 Plan, Technical Report, Appendix A, Screening of Options	Not public, accessed via EA	Nov 2009	29
TE2100 Plan, Technical Report, Appendix B	TE2100 Plan, Technical Report, Appendix B, Costing of Options	Not public, accessed via EA	Nov 2009	15
TE2100 Plan, Technical Report, Appendix D	TE2100 Plan, Technical Report, Appendix D, The Estuary Wide Options	Not public, accessed via EA	Nov 2009	335
TE2100 Plan, Technical Report, Appendix E	TE2100 Plan, Technical Report, Appendix E, Land Strategy Preliminary Assessment	Not public, accessed via EA	Dec 2009	47
TE2100 Plan, Technical Report, Appendix F	TE2100 Plan, Technical Report, Appendix F, Approach to Adaptation	Not public, accessed via EA	Oct 2009	152
TE2100 Plan, Technical Report, Appendix H	TE2100 Plan, Technical Report, Appendix H, Appraisal in TE 2100	Not public, accessed via EA	Nov 2009	112
TE2100 Plan, Technical Report, Appendix J1	TE2100 Plan, Technical Report, Appendix J1, Consultation Phases 1–3	Not public, accessed via EA	not dated	18
TE2100 Plan, Technical Report, Appendix J2	TE2100 Plan, Technical Report, Appendix J2, Consultation Phase 4	Not public, accessed via EA	Oct 2009	33
TE2100 Plan, Technical Report, Appendix K	TE2100 Plan, Technical Report, Appendix K, The TE 2100 Studies	Not public, accessed via EA	Oct 2009	88
TE 2100 Plan, Technical Report, Appendix L	TE 2100 Plan, Technical Report, Appendix L, Climate Change	Not public, accessed via EA	Apr 2009	211
Thames Estuary 2100, Monitoring of Key Indicators	Thames Estuary 2100, Monitoring of Key Indicators, Outline Monitoring Specification	Not public, accessed via EA	Dec 2011	59

Delta Programme (national and Rotterdam region)

Reference	Document name	Access	Date	Pages
DP 2010	The 2011 Delta Programme, Working on the delta – Investing in a safe and attractive Netherlands, now and in the future	Public	Sep 2010	102
DP 2011	The 2012 Delta Programme, Working on the delta – Acting today, planning for tomorrow	Public	Sep 2011	82
DP 2012	The 2013 Delta Programme, Working on the delta – The road towards the Delta Decisions	Public	Sep 2012	118
DP 2013	The 2014 Delta Programme, Working on the delta – Promising solutions for tasking and ambitions	Public	Sep 2013	129
DP 2014	The 2015 Delta Programme, Working on the delta – The decisions to keep the Netherlands safe and liveable	Public	Sep 2014	175
Handreiking ADM	Handreiking Adaptief Delta Management	unpublished, accessed via archive	Aug 2012	102
Rijnmond-Drechtsteden 2011a	Probleemanalyse Deltaprogramma Rijnmond-Drechtsteden	Public	Sep 2011	32
Rijnmond-Drechtsteden 2011b	Regionale Deltascenario's Rijnmond Drechtsteden	Public	Dec 2011	90
Rijnmond-Drechtsteden 2012	Verkenning mogelijke strategieën voor Rijnmond-Drechtsteden	Public	Aug 2012	70
Rijnmond-Drechtsteden 2013	Kansrijke strategieën voor Rijnmond-Drechtsteden	Public	Jun 2013	112
Rijnmond-Drechtsteden 2014	Advies Deltaprogramma Rijnmond-Drechtsteden	Public	Jun 2014	42