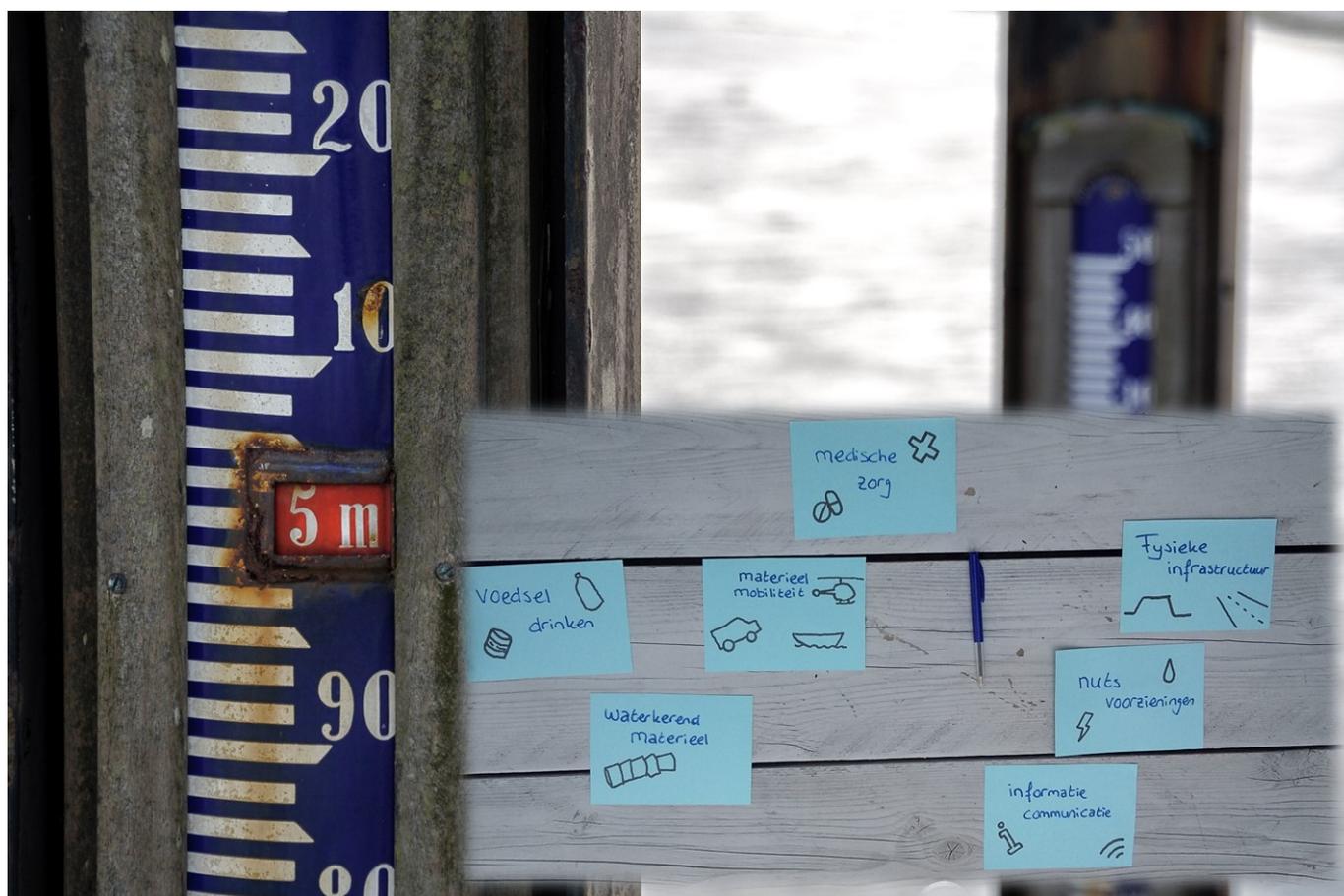


Helping hands during a flood

A study of community capacity during the potential flooding of Alblasserwaard Vijfheerenlanden



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Helping hands during a flood: a study of community capacity during the potential flooding of Alblasserwaard Vijfheerenlanden

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Researched within the framework of



Carried out for



In close collaboration with



Contents

Contents	3
Summary	4
Chapter 1. Introduction	8
1.1 Multi-layer safety in the A5H area.....	8
1.2 Seeking synergy.....	8
1.3 Research	9
1.4 Reading guide and terminology	10
Chapter 2. The principles of community capacity in A5H.....	12
2.1 The principles of community capacity	12
2.2 The social network of Alblasserwaard Vijfheerenlanden.....	14
2.3 The principles of community capacity in A5H.....	16
Chapter 3. A5H flood scenarios	19
3.1 Flooding by river water	19
3.2 Flooding by storm surge at sea	20
Chapter 4. Synergy in the ‘warm’ phase	22
4.1 Evacuation because of imminent flooding by river water	22
4.2 Evacuation because of imminent flooding by storm surge at sea.....	24
4.3 Escaping the flooding of A5H	25
4.4 Rescue after the flooding of A5H.....	26
Chapter 5. Recommendations for the ‘cold’ phase	28
5.1 Prepare a network	28
5.2 Take key decisions	29
5.3 ‘Many channels, one message’	30
5.4 Identify places of refuge.....	31
5.5 Facilitate decentralized coordination (‘many to many’)	32
5.6 Acknowledge the value of community capacity	33
Chapter 6. Reflection.....	34
6.1 Reflection from four expertise domains.....	34
6.2 What does A5H teach us about the Netherlands and north-west Europe?	36
6.3 In conclusion.....	37
Appendix 1. Bibliography	38
Appendix 2. Interviews and design sessions	41

Summary

Study scope

Ablasserwaard Vijfheerenlanden (abbreviated as A5H) is a polder in the Dutch river area, low-lying land that is protected from flooding by dikes. Although these dikes offer protection, the Dutch government also wishes to explore extreme scenarios in which the dikes are threatened by high water levels and evacuation becomes necessary. However, the evacuation of more than 230,000 inhabitants from a polder surrounded by rivers, and rescue operations if a flood has occurred, is, as one can imagine, a huge operation. Governmental capacities for this kind of operation (with a very low probability but a high impact) are limited. The expectation is, however, that if a flood is imminent, the local community will also contribute to the operation; for instance by informing each other, helping vulnerable people during evacuation, or by providing food for first responders.

In this research we will explore this combination of community capacity and governmental capacity. The main research question is therefore: how can synergy between community and governmental capacity arise in the event of the flooding, or imminent flooding, of A5H, and what steps can be taken to support this? To answer this question we conducted an empirical study that included desk research and interviews. Three design sessions with experts were also held, in which we designed concepts and approaches contributing to the synergy between community and governmental capacity.

Principles of community capacity in response to flooding

In the literature and in Dutch case studies of community capacity during crisis situations, we distinguished four general principles for community capacity to respond to flooding:

1. *Mutual self-reliance*: the civil society contribution in the event of imminent or actual flooding begins with the acknowledgement of the resilience of communities. People in communities have the capacity to respond to a situation of such flooding, and their response and help is essential in such a situation.
2. *Leadership*: governmental leaders and community leaders stimulate civil society contributions through the decisions they take and the messages they spread.
3. *Unambiguity*: a clear, unambiguous message provides direction to, and room for, communities to contribute.
4. *Joint responsibility*: the dynamics and mobilizing power of communities differ from the professional, institutionalized approach of governments. These approaches strengthen each other when joint responsibility is experienced.

The A5H region is characterized by comparatively high levels of social cohesion and entrepreneurialism. Its relatively small villages have close-knit networks. Its urban areas also show relatively strong social cohesion, although mutual interdependence and familiarity are, for reasons of scale, weaker. A5H is an entrepreneurial region, with many businesses and family firms historically linked to the area. The region possesses a comparatively large amount of equipment, such as excavators, building materials, pumps and ships. Food and drink stocks are

available in only limited amounts, and for medical care residents are directed towards hospitals in cities bordering, or outside, A5H.

We examine the opportunities for community capacity by reference to these four principles. The A5H region is characterized by a relatively high level of mutual self-reliance, particularly thanks to the combination of social cohesion and entrepreneurship. There are, of course, urban districts in which these networks are weaker. The availability of leadership varies between rural and urban areas; villages generally have a small number of prominent figures who are well known in the community, but in urban areas this role is tied to institutions, for instance the chair of an association, a minister, or a neighbourhood police officer. Unambiguity is an important area of attention. Alongside the Dutch culture of water safety directed towards the prevention of flooding, A5H is characterized by a certain intractability and mistrust of the authorities. Substantive unambiguity is therefore essential to the clear communication of urgency and concrete action perspectives. The potential for community capacity is present, but at the same time it is dynamic, creative, and impossible to manage centrally. This demands a partnership in responsibility, in which inhabitants feel co-responsible for safety and its preconditions, and in which the authorities facilitate this involvement from the standpoint of a clear objective.

Synergy between community and governmental capacities in the event of A5H flooding

The threat of flooding in A5H originates from either the rivers or from the sea. In the first scenario, excessively high water levels in the rivers could result in dike failure. These high water levels can be predicted a few days in advance. If the dike should fail, the flood would affect the whole A5H area and could result in floodwater depths of up to 6 metres. In the second scenario a storm causes unusually high water levels in the North Sea. If the Maeslandtkering storm surge barrier should fail, these high water levels would reach A5H. This would lead to dike failure, and a flood would occur in the western part of A5H, resulting in flood depths up to 2 metres (except for certain specific locations). In comparison with the first scenario this flooding can only be predicted at short notice.

For both these scenarios we analysed how synergy between community and governmental capacities could arise. The results are summarized in the table below. We distinguished three phases: evacuation (flooding is imminent), escape (during the flood), and rescue (the start of rescue operations in the flooded area). In the evacuation phase we found significant differences between both flood scenarios. During the flight and rescue phases these differences became less significant.

	<i>Evacuation (high water levels in the rivers)</i>	<i>Evacuation (storm surge, high water levels on the sea)</i>	<i>Escape</i>	<i>Rescue</i>
General	<ul style="list-style-type: none"> • Everyone has to leave 	<ul style="list-style-type: none"> • ‘Keep calm and go east’ • Horizontal and vertical evacuation 	<ul style="list-style-type: none"> • Escape is evacuation under pressure 	<ul style="list-style-type: none"> • All help is needed
Community capacity	<ul style="list-style-type: none"> • Evacuate yourself and help others • Follow your usual routines 	<ul style="list-style-type: none"> • Follow the instructions • Help your neighbours 	<ul style="list-style-type: none"> • Help each other to safe havens • Decentralized communication 	<ul style="list-style-type: none"> • Vessels • Decentralized communication

Synergy between governmental capacity and community capacity	<ul style="list-style-type: none"> • Facilitative actions • Clear, visible message in which specific actions are promoted 	<ul style="list-style-type: none"> • Top-down coordination • Authoritative decision-making • Ask communities for help 	<ul style="list-style-type: none"> • Safe havens • The right call • Decision-making under pressure 	<ul style="list-style-type: none"> • Smart allocation of tasks • Inform people in the area
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Summary of community capacity and its synergy with governmental capacity in the event of A5H flooding

Recommendations

To achieve synergy during an imminent or actual flooding scenario, we must also look at the pre-flooding phase: which preparations should be made in advance in order to achieve synergy between community and governmental capacities during a flood? On the basis of our findings we give the following recommendations:

- *Understand the community networks*: explore whether access to community networks, for instance by local first responders (volunteer firefighters, local police) is available when flooding is imminent.
- *Formulate key decisions*: explore dilemmas related to the far-reaching decisions that the authorities are confronted with when a flood is imminent. This could lead to the formulation of key decisions as part of emergency response plans, together with a limited number of flood scenarios.
- *One message, many channels*: formulate a single clear message through which urgency is visualized and specific actions are promoted. Spread this message through all available communication channels. This could also become part of crisis management exercises.
- *Safe havens*: gather information about the limited number of locations in A5H that are suitable for vertical evacuation. Be aware of opportunities to combine dike reinforcement and other spatial developments with the creation of additional ‘safe havens’.
- *Facilitate decentralized coordination* (‘many-to-many’): by developing online applications, governments could facilitate coordination without the use of a central agent. Offline, this coordination could be facilitated by appointing coordinators for this specific task.
- *Acknowledge community capacities*: the acknowledgement and appreciation of the contribution made by communities in responding to a crisis, such as imminent or actual flooding, is an essential condition. This is part of the organizational culture and could be strengthened through learning.

Lessons for FRAMES – north-west Europe

This exploratory research is part of FRAMES, the EU’s Flood Resilient Areas by Multi-layered Safety project. The most important contributions of this research to the FRAMES partners are the four general principles for developing the community capacity to respond effectively to flooding. These principles can be applied to other areas in order to explore how synergy between community and governmental capacities can arise. Besides these principles, the research resulted in four lessons for FRAMES.

Firstly, we found that the governance context of the Netherlands influences the synergy between community and governmental capacities in the event of A5H flooding. Flood prevention is a national task and the Dutch government promises ‘dry feet for citizens’. Consequently, people are

barely aware of flood risks and feel no responsibility to contribute to towards multi-layer safety layers 2 and 3. This can differ from country to country; for instance, flood safety in the UK is regarded as much more of a joint responsibility between state and society.

Secondly, in many FRAMES studies the importance of equality, mutual understanding and collaboration between communities and governments is underlined. These are essential parts of a flood-resilient area. This study confirms these findings, especially through the principle of 'joint responsibility' and its recommendations on the acknowledgement of community capacities. FRAMES partners could explore whether these findings could contribute to policy change.

Thirdly, the recommendation to facilitate 'many-to-many' coordination, in which no central agent is involved, is of interest to the international FRAMES partners. Modern communication channels offer many opportunities for decentralized coordination. An interesting question is how the change from 'one-to-many' to 'many-to-many' might impact the third layer of multi-layer safety in emergency response situations.

Finally, this research focuses explicitly on the community dimension of multi-layer safety. Multi-layer safety is not just about the physical characteristics of an area and the technical characteristics of water management, but should also include consideration of the social dynamics of communities. It is therefore recommended to include this social dimension in further research and policy practice on multi-layered safety.

Chapter 1. Introduction

1.1 Multi-layer safety in the A5H area

Alblasserwaard Vijfheerenlanden (A5H) is located in a transitional area that is at risk both of flooding from rivers and storm flooding from the sea. For this reason the authorities (municipalities, the province, the water boards, and the regional safety body) work together in A5H to safeguard water safety, and to improve it, using the concept of ‘multi-layer safety’. Current and future dike reinforcement works will reduce the likelihood of floods (the 1st layer). The ambition, however, is to further reduce the impact of possible flooding through spatial planning (the 2nd layer) and crisis management (the 3rd layer). Multi-layer safety in A5H has been a focus of study in recent years, with several studies being carried out within the framework of the EU’s Interreg project FRAMES.

If A5H were to be threatened with flooding the authorities would be confronted by an enormous challenge. Initial inventories of multi-layer safety in A5H have shown that evacuation of the area would not be straightforward and that the infrastructure itself is vulnerable (Procap literature study, 2017; Sweco meeting, 2018). Governmental aid would become available, but it is by no means clear, given these vulnerabilities, whether this would be adequate. Thankfully, the government is not the only body able to organize assistance. In a threatened or actual flood it is expected that inhabitants themselves will take action, and that a great many collective initiatives will arise (Baker, 2019; Boersma *et al.*, 2018; IFV, 2010). This might take the form of residents and companies passing on information; enabling evacuation by means of their own vehicles or boats; and providing shelter, food and drink to first responders or evacuees. In the absence of governmental management or direction, a community will organize all kinds of community capacity. This study focuses on the contribution made by this kind of community capacity in the threatened or actual flooding of A5H.

1.2 Seeking synergy

In the threatened or actual flooding of A5H it is expected that governmental capacity will be stretched to its limits, and it is in just this situation that community capacity can make a great difference. However, this requires that the types of aid being provided by the authorities and by the community do not obstruct one another and, ideally, that they reinforce each other. From the perspective of scientific research, three types of interaction between community capacity and governmental capacity may be distinguished (Odum, 1971; Teisman *et al.*, 2009):

- The community and the government *weaken* one another ($1 + 1 = 1$; also known as ‘interference’). For example: government information on the scale of the flood falters, and inhabitants start using their own communication channels. As a result the authorities gain an even less accurate picture of the scale of the flood.
- The power of the community is wielded *at the expense* of that of the authorities, or the power of the authorities is wielded *at the expense* of the community ($1 + 1 = 0 + 2$; also known as ‘parasitism’). For instance: the government takes over all communications on the scale of flooding, and inhabitants therefore stop communicating with each other directly and wait

passively for news from the authorities. This means that the authorities have a good picture of the disaster area, but its inhabitants do not.

- *Synergy*, in which the community and the authorities strengthen each other ($1 + 1 = 3$; also known as ‘symbiosis’). For instance: the authorities use residents’ social media networks to communicate about the disaster. By using the same networks, the inhabitants keep the authorities up to date on their findings and activities.

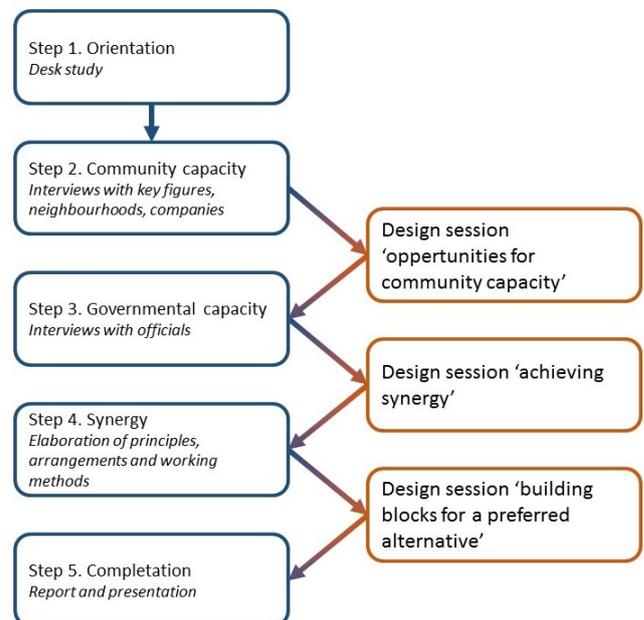
		Community capacity	
		Weak	Strong
Governmental capacity	Weak	Interference <i>Assistance is not achieved</i>	Parasitic <i>Community capacity impedes governmental capacity</i>
	Strong	Parasitic <i>Governmental capacity impedes community capacity</i>	Synergy <i>Assistance from both sources is strengthened</i>

Figure 1.1. Interaction types between community capacity and governmental capacity

In this study of the community capacity provided in the flooding of A5H, **we searched for synergy**: how can community capacity and governmental capacity in A5H strengthen one another? Which principles, arrangements and working methods could support this synergy? And which modifications of principles, arrangements and working methods would be needed to prevent the overall weakening of aid provision?

1.3 Research

This search for synergy between community capacity and governmental capacity took the form of a parallel process of research and design sessions (see figure to the right). The research process examined the situation in A5H step by step, starting with the characteristics of the community and its potential for community capacity. We then switched to the ‘official side’ to identify how governmental capacity could support this community capacity. The research process included a document study (see the bibliography in Appendix 1) and 16 interviews (see Appendix 2).



Three design sessions were held in parallel with the research process. Four experts were convened for these sessions: Professor Frans Klijn (Deltares), Dr. Fransje Hooimeijer (TU Delft), Professor Arwin van Buuren (Erasmus University, Rotterdam) and Dr. Iris Casteren van Cattenburch (independent). Depending on the theme of the design session, practical experts, such as professionals and residents, were also invited. In the three design sessions, the search for synergy followed a stepwise interactive method: (1) identifying the possibilities, opportunities and risks

for community capacity in the imminent or actual flooding of A5H; (2) developing a concept with an optimum combination of governmental capacity and community capacity for two scenarios (flooding from river water and flooding from a storm surge at sea); and (3) identifying the building blocks of a preferred alternative for two scenarios (as for Session 2) and two types of area (urban and rural A5H). The information documents used in, and the reports of the design sessions have been included in a separate appendix.

1.4 Reading guide and terminology

Reading guide

In this study we begin by examining the social network of A5H (Chapter 2). We then shift our focus to an imminent or actual flood: the characteristics of the imminent flooding of A5H (Chapter 3), what kinds of community capacity we can expect to emerge, and how synergy with governmental capacity can be achieved (Chapter 4). We then translate our findings into concrete proposals which can help, in the ‘cold’, preparatory phase with no direct threat of flooding, to bring about this synergy under conditions of imminent threat (Chapter 5). We close with some reflections from the perspective of various different areas of expertise, and with some lessons for other regions in the Netherlands and north-west Europe (Chapter 6).

Terminology

The study makes regular use of a number of terms and concepts that are commonly used in the literature on disaster management, imminent and actual flooding, and the A5H region. We provide a brief overview of these terms and concepts below.

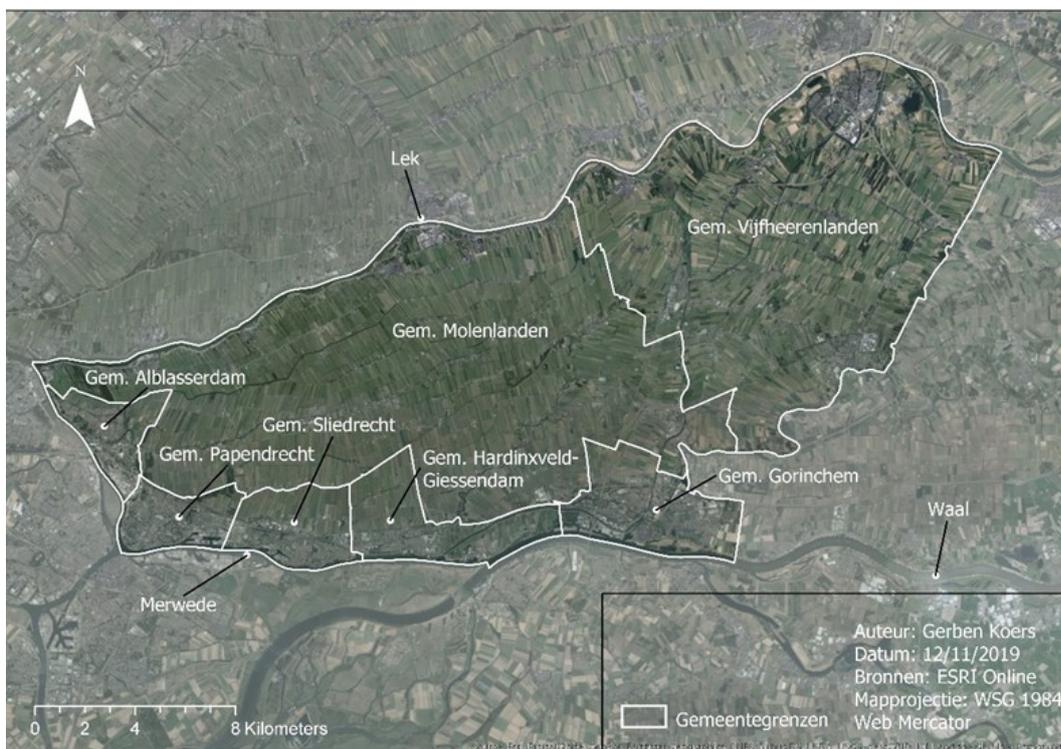


Figure 1.2: Base map of the Alblasserwaard Vijfheerenlanden (A5H) region

Alblasserwaard Vijfheerenlanden: delineation of the study area

The Alblasserwaard Vijfheerenlanden region (abbreviated as A5H) is the area lying between the Lek and Merwede/de Noord rivers, and bordered to the east by the Diefdijk. The area comprises the municipalities of Alblasserwaard, Papendrecht, Sliedrecht, Hardinxveld-Giessendam, Gorinchem and Vijfheerenlanden. The area is depicted in Figure 1.2 above.

Flood phases

In considering imminent or actual flooding a distinction is generally made between four phases. The first phase is 'preparation', also known as the 'cold' phase. In this phase there is no immediate threat of flooding. The other three phases together form the 'warm' phase, with a concrete threat of flooding. The second phase is 'evacuation'. In this phase the threat of flooding is posed by a storm surge at sea, for instance, or high rainfall in the catchment area of the river(s). If the threat is serious enough the authorities initiate evacuation of the area. In the third phase, 'escape', flooding has already begun. In this phase first responders will leave the area for safety reasons. Those remaining in the area are left to their own devices. The fourth phase, 'rescue', begins from the moment it becomes possible to start rescuing those left after evacuation. In some other categorizations this is followed by a fifth phase, one of rehabilitation and reconstruction. The present study focuses on crisis and disaster management and does not, therefore, take this fifth phase into consideration. An important concept to remember in these phases is the time it takes for a flood to occur. There can sometimes be a period of days between the moment a dike breaks and the moment that an area is inundated. This also means that the phases cannot always be neatly demarcated, and that the course of events can differ widely between different areas.

GRIP

The organization of crisis and disaster management in the Netherlands makes use of the so-called Coordinated Regional Incident Management (*Gecoördineerde Regionale IncidentbestrijdingsProcedure* or GRIP) procedure. There are five GRIP levels, each corresponding to a specific level and increased degree of danger and scale. For each GRIP level it has been decided which organizational structure should be employed and who is authorized to take decisions. If A5H is threatened by flooding, a GRIP level is first determined. This level can be later revised upwards or downwards, depending on developments (IFV, 2015; 2017; 2019).

Multi-layer safety

The principle of multi-layer safety means that mitigating the risks of flooding can be regarded as a layered activity. The first layer is the prevention of flooding through flood defences and dikes. The second layer concerns the attempt to limit the consequences of flooding through precautionary zonal planning. The third layer is formed by the crisis and disaster management response instigated by the imminent flooding of an area. After a flood has subsided, the recovery and rebuilding process could also be regarded as a fourth layer.

Resources

The threat of flooding generates a need for different kinds of resources. In this study we have considered the following types of resource: physical infrastructure, flood-defence equipment, transport equipment, food and drink, health care, utilities, information and communications. In so doing we aim to have provided the widest possible overview of the available resources.

Chapter 2. The principles of community capacity in A5H

2.1 The principles of community capacity

community capacity has four principles: mutual self-reliance, leadership, unambiguity, and appropriateness. These principles are defined on the basis of the literature and the expert sessions. They are principles which we describe here separately, but which have a direct effect on each other. For instance, mutual self-reliance and community leadership have a direct influence on one another, just as unambiguity can be strengthened by leadership – and vice versa.

Mutual self-reliance: people help one another in a crisis

The capacity for community capacity begins with the acknowledgement that communities are self-reliant, and that this self-reliance is of indispensable value in an imminent flooding situation. Whenever a disaster occurs, or threatens to occur, people always offer each other help. Research has shown that even now, in an age when the government is expected to take responsibility for many of the tasks associated with a possible disaster, civilians want to help and will do so. Their help is particularly associated with general processes for which great effort, but no specific knowledge is required: this can include providing shelter and care to victims, cordoning off an area, or helping to evacuate it (IFV, 2010; Oberije & Ros, 2017). Mention is often made of ‘self-reliance’, but these research studies have emphasized how civilians help each other, and in this sense we should speak rather of ‘mutual self-reliance’.

This mutual self-reliance is indispensable during imminent flooding, whose scale and impact is such that official channels are soon overwhelmed. When flooding is imminent a certain amount of central control is possible, but as soon as the evacuation of large areas is required, and certainly in the event of an actual dike breach, even this limited amount of control will decrease. The authorities then become increasingly dependent on the mutual self-reliance of the community. It is precisely when governmental capacity reaches its limits that a community’s mutual self-reliance becomes indispensable. Shaping this community capacity begins with the acknowledgement and appreciation of its value.

Leadership and clarity: giving guidance and objectives to community capacity

The scale and dynamics of the community capacity offered during a threatened or actual flood cannot be managed or controlled, but substantive clarity and personal leadership can give it valuable guidance.

Leadership makes it possible for community capacity to arise and for it to reach its full potential value (Bankoff, 2015). This leadership arises both in government and in society. Leadership in government is concerned with decision-making and with being the ‘face’ of information and coordination. It is precisely the scale and potential impact of flooding that place decisions under such pressure. This was seen, for instance, in the decision-making that surrounded the evacuation of the river area in 1995, in which a study of the communications concluded: *‘Different statements made by the mayor, the provincial authorities and the dike wardens led to confusion, while they undermined each other’s authority’* (Jong & Besselink, 2008, p.35; see also Box 2.1). The official Safety Regions and the GRIP system provide institutional support for decision-making, but even here it all comes down to personal leadership.

Communities will have local leaders who mobilize and coordinate others. Most of the coordination of community capacity takes place at the microlevel (IFV, 2010). Leadership at this local level emerges from the community itself, and is indispensable to overall coordination.

Box 2.1 Leadership in evacuation 1995 (from Jong & Besselink, 2008)

“Finally, the positive result of the successful evacuation operation was overshadowed by the confusion that surrounded administrative coordination. Both during and after the flood there were endless discussions about the responsibilities and powers of the administrative authorities. Why had the Minister of Internal Affairs intervened in the decision-making process? What was the role of the Queen’s Commissioners, and what was the position of the so-called ‘coordinating mayors’? From what level could the aid and disaster relief have been best coordinated? The process of ‘evacuation expansion’, in which the authorities felt pressured to take the decision to evacuate and civilians consequently felt pressured to leave, was another result of this confusion.” (pp.43-44)

The guidance of community capacity is also promoted by substantive clarity. A clear, unambiguous message motivates and activates people. This applies, firstly, to the message communicated about the imminent flooding situation. Clarity and unambiguity strengthen the sense of urgency and creates an action perspective in its listeners. Secondly, clarity is important in communicating the purpose of help. When the goal is clear, all aid actions will contribute more strongly towards it: *“But the most important thing is to formulate the goals; it gives both guidance and space for everyone’s actions”* (interview).

Partnership in responsibility: the dynamic between state and society

Combining the structures and professionalism of governmental capacity with the dynamics and power of community capacity does not go well automatically. It requires partnership in responsibility on both sides.

On the one hand, the community needs to show partnership in responsibility that is appropriate to the urgency and danger of a situation of imminent or actual flooding. Community capacity is offered voluntarily, but it is not free of obligation. In a disaster situation, certain frameworks are required to safeguard helpers’ safety. We saw an example of this in the Rotterdam harbour oil spill of 23 June 2018. Spontaneous helpers wanted to save oil-covered swans and went into the harbour – against police advice – in their own small boats or waders. This community capacity created a dangerous situation (see Box 2.2).

Box 2.2 Community capacity during the oil spill at Rotterdam (from IFV, 2019)

“They struggled to coordinate the volunteers who flocked to the scene. Some annoyance was voiced that there weren’t enough boats to catch all the swans. So people took independently to the water in their own boats, to ‘fish’ for swans, which led in some cases to dangerous situations. Via Facebook the police advised people not to try to catch swans without professional help. The Port Authority sent a patrol boat to go alongside passing ships and warn their skippers to go more slowly, so as not to create a wash, “because there are small boats with people catching swans”. And people standing in the water.” (pp.12-13)

On the other hand, it also demands partnership in responsibility from the authorities. The government may sometimes – with the best of intentions – overly dominate the organization of

community capacity. This leads to demotivation, however, and limits the dynamism that the community possesses. Partnership should mean the facilitation of community capacity from a standpoint of parity and recognition. We saw a good example of this in the Wadden Sea. During a storm a ship lost a number of containers. In the beach clean-up action that followed, the authorities consciously chose to leave room for the spontaneity of the help that people offered (see Box 2.3).

Box 2.3 Community capacity during the Wadden Sea container disaster (from IFV, 2019)

“Earlier positive experiences encouraged the authorities to consider giving the loosest possible rein to the energy that emerged in the population – the *mienskip* (community), as the Frisians so beautifully put it. It might have had a counterproductive effect if the government tried to direct activities with too heavy a hand; it could well come across as pedantic, and would discourage people from volunteering their help. People who are attached to Terschelling don’t want to be sent to Schiermonnikoog just because most of the mess is there. So community capacity was taken as much as possible for what it was – spontaneous.” (pp.71-72)

2.2 The social network of Alblasserwaard Vijfheerenlanden

In order to map the social network of A5H we looked at the characteristics of the regional network and at the resources available for, and relevant to, an imminent flood.

General characteristics

The social network of A5H is characterized by relatively strong social cohesion and entrepreneurship. The A5H area itself does not constitute a unifying identity for its inhabitants, principally because of its different orientations: part of the Alblasserwaard is oriented towards Dordrecht, part is oriented towards Gorinchem, and part is oriented towards Vianen, Nieuwegein and Utrecht. These differences in physical orientation are not expressed in significantly different social networks, but there are clear differences between the urban and rural parts of A5H (which we will examine more closely later).

The A5H population is comparatively conscious of its water, dikes and polders. Places are often considered with respect to waterways: “*Do you live by the Lek or by the Graaf?*” (interview). Most people living there are aware that it is a low-lying area and that the dikes are among its few higher-lying spots.

The A5H is an entrepreneurial region, with many businesses and family firms historically linked to the area. Part of this industry – the dredgers and marine contractors, for instance – is linked to the water. There are also many firms working in construction, infrastructure, and farming. The region possesses a comparatively large amount of equipment, such as excavators, building materials, pumps and ships. Food and drink stocks are available in only limited amounts, and for medical care residents are directed towards hospitals in cities bordering, or outside, A5H (Sliedrecht, Gorinchem, Dordrecht, Nieuwegein). The availability of many resources depends on the availability of electricity and communication channels (see Box 2.4).

Box 2.4 The availability of electricity

Earlier research and interviews have made it clear that society's dependence on electricity and communication channels is growing. The large-scale power failures that would follow flooding would disable the internet and most land line telephones, automated payment systems, most shops and filling stations, and after a time, mobile phone towers.

Two recent examples of large-scale power failures have demonstrated the impact of this effect. After a lengthy power cut in North Holland in 2015, the Security and Justice Inspectorate concluded in 2016: *"In planning for the organization and continuity of basic structures the Safety Regions assume the availability of communication channels and are unfamiliar with possible alternatives"* (p.8). *"Civilians are practically 'unreachable' during power failures"* (p.9). *"Uninterrupted access to 112 is not guaranteed"* (p.9).

A large power failure in the West Betuwe in 2017 also showed that the Safety Regions themselves were affected: *"The ICT environment of the Regional Operational Centre failed, and as a result several systems worked only in part or not at all. Since the power failure also affected telephone accessibility, it was difficult to make contact with the field."* (South Gelderland Safety Region, 2018, p.48)

Social network and resources in rural areas of A5H

The rural areas of A5H have dozens of small villages that show a strong social cohesion. The small scale means that these social networks are also small. There is an active social sector and many people are actively involved in their surroundings. Some of these networks are separate (e.g. religion, sport) while others are more inclusive (e.g. volunteer firefighting services, business associations, primary schools). People from different networks do know each other, but the interconnections within networks is much stronger than it is between networks. Villages located closer to the area's cities are often more oriented towards the city and show less social cohesion (e.g. Schelluinen and Arkel, close to Gorinchem).

The entrepreneurship in the villages is associated with a certain intractability; a message from the authorities would probably not be automatically obeyed. *"We can arrange stuff, sure – generators, sand and so on. But the dike water has to be really high. There has to be a real problem"* (interview).

In the rural areas people know who they can ask and they can find creative solutions to problems. In the event of an imminent flood, this means that it is fairly well known who can provide what kind of material or other resources. There is plenty of equipment in and around the villages, and the availability of food and drink is not perceived as a problem.

Social network and resources in urban areas of A5H

A5H also has a number of urban areas: the northern Drechtsteden, comprising Alblasterdam, Papendrecht, Sliedrecht, Hardinxveld-Giessendam, and the towns of Gorinchem and Vianen, although these locations are more 'large villages' than towns. Compared with other urban areas in the Netherlands there is relatively strong social cohesion, entrepreneurship and an active social life. At the same time these towns are on a larger scale than the villages in A5H, so there is less mutual interconnectedness and familiarity.

The urban areas also contain neighbourhoods with a weaker social cohesion, whose residents have weaker family or other ties to the town, and where there is less involvement in social clubs and societies. This may come to light in crisis situations; for instance, *"There was a gas leak and*

fifty houses had to be evacuated. But the people who lived in them didn't know their neighbours, so they couldn't go there" (interview).

As in the villages, the towns have strong links with water. Thanks to industry, especially along the Merwede, a great deal of equipment is present. In urban areas, however, people may be expected to have fewer opportunities and employ less creativity in meeting needs such as food, drink, warmth, light, etc.

The urban areas include points of higher elevation; the towns are all built along dikes, and there are office blocks and high-rise flats. Urban inhabitants, however, generally have little awareness of the location of higher buildings in the area and the opportunities this might offer in a flood.

2.3 The principles of community capacity in A5H

On the basis of these insights into the social networks of A5H, we can now translate the four principles of community capacity into comments specific to the area.

Strong mutual self-reliance, but with specific attention points

The social cohesion and entrepreneurial spirit in A5H mean that mutual self-reliance in the area is relatively strong. As one of the villagers explains: *"We can be valuable in a possible evacuation. There are community groups and community care projects in the neighbourhoods. Thanks to these kinds of smaller networks, we know who lives where and whether they need help"* (interview). Because people know each other (social cohesion) and can tackle problems for themselves (entrepreneurship), our expectation is that an imminent flood would give rise to a high degree of mutual self-reliance.

Two remarks should be made, however. Firstly, there are differences between different urban districts. Although the degree of social cohesion is relatively strong for an urban area, there are also neighbourhoods and residential groups that are not part of these social networks. Secondly, the networks in the villages do not always overlap. This is relevant to information dissemination, for instance, or mass mobilization. In some villages a single entry point is enough, but in other villages it is necessary to use several entry points in order to achieve the same effect.

Leading persons and institutions

Leadership in the community differs between rural and urban areas. In rural areas, most villages have a few prominent figures who are often active in more than one village network. In urban areas this role is more closely linked to institutions, for instance the chairperson of an association, the minister of a church community, or the local police officer.

As in communities, leadership in government is linked to institutions, but within these institutions individuals do play a significant role. Two aspects of the administrative borders in A5H are worth noting. Firstly, since 2019 the border between Utrecht and South Holland lies in the middle of the area (see Figure 2.1). This border arose when the municipalities of Leerdam, Vianen and Zederik merged to form the municipality of Vijfheerenlanden. It was ultimately decided to have this municipality fall under the province of Utrecht, which also makes it part of the Utrecht Safety Region. Agreements have been made in the GRIP system with regard to imminent or actual disasters that happen to straddle the border between the two Safety Regions, but it is not clear how this would work in practice. Secondly, there have been many other municipal mergers in the area: besides the formation of Vijfheerenlanden in 2019, the municipality of Molenlanden was formed in 2019 from a merger between Molenwaard (itself

formed by merger in 2013) and Giessenlanden. In rural areas this municipal upscaling has increased the level of detachment between inhabitants and their local government. With regard to personal leadership, the mayoral role stands out. In the GRIP system mayors have an important decision-making role in crises and disasters, and they often also play an active role in the community, although this latter role of direct personal contact is becoming less significant in A5H because of municipal upscaling. Leadership in crises and disasters depends strongly on individuals, and the decision to evacuate demands particular courage: *“An administrator’s decision to evacuate is always critical, not least because of its economic impact”* (interview).

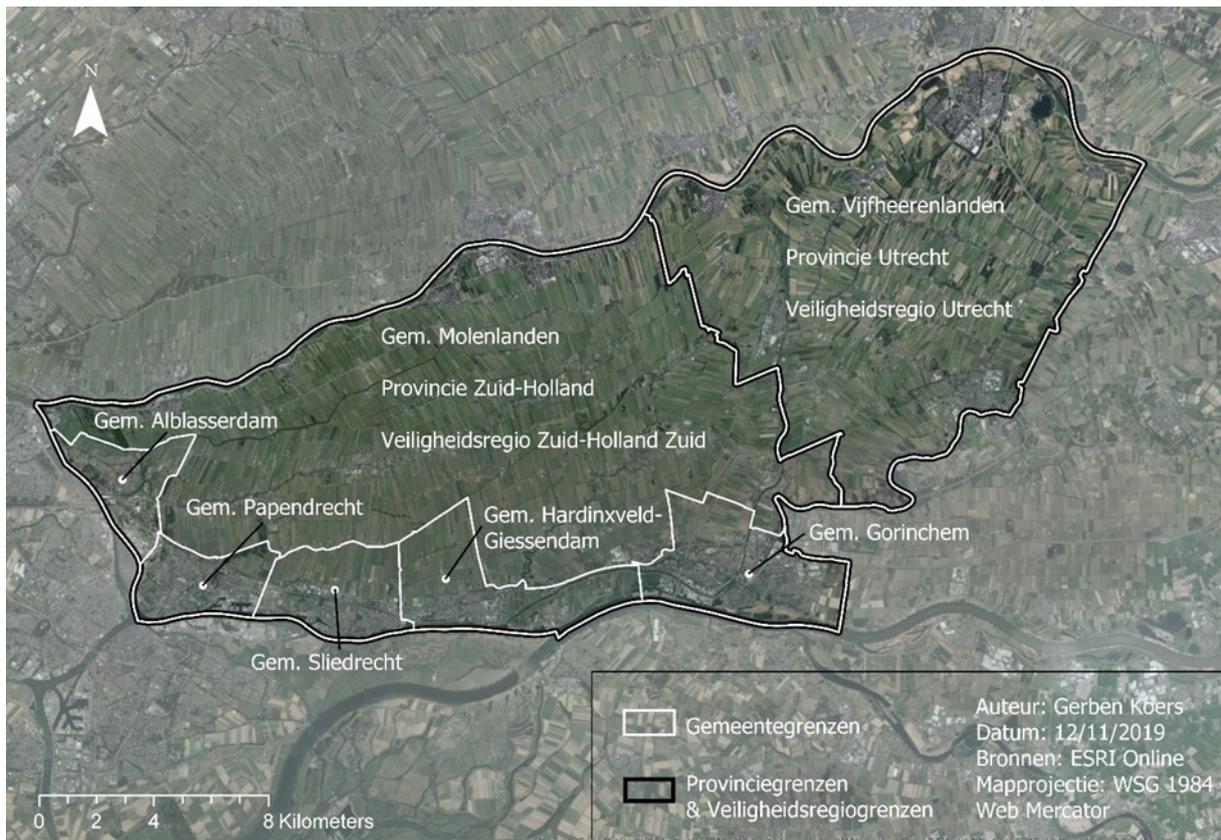


Figure 2.1 Administrative borders within A5H

A flood-safe Netherlands and an intractable A5H need clarity and persuasion

The inhabitants of A5H feel safe behind their dikes. In conversations about the threat of flooding, an often-heard opinion is: *“They just finished up, didn’t they just strengthen the dike?”* (interview). The Dutch approach – flood prevention dikes and government assurances of ‘dry feet’ – means that many people are unaware of the risk of flooding, let alone prepared for it: *“Awareness is essential, but how can you activate it? Preparedness is difficult because it [a flood] seldom occurs”* (design session; compare OECD, 2014).

Substantive clarity and unambiguity are therefore important to communicating urgency and offering A5H inhabitants concrete action perspectives. This is all the more important given that these inhabitants display a certain intractability and mistrust of the authorities. In an evacuation *“It’s no good saying ‘people in this district leave now, and the next district tomorrow’, people will just ignore it”* and *“Everyone in the government is busy pushing paper around and organizing, but that doesn’t get the job done”* (interviews). The persuasive power of a clear,

unambiguous message is therefore needed, both for a flood-safe Netherlands and a headstrong A5H.

For an ungovernable entrepreneurship: partnership in responsibility

Living as they do in an entrepreneurial area, residents and businesses in A5H have numerous ideas for possible solutions that could be employed during an imminent flood. What they want from the government is the most concrete possible request: “They’re always asking us to come to a meeting, or to think about something with them – they should just ask for what they actually need, as concretely as possible” (interview). They then want to be relied upon as professionals to carry out the required measures correctly.

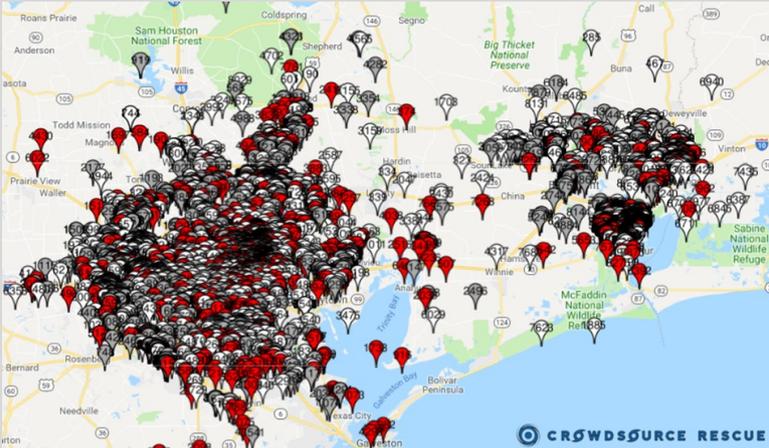
Professional first responders are expected to facilitate community capacity, the only ‘direction’ being a clear goal, the formulation of a clear help request, and a few preconditions (e.g. the safety of aid work). This demands that the inhabitants also take these preconditions seriously.

Thanks to the availability of social media, this partnership can be supported by ‘brokering’ help needs and helpers. At the international level there are growing numbers of examples of online communication channels that enable direct communication between helpers and those in need of help (See Box 2.5).

Box 2.5 Applications for imminent floods

Apps, social media and big data are being increasingly used to support community capacity. There are apps that ‘broker’ between helpers and those in need of help, and apps that collect data in order to map the scale of the flooding. Examples of both are given below.

The app *CrowdSource Rescue* was developed when Houston was threatened by Hurricane Harvey. People could use the app to share their location and indicate their help needs. All these notifications were collected on a map, which enabled voluntary aid workers to know what kind of help was needed and where.



Source: www.crowdsourcerescue.com

The Indonesian app *PetaBencana* is an official, government-provided app that provides a real-time map of a flooded area which also shows how it is expected to develop. The map is based on flood models but also on social media information. People sharing a photo and location on social media provide information that allows a map to be drawn up, showing the water height at different locations.

Chapter 3. A5H flood scenarios

In this study we examine the opportunities for synergy between community capacity and governmental capacity in the event of a threatened or actual flooding of A5H. Flooding by river water is substantially different from flooding by a storm surge at sea. In this chapter we sketch the characteristics of both scenarios.

3.1 Flooding by river water

A5H could be inundated by river water. Flooding scenarios have shown that the location of the river dike breach determines the scale and depth of flooding (LIWO Rijkswaterstaat, 2018; South Holland South Safety Region, 2019). Flooding by river water has a number of characteristics:

- 1) The inundated area is relatively large
- 2) The floodwater is relatively deep, especially in the Alblasserwaard (up to 6 metres)
- 3) Depending on the location, it would take from a few days to over two weeks for the floodwater to reach the furthest locations
- 4) The flooding can be predicted a few days in advance
- 5) The weather conditions do not need to be bad



Figure 3.1 Example river flooding scenario, dike breach (red dot) at Hardinxveld-Giessendam east (source: LIWO)

Two remarks need to be made here. Firstly, it is often said that river flooding can be well predicted. Nevertheless, experts note that the uncertainties are large and that the threat can be properly evaluated only about two days in advance (design session). Secondly, floodwater depths in the A5H area are co-determined by the lay of the land, which resembles a shallow ‘bathtub’ (see Figure 3.2). Vijfheerenlanden is higher than Alblasserwaard, so if a dike breach were to occur in the east of the A5H the water would also flow towards the lower-lying Alblasserwaard.

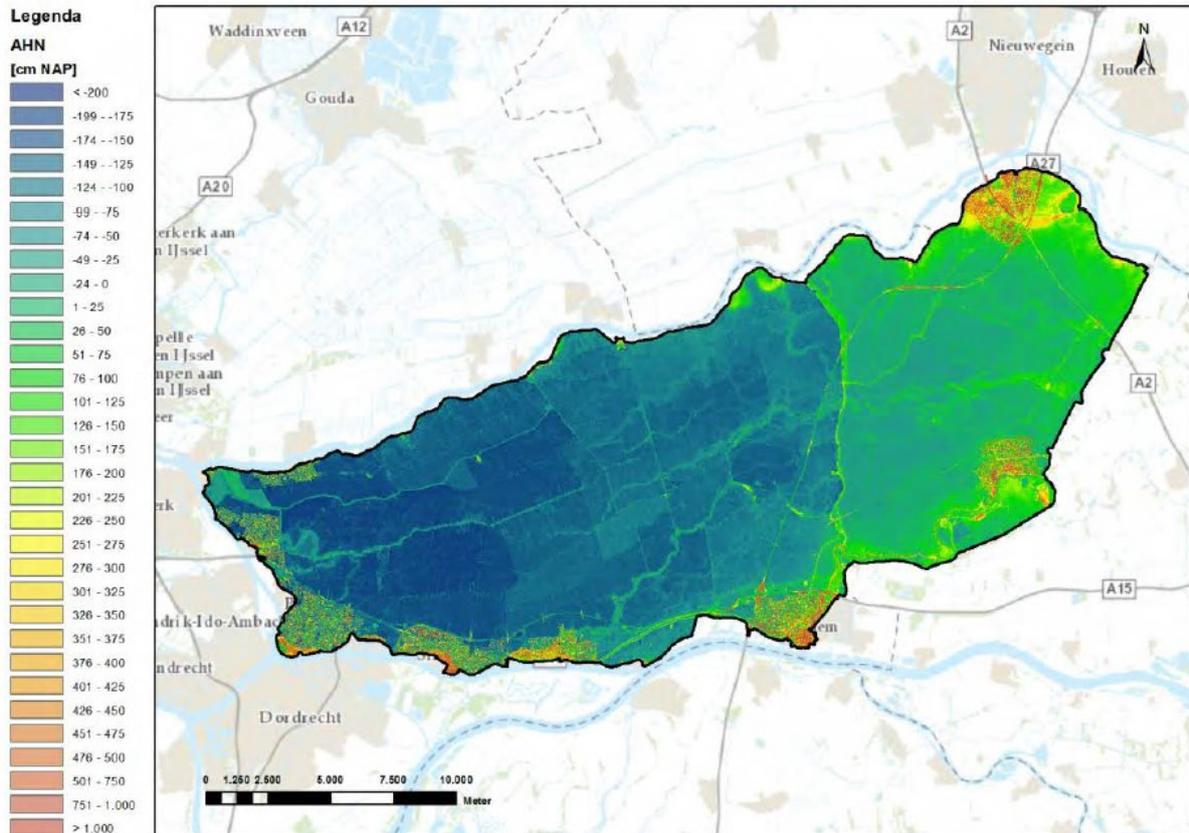


Figure 3.2 Contour map of the A5H, showing the 'bathtub' contours

3.2 Flooding by storm surge at sea

A5H could also be inundated if a storm surge at sea prevented the rivers from discharging their water. This is possible if a storm at sea raised sea water levels and the Maeslandtkering storm surge barrier were not closed (LIWO Rijkswaterstaat, 2018; South Holland South Safety Region, 2019). A flood caused by a storm surge at sea has a number of characteristics:

- 1) The A5H area would be flooded west of the A27/Merwedekanaal
- 2) The floodwater would be relatively shallower (up to 2 metres, with a few local exceptions)
- 3) Depending on the location, it would take from a few days to about two weeks before the water reached the A27/Merwedekanaal
- 4) The flooding could be predicted only shortly beforehand
- 5) The weather conditions would have to be bad (very heavy storm)

The flooding of A5H because of a storm surge at sea would actually be caused by a combination of factors. The advance warning period is therefore short, because the question of whether the combination of high river water levels and a storm at sea may give rise to excessively high water system levels only becomes clear a short period of time before a flood becomes imminent. This period is often said to be no more than two days. A5H is particularly threatened by flooding if the Maeslandtkering storm surge barrier fails to close, and this would only become clear at the moment of its failure.



Figure 3.3 Example scenario of flooding by storm surge at sea, dike breach (red dot) at Kinderdijk (source: LIWO)

Chapter 4. Synergy in the ‘warm’ phase

To get a picture of the potential synergy between community capacity and governmental capacity in an imminent flood, we begin with the ‘warm’ phase: what kind of community capacity could be expected at the moment of the imminent flooding of A5H? We have split the ‘warm’ phase into three parts: evacuation, escape, and rescue. Help provided during the evacuation phase will develop differently if the threat comes from a storm surge at sea than if it comes from high river levels alone, but in the escape and rescue phases these differences are much smaller. Table 4.1 summarizes how community capacity develops during the ‘warm’ phase and how synergy could be achieved. The sections following this table elaborate this process for each phase.

	<i>Evacuation (high water levels in the rivers)</i>	<i>Evacuation (storm surge, high water levels on the sea)</i>	<i>Escape</i>	<i>Rescue</i>
General	<ul style="list-style-type: none"> • Everyone has to/wants to leave 	<ul style="list-style-type: none"> • ‘Keep calm and go east’ • Horizontal and vertical evacuation 	<ul style="list-style-type: none"> • Escape is evacuation under pressure 	<ul style="list-style-type: none"> • All help is needed
community capacity	<ul style="list-style-type: none"> • Evacuate yourself and help others • Follow your usual routines 	<ul style="list-style-type: none"> • Follow the instructions • Help your neighbours 	<ul style="list-style-type: none"> • Help each other to safe havens • Decentralized communication 	<ul style="list-style-type: none"> • Vessels • Shelter • Decentralized communication
Synergy between governmental capacity and community capacity	<ul style="list-style-type: none"> • Facilitative actions • Clear, visible message in which specific actions are promoted 	<ul style="list-style-type: none"> • Top-down coordination • Authoritative decision-making • Ask communities for help 	<ul style="list-style-type: none"> • Safe havens • The right call • Decision-making under pressure 	<ul style="list-style-type: none"> • Smart allocation of tasks • Inform people in the area

Table 4.1 Summary of community capacity and its synergy with governmental capacity in the event of A5H flooding

4.1 Evacuation because of imminent flooding by river water

In the event of threatened flooding by river water, the guiding principle of evacuation is “*Everyone has to/wants to leave*” (design session). Precisely because the enormous scale of this flooding, and the depth of floodwater, it is vital to use the limited time available for the evacuation of the area. Horizontal evacuation can be combined with vertical evacuation in a few specific locations, particularly in the northern Drechtsteden. It is also worth noting at this point that there is a group of people who will not want to leave, but who must, given the threat.

Community capacity

Community capacity in an evacuation can be summarized in two principles. The first is “*Save yourself and someone else*” (design session). Mutual assistance is indispensable to getting everyone out of an area. It might take the form of helping less able or care-dependent people, taking them on as passengers in an evacuation, making optimum use of the available vehicles so as to get as many people out of the area as possible, or – for those outside the evacuation area – giving evacuees food, drink, or somewhere to sleep. Besides spontaneously helping with evacuation, people can also help with flood protection construction: “*Working with sandbags is*

precisely the kind of thing that the population can do” (interview). We expect many people to offer spontaneous help of this kind, particularly in the rural areas of A5H.

This principle includes the explicit message to ‘save yourself’. This is because not everyone in an area will be willing to leave. There will be farmers, for instance, who will not want to leave their cattle behind. In an imminent flooding from river water, there will also be uncertainty about the urgency of evacuation. This may lead, particularly in the villages with intractable residents, to some people refusing to leave.

The second principle of community capacity during the evacuation phase is *“Follow your usual routines”* (design session). Departing from normal routines, for example by closing a road or stipulating an obligatory evacuation route, can lead to a great deal of uncertainty and stress amongst residents. The threat of river water flooding allows a little more time for ordinary behaviour: *“In an evacuation you want to optimize traffic flow. But we also know that you have to keep it very limited, because traffic flow measures take up a lot of energy and resources, and cause a lot of frustration”* (interview).

With these principles in mind, in the evacuation phase community self-reliance can be used to greatest effect by allowing space for routine behaviours and ordinary human dynamics.

Synergy between governmental capacity and community capacity

The authorities can make best use of this community capacity by doing as little as possible themselves and facilitating people’s normal routines. ‘As little as possible’ in this case does not mean doing nothing – the government will still be doing a great deal, but efforts will be directed towards supporting the community rather than directing it and taking over responsibility for the help that is needed.

Let us give a few examples. Facilitation means avoiding large-scale road closures, but finding small interventions that optimize traffic flows: *“In an evacuation you want to optimize traffic flow. But we also know that you have to keep it very limited [...] In [the large-scale exercise] Waterproof we saw that a re-routed cloverleaf interchange can help”* (interview). The authorities should not set about helping all less self-reliant residents, but check – through GPs or community care organizations, for instance – whether they have all been identified. A ‘minimal role’ also means leaving space for all kinds of local communication channels. Communications are therefore not centralized; the authorities simply ensure that their representatives in a given area (e.g. firefighters, district police) keep talking with its residents, thereby getting early notification of relevant details. This kind of contact is also used amongst dike wardens: *“Dike wardens can also receive information from the people they meet on their rounds. [...] Residents often know the area very well and will notice a change, seepage etc., because it’s ‘different than normal’”* (interview).

It is also precisely in this scenario, with the threat of flooding by river water, that it is vital that the authorities convey the urgency of the situation. Research into evacuation preparedness has shown that urgency has to be made tangible: *“The amount of time available to prepare for evacuation is not that important; it’s much more important how people experience it – that they have a clear picture of the threat they’re facing. Since people have so little actual experience of floods, you have to stimulate it, explicitly, to motivate them”* (interview; see also Moens, 2019).

Communications aimed at those who do not want to leave, but given the threat must leave, are also essential. This urgency will ideally be communicated not just through the authorities but also through neighbours.

For the authorities, conveying the urgency of the situation needs to take two things into account. Firstly, a great deal of information is available during the phase preceding the decision to

evacuate. Agreements on the use of this information have been made in the working methods and structures of the crisis and disaster response organizations. At the same time it is open to question whether, in the event of the threat of flooding, authorities are able to ask each other the right questions and then share the relevant information. Secondly, it is essential the message is communicated clearly, visibly, and with an action perspective. Only then does the situation for a community become clear (unambiguity), is the urgency of their situation conveyed (visible), and is it clear to residents what is expected of them (goal and action perspective).

4.2 Evacuation because of imminent flooding by storm surge at sea

In the event of threatened flooding by sea water following a storm surge, the guiding principle of evacuation is different because there is greater urgency and because the flood, according to the scenarios, will not come further than the A27/Merwedekanaal. This scenario therefore employs the following core message: *“Keep calm and go east”* (design session). There is too little time to get everyone out of the area, so a combination of horizontal and vertical evacuation is needed. Given the relatively shallower floodwaters, there are also more vertical evacuation options than in a river water flood.

Community capacity

When a storm surge at sea threatens an area with flooding, people experience time pressure. They do not know whether it would be best to evacuate vertically or horizontally; which routes will be available and for how long; and in which direction evacuation would definitely be unsafe (this applies in particular to the Eiland van Dordrecht and Krimpenerwaard). People will spontaneously help each other only if there is clear coordination. We would also expect to see differences in reaction between urban and rural areas.

In urban areas we would expect that urgent evacuation would encourage people to secure their own safety as quickly as possible: *“It’s everyone for himself; everyone wants to get away as fast as they can. That’s what individualism has done”* (interview). It is precisely in urban settings that community capacity has to be explicitly invoked, with slogans like *“Take your neighbour, not your flatscreen”* or *“With four to a car we can save everyone”* (design session).

In rural areas we would expect that a call to evacuate would not be immediately obeyed: *“The intractability in villages is strong, and it sometimes causes problems. These are the people who won’t stay behind the security cordon – precisely because they want to help”* (interview). In these areas it is therefore important to make urgency tangible, as clearly and literally as possible, and to call on everyone to follow instructions.

Synergy between governmental capacity and community capacity

As we have said, the time pressure demands an optimum combination of vertical and horizontal evacuation, with clear communication of the time available for evacuation and the best direction of travel (to the east). In the event of the threat of flooding by a storm surge at sea *“you might well ask yourself how much room there still is for voluntary behaviour; a top-down approach might be the preferable strategy here, ‘instructions’ from the relevant authorities to take people out of the area compulsorily”* (design session). In this scenario, with the threat of flooding from a storm surge at sea, we would argue that synergy arises through top-down coordination from the authorities.

This coordination can only arise if these authorities arrive at authoritative decisions. We have already discussed the dilemmas surrounding information provision and decision-making in the

river flooding scenario (see §4.1). In this storm surge scenario it is not just decision-making that is needed, but the authoritative communication of these decisions. In urban areas this means disseminating decisions from authoritative institutions, such as the municipality, the water board, or the police. In rural areas it requires the cooperation of authoritative individuals: *“That’s very important in the villages – you might have lots of braid on your uniform, but people there would rather listen to someone they know, someone they know to be reliable”* (interview). These authoritative individuals might be local functionaries, such as the local policeman or fireman, but they are often people who have authority in the local community without holding an official position.

At the same time, the effectiveness of an urgent evacuation will depend strongly on the combination of horizontal and vertical evacuation. Synergy can arise if the authorities know what effect this combination can have, and communicate it, so that people can take the most effective action: either find a higher spot, or head east in order to leave the area altogether. Knowing what effect this combination can have demands a great deal of knowledge from the authorities: which higher-lying spots can be expected to remain safe, and which groups of people should be called upon to make use of them? Which places lie too far away from these higher spots, and which groups of people should be called upon to leave the area? With this information to hand, the authorities can make clear demands for help, thereby mobilising the community capacity they need.

4.3 Escaping the flooding of A5H

In the escape phase, high water levels in rivers or at sea have already led to a dike breach. Incidentally, this need not mean that the entire area is already under water. The contour structure of the specific area, and the presence of artificial elevations in the area (including the A27, A15, and A2 motorways and the Merwedekanaal), mean that the course taken by the flood will also depend on the exact location of the dike breach. In the escape phase, therefore, the location of the dike breach strongly determines the escape options and time windows available to those still in the area.

Community capacity

The escape phase is subject to similar basic principles to those in the evacuation phase. There is, of course, one big difference: the threat is real and immediate, and people know for sure that the water is coming. In other words: *“Escape is evacuation under pressure”* (design session). We are speaking here explicitly of pressure and not of panic; research into the civilian help provided during disasters has concluded that *“We observed no panic, apathy or antisocial behaviour amongst civilians providing help”* (IFV, 2010, p.98).

There comes a moment in the escape phase that first responders leave the area and ‘stragglers’ are left to fend for themselves. Searching for a refuge then becomes the only remaining option, and the stragglers will help each other. Community capacity is then the only form of available help. A search for these refuges in A5H reveals that there is a very limited number of areas having a higher elevation. In urban areas there are some high-rise flats and commercial buildings, but in rural areas the dikes form the only elevated element in the landscape: *“The edges of the polder are often the highest places, along with the office blocks; it should be policy that the authorities know where the higher places are”* (interview). At the same time, the borders of A5H are also vulnerable: *“The dike can be used as long as it’s usable. But when the water board foresees problems, then access to the dike can be denied”* (interview). The dike is therefore an

indispensable elevated route and refuge – but only until the moment that problems with the dike itself are foreseen.

Moreover, communications are essential during this phase. Only after a dike breach has actually occurred does it begin to be clear exactly how much time there is in which to escape; which escape route would be wisest; and which escape routes are still available. However, in this phase communication channels are also expected to eventually break down because of power failures and overloading: *“Communications will also suffer. Power failures will mean that transmission towers stop working. All the equipment that uses the mobile network will then switch to other active transmission towers. The ultimate result is that these transmission towers become overloaded, and people can no longer make use of them”* (interview). It then comes down to local communication between stragglers, and mutual help through information sharing becomes indispensable.

Synergy between governmental capacity and community capacity

Once a dike has been breached and the escape phase has begun, first responders will no longer be in the area. Nevertheless, governmental capacity can still support community capacity. We see three clear areas in which this synergy is possible.

Firstly, the depth of the polder and the very limited number of elevated places presents an acute problem during the escape phase. The government can provide support if, for instance, the authorities know where such places exist and inform those who are still in the area. The deliberate construction of such raised areas could also be considered: *“We really have to start thinking about options in line with multi-layer safety”* (interview) and *“I would definitely make wide, higher places along the dike. We have a spot like that in Papendrecht, from the most recent dike reinforcement work. It’s pretty smart; they’re going to build a police station there soon, so that’ll stay dry”* (interview). Communicating actively about higher-lying locations during the preceding evacuation phase can also be counterproductive, however, in that people may then be less inclined to leave. What matters most here is that the authorities know where these places are, and communicate these locations when the options for horizontal evacuation become limited.

Secondly, and to repeat this point, communications about escape options are essential. Synergy arises when the authorities spread the right message, make *“the right call”* (design session). This message must give people a concrete action perspective: for instance, information on the available escape routes and the remaining time to use them.

A third area of potential synergy (but possibly also of weakening) is decision-making. For community capacity most of the same principles apply as in evacuation, but now in a situation under pressure. The decisions being taken by the authorities will therefore also come under pressure. Synergy arises when, on the basis of the information available, and despite the pressure, clear decisions are taken on, for instance, the availability of dikes as escape routes, the moment that first responders have to leave the area, whether or not to cut off electricity and gas, and so on.

4.4 Rescue after the flooding of A5H

In the rescue phase an area has already flooded, the situation has stabilised, and it has become safe enough for rescue workers to re-enter the area. Rescue is a labour-intensive and inefficient process: *“You go from 50 people in a bus travelling at 50 km/h to 10 people in a boat going at 5 km/h”* (design session). Now all possible assistance is required. In this phase there is no real difference between river water or sea water flooding as far as rescue efforts are concerned. The scale and the floodwater depths may vary, but the principles of this help remain the same.

Weather conditions, however, such as a heavy storm accompanying a storm surge at sea, may limit the possibilities for community capacity during the first hours of this phase.

Community capacity

All help is welcome, and in A5H a great many transport options are available. There are firms with vessels along the Noord, Merwede and Lek rivers, as well as many private small boat owners. Some of these vessels could be used to go into the area to save people. Community capacity can also be expected in terms of care: offering shelter, providing food and drink, and giving medical help. This kind of help will be given all around the affected area, including to aid and rescue workers.

Within the flooded area there will also be those who stayed behind and have had to look after themselves for a certain time. There is a difference in this regard between urban and rural areas; in urban areas there are more high-lying locations where people can remain for some time, while in rural areas people can be expected to show more resourcefulness in looking after themselves: *“In rural areas people are better at coping. It’s in the towns that people ask the strangest questions, for instance during power failures”* (interview).

Synergy between governmental capacity and community capacity

A flooded area is a dangerous one to enter. Orientation is difficult and there are objects floating everywhere. This may lead to the assumption that governmental capacity is required and community capacity should be limited. However, in the rescue phase *all* help is needed and professional aid workers will already have their hands full with specialized tasks with which residents cannot assist. governmental capacity and community capacity are therefore both indispensable in rescue work.

Synergy arises when the authorities facilitate community capacity, for example when people with boats enter the area: *“Allocate tasks; professionals go out into the polder and spontaneous helpers stay in the ‘first zone’, directly alongside the dike”* (design session) or *“Go out with several boats together; have an official boat take the lead, with civilians following in their own boats”* (design session).

The crucial point here is that the authorities should not hinder community capacity, but facilitate it. At the same time they should ensure that this facilitation occurs in a decentralized way; centralized direction will often be impossible because of the damage caused by flooding, and in any case it is undesirable because of the dynamics of community capacity.

In this phase, too, it is essential to provide information: what are the aims and priorities of the rescue activities? What do spontaneous helpers need to know before they enter a specific area? In the rescue phase, however, disseminating information is very difficult. It will demand some creativity from the authorities to be able to successfully spread relevant information. It might involve battery radios, flyers, and physical information points (IFV, 2018). Finally, the professional aid and rescue workers and the spontaneous helpers who enter the area are all important sources of information who can give the inhabitants action perspectives.

Chapter 5. Recommendations for the ‘cold’ phase

Starting from the opportunities for synergy in the ‘warm’ phase (that of the management and direction of actual emergency assistance), we can extrapolate backwards to the ‘cold’ phase (the administrative relations governing the planning and organization of these provisions): what needs to be put in place in order to achieve synergy during an actual flood? We see concrete possibilities for this synergy in six areas: (1) prepare a network, (2) take key decisions, (3) work with ‘many channels, one message’, (4) identify places of refuge, (5) facilitate decentralized coordination, and (6) acknowledge the value of community capacity. For each of these areas we formulate a few concrete recommendations and address these towards one or more of the A5H partners (underlined in each recommendation).

5.1 Prepare a network

To make the best use of community capacity it is advisable to prepare the social network. The network in A5H is relatively accessible, thanks to social cohesion and the presence of personal leaders. Investments in this network can be made in the ‘cold’ phase, for example by finding out whether the local ‘eyes and ears’ are known. Some of these figures will be familiar – the local police, firefighters, and community care workers, for instance – but there may be other leading community figures, people who are widely known and trusted, who are nevertheless unknown to the authorities. A growing part of these networks is to be found online. Social media, such as a local Facebook group or neighbourhood app, can represent a relevant entrance point. By getting to know this network better, and making the subject a topic of conversation, community awareness is also indirectly raised.

In this study of community capacity, ‘awareness’ has been a recurring theme. People who are aware of the threat, and of the impact of flooding, are likely to be better prepared and better able to offer spontaneous help. At the same time there are, thankfully, very few flooding incidents in the Netherlands, and it is open to question whether awareness and preparation can be demanded for something that occurs so infrequently. The interviews and expert sessions have made it clear that active awareness campaigns will probably have little effect. Nevertheless, awareness of water issues is strong, and water-related events such as dike reinforcement could be used to promote area knowledge and strategic awareness.

To prepare the network, the following recommendations are made:

1. *Find out whether the local eyes and ears can be reached quickly*

Those working in Safety Regions, municipalities, and as local aid workers (e.g. district police, voluntary firefighters, community care) have their own local networks. They know the relevant leaders, societies and associations, and are therefore the local eyes and ears in disaster response management. It is not clear, however, whether the authorities would have a clear picture of these contacts in the event of a calamity such as an imminent flood. It is therefore recommended that municipalities, in consultation with the South Holland South Safety Region examine whether these local eyes and ears can, indeed, be reached quickly.

2. *Use water-related events to promote awareness and strategic knowledge*

A5H partners are regularly involved in water-related events, such as the commencement or completion of a dike reinforcement project, an exercise, or a conference. We recommend that the collaborating A5H parties use these moments to increase people's strategic knowledge of the A5H area and their awareness of water issues.

3. *Join relevant social media networks*

Local aid workers such as district police and the voluntary fire service often have a broad local network (see recommendation 1). In several villages we have seen that this network also takes an online form, such as a Facebook or WhatsApp group. We recommend that local aid workers join these social media networks as part of their jobs, so that in the event of an imminent disaster they also have work access to these networks.

5.2 Take key decisions

In a situation of imminent flooding the competent authorities are confronted with numerous far-reaching decisions. To cite some examples that arose in our interviews and discussions: what should one do with all the livestock (cattle, pigs, chickens) in A5H? Is it wise to optimize only national-level evacuation routes (at cloverleaf interchanges) or should this also be done at the regional and local level? At what moment can the dike no longer be used as an evacuation route, and how is this decision taken? Is there a moment when the electricity and gas have to be shut off? How should you handle bridge openings and tunnels during an evacuation?

In this study we also conclude that clarity and unambiguity are essential to community capacity. They impart a clear purpose and direction to spontaneous help, and at the same time they create opportunities for the community to contribute towards these aims. Up to now little thought has been given to far-reaching decisions at times of imminent flooding, a few examples of which we have just given. In order to expedite clear, unambiguous decision-making in the 'warm' phase we recommend taking the time to identify possible dilemmas in the 'cold' phase. Some of these dilemmas can then be incorporated into key decisions and included in the disaster response plans. Other dilemmas are so situation-dependent, or so uncertain, that their incorporation into key decisions is inappropriate.

In order to map the evacuation options the South Holland South Safety Region has already explored a number of scenarios and developed evacuation strategies accordingly. This has yielded a great deal of information and movement patterns. We would suggest considering collecting information for a number of main scenarios, for example flooding by river water and flooding by storm surge sea water. This would clarify the main principles, which would be relatively easy to document and communicate. For instance, the '*Keep calm and go east*' principle that applies to sea water flooding because it stays dry beyond the A27, and the '*Everyone has to/wants to leave*' principle that applies to river water flooding because of the considerable depth of such floodwaters.

With regard to key decisions we therefore recommend:

4. *Identify possible dilemmas and establish whether certain key decisions could be included in the disaster response plans*

The South Holland South Safety Region is already working on evacuation strategies. Within the framework of this process we recommend that possible dilemmas are identified and discussed with the relevant parties. The studies being carried out within FRAMES (of which this study is one) and Wave 2020 (including a subproject on rescuing people and animals) may well be of assistance. On the basis of these dilemmas the Safety Region can then determine whether it is relevant and desirable to formulate a key decision and include it in the disaster response plans.

5. *Develop a limited information base from a small number of main scenarios*

In developing evacuation strategies work is currently being done on a comprehensive set of possible scenarios. We recommend that the Safety Regions and water boards together examine which main scenarios and principles could be distilled out of this full set.

5.3 ‘Many channels, one message’

In a crisis situation, communication is both one of the most vital aspects and one of the most problematic. In an age that uses a great many communication channels, what is needed is a single, clear message that can be disseminated through a wide variety of channels. During our research it became clear that this message has to meet three criteria: it has to (1) be clear and unambiguous, (2) have a clear urgency, and (3) offer action perspectives. Disaster response organizations already devote considerable attention to clarity and action perspectives. Making urgency tangible demands extra attention, since we know that this urgency is actually acknowledged only on the basis of personal experience and factual, as opposed to fictional, accounts. We therefore recommend devoting thought during the ‘cold’ phase to the kind of information or images that can best convey urgency in the event of an imminent flood. With regard to community capacity it is also important that the authorities make the right kind of requests for help. Little conscious attention has been given to this question up to now, and it might be worth considering the inclusion of this question in exercises and involving potential ‘spontaneous helpers’.

Three practical pointers may be deduced that would help to achieve ‘one message, many channels’:

6. *Practice formulating requests for help from spontaneous helpers*

Safety Regions regularly carry out exercises to prepare for an imminent flood. We recommend that the formulation of official requests for help from the community be included in these exercises, and if possible, that residents should also be included as the ‘recipients’ of these requests.

7. *Look at communication messages from the three criteria: (1) clarity and unambiguity, (2) tangible urgency, and (3) offering action perspectives*

Safety Regions are already working on communications in many ways. In this study, too, communication was revealed as an important stimulus for, but also a possible barrier to, community capacity. We recommend that communications promoting community capacity (clear, unambiguous, manifestly urgent, and offering action perspectives) be included in the ongoing processes being undertaken by Safety Regions to improve their communications.

8. *Think about the possibility of making urgency tangible through experiences and facts*

We recommend the A5H partners work together to devote a session or workshop to making urgency more tangible. The core question is: how can we most effectively convey the urgency of an imminent flood situation in the ‘warm’ phase? It is crucial here to build on experiences and facts, rather than fiction. Local, private parties may well be able to offer inspiration and ideas.

5.4 Identify places of refuge

The low-lying nature of A5H makes the area particularly vulnerable to flooding. We often heard it said of the possible flooding of the area: “*Let’s hope it never happens*” (interviews). There are a few more elevated locations, including dikes and office blocks, and here and there in the polder there is a higher-lying *donk* (an ancient sandy mound). To make best use of the opportunities for vertical evacuation and escape, more strategic knowledge of these features is vital.

Moreover, the area is undergoing numerous zonal developments, including the construction of housing, business parks, and future dike reinforcements. It would be wise to consider the impact of these developments on heights: do they jeopardize higher-lying areas in the landscape, and if so, how could this be prevented? And do these developments offer any opportunities for creating higher-lying areas? The peat-rich A5H does not offer many such opportunities, but at the local level these linked opportunities do exist. In dike reinforcement work it is important that the authorities first think in fundamental terms about the principles of multi-layer safety: do opportunities exist to exploit zonal planning – a Climate Dike, for instance, a small elevation to a dike, or shelter – in order to improve water safety?

Gaining improved insight into existing refuges, and creating more of them, is a way to reduce the vulnerability of an area. In concrete terms this means:

9. *Ensure more insight into higher-lying locations in the area*

In the Safety Region processes surrounding evacuation strategies it is worth identifying the higher-lying locations in the area. We recommend that the Safety Region employs the invaluable knowledge of the Water Boards and the zonal knowledge of municipalities and provinces to involve this identification process in the development of evacuation strategies.

10. *Identify whether, on the basis of the policy principles of multi-layer safety, future dike reinforcement work could include the creation of additional high-lying locations or refuges*

Several dikes are expected to be upgraded in A5H over the coming years. We recommend that the Rivierenland Water Board, the province of South Holland and the municipalities work together, from the earliest preparatory phases, to identify opportunities to link additional higher-lying locations or refuges to these dike reinforcements. Dike reinforcement work is up to the water boards, but at the same time it is the responsibility of the province, besides the local integration secured by the municipalities, to give form to the multi-safety policy principle at the regional level.

11. *Be aware of the possible negative impact of, and the opportunities offered by, zonal developments in existing higher-lying locations in A5H*

By identifying higher-lying locations in the area (recommendation 9) another step can be taken towards raising awareness of the impact that zonal developments can have on the availability of such locations. It is the municipalities that have the clearest view of this and who can stay alert to zonal developments through their consultations with A5H partners. We recommend that the provinces and water boards identify the influence of the infrastructural measures affecting their specific domains on the multi-layer safety of the area.

5.5 Facilitate decentralized coordination ('many to many')

During an imminent disaster coordination is often centralized, using the principle of 'one to many'. Information is collected, instructions drawn up and disseminated, and an overview of all actions maintained from a single position. However, modern communication technologies make it possible to work according to the principle of 'many to many', in which communications and assistance take place in mutual contact with no central intermediary. The authorities can enable this kind of decentralized coordination in a number of ways.

As long as internet and electricity networks are in operation, online applications can enable and facilitate decentralized coordination. There are several international examples of this, including apps that link help requests with offers of help (e.g. *CrowdSource Rescue* in Houston, see Chapter 2), apps that collect real-time information during a flood (e.g. *PetaBencana* in Indonesia, see Chapter 2), communication apps linking volunteers, and a kind of 'Ebay' for extra sleeping accommodation during a large-scale evacuation. The Dutch NL-Alert and Crisis.nl platforms provide a government information platform ('one to many'), but there are still no Dutch online applications ready to support decentralized coordination ('many to many').

Earlier crises during which community capacity was offered (see Chapter 2) have shown that decentralized coordination is also needed offline. Two recent evaluations sketched a variety of options in this regard. The first option is to appoint one or more people on the spot to explicitly adopt this role, as occurred during the oil spill in Rotterdam harbour: *"From that moment on, a representative of the Dierenbescherming (animal protection foundation) acted as an intermediary between volunteers and the CoPI (incident site command), which proved successful"* (IFV, 2019, p.13). The second option is to allocate this task to a duty officer, as was recommended in the evaluation of the Wadden Sea container disaster: *"to introduce, within the Safety Region, the function of Volunteer Coordinator or Volunteer Duty Officer"* (IFV, 2019, p.73). The wide variety of crises during which community capacity can arise, and the wide variety of social networks and their entrance points in the Netherlands, would seem to point to the first option.

In order to facilitate both online and offline decentralized coordination ('many to many'), we recommend the following:

12. Identify possible applications for the decentralized coordination of help requests and help offers using the 'many to many' principle

Given the potential benefit of decentralized coordination for linking appeals for help with offers of help, we recommend that it be examined at the Dutch national level whether one or more online support applications could be developed for this purpose. It may prove possible to

modify an existing app for this use. It is important that the leading principle here is ‘many to many’, alongside existing information platforms that are based on the ‘one to many’ principle.

13. *In the event of an imminent flood, make the linkage of community capacity and professional aid the explicit task of a small number of people*

Given the evaluations of the Wadden Sea container disaster and the Rotterdam oil spill, we recommend that decisions are taken at the Dutch national level to determine how the link between community capacity and professional aid should be embedded in the Dutch crisis response organization. The explicit conferral of this task to a single person, or a small number of people, depending on the local situation, should also be considered.

5.6 Acknowledge the value of community capacity

This study has shown that community capacity has its own dynamic. We have discussed spontaneity, improvising capacity, creativity and dynamics. This dynamism is somewhat at odds with developments at the governmental level; there we see the professionalization of the disaster response organization, the professionalization and upscaling of water management, and the merging of municipalities. In our conversations we regularly picked up signals that tended to reflect an assumption of top-down organization and the regulation of help, of wanting to be ‘in control’, and therefore of keeping civilians at a distance.

It is crucial to realize that a threatened or actual flood would be on a huge scale and have an enormous impact. In this kind of situation there is more chaos than control, and in this chaos community capacity becomes indispensable. This affects the culture of disaster management and water management. We advise an alert attitude: what kind of work culture can be recognized during exercises? How does the organization handle spontaneous helpers in an actual crisis?

We see two focus points in the acknowledgement of community capacity:

14. *Table, discuss, and learn from experiences of community capacity in recent crises and disasters*

There are frequent crisis and disaster situations in which community capacity is offered. We recommend that the Safety Regions discuss these situations in order to draw lessons for their own working methods, while also making use of the experiences that other Dutch organizations – such as the Ministry of Defence, and water boards with dike wardens – have had with community capacity.

15. *Achieving synergy with community capacity requires a culture that makes room for spontaneity, dynamics, creativity, and improvisation skills. Be alert to these, and develop them where necessary.*

The A5H partners acknowledge the potential value of community capacity and the possibilities of synergy. We recommend that official members of the A5H partnership convey this within their own organizations. This will contribute towards a culture that has room for spontaneity, dynamics, creativity and improvisation skills.

Chapter 6. Reflection

In this last chapter we reflect on our research. We do so first through four brief reflections from the experts involved in our study, with expertise in water management, zonal planning, public administration, and communication. We then reflect on the significance of this A5H-based study for other areas in the Netherlands and north-west Europe, within the framework of the EU's frames (Flood Resilient Areas by Multi-layered Safety) project. We close this chapter with some brief conclusions.

6.1 Reflection from four expertise domains

Reflection by Frans Klijn (water management)

Because this study is based on the intention to think through a number of future scenarios with a very low likelihood of actual occurrence, it examines events that will probably not take place for many generations to come. This gives me repeated doubts about the usefulness of such studies: does their supposed effectiveness justify the required investment of time and effort?

Meanwhile, this study makes a clear contribution to the broader recognition that organizing to deal with very large, very infrequent flood disasters is ineffective, with the result that command and control through existing aid services will ultimately be impossible. This also means acknowledging the relevance of spontaneity (based on the advantages of a 'loosely coupled' system; see Perrow's *Normal Accidents*, 1984) – something that does not accord, however, with the government's predominant desire to maintain control.

The interviews have made very clear how much knowledge and capacity is currently available in the area, but it is open to question whether this will remain the case in the future, if residential attachment to the land and the village should dwindle.

There are a number of concrete challenges:

- Do not allow the distance between civilians and the authorities to become too great, and/or drown in procedures and rules; this is detrimental to improvisational talent (and also to trust in the authorities).
- Give those responsible adequate knowledge of the locality (a geography lesson with flood scenarios).

NB: do not rely on modern communication technologies, as these will probably stop working, and if anything causes panic it is smartphone failure.

There are opportunities if 1) water safety is brought to the attention of zonal planners and developers, and 2) water awareness is increased amongst aid workers and emergency services and through lessons in schools. This is the only way to ensure that this knowledge is passed on to subsequent generations.

Reflection by Fransje Hooimeijer (zonal planning)

Dutch zonal planning has always been concerned with disaster prevention. Dealing with a disaster means undergoing profound changes. The design sessions made it clear how important it is to let people save themselves, and each other. To this day the dike is a *sine qua non*, and for this reason there is little public awareness, people build tunnels instead of bridges, and there is no publicly recognized government control body in a possible disaster. These three aspects are important in a future which may see an end to the dike and in which disasters might occur with greater frequency. It is imperative, and a vital opportunity, to make the Dutch more aware of hydraulic

engineering; there should be history lessons on water management construction from primary school onwards. Mapping the spatial framework of evacuation is needed to enable new spatial interventions to play a better role in such evacuations, and to support public disaster response plans in such a way that individual and mutual self-reliance is given every opportunity.

Reflection by Arwin van Buuren (public administration)

Ours is an energetic society. Civilians are getting involved in issues in all kinds of ways – issues that are sometimes also governmental concerns. This study poses the exciting question: what can community capacity do in a situation where all eyes are on the professionals? When the reflex response of these professionals is often to explicitly assume their own primacy? This gives rise to an interesting dilemma: how do we combine the abilities of the professional first responder with ordinary civilians' well-intentioned desire to lend a helping hand?

In my view the idea of working with simple guiding principles, in line with the theory of complex adaptive systems, is promising. The extremely complex organization of a flock of birds is, after all, determined by relatively simple principles.

The literature on civilian initiatives has shown us that there is a danger that the authorities will sometimes unwittingly extinguish such initiatives, whether by reacting over-enthusiastically to them, making excessive demands of them, or trying to take them over. This report shows us polder inhabitants who know what they're doing and who combine this with a healthy portion of stubbornness. In that case, making room and leaving space are essential. This then raises the question: to what extent is the existing disaster response organization able to do this, and would it exercise the necessary humility at the most critical moments? It is also open to question whether we know which levers to pull in order to effectively mobilize this community capacity. I think it would be wise to consider this question now, while skies are clear, rather than after the event.

Reflection by Iris Casteren van Cattenburch (communications)

'Good communication saves lives.' But what do we mean by 'good'? The inhabitants of A5H live in a flood-prone area. They have the capacity and the means to react independently to the threat of flooding, and to offer 'spontaneous' help. Our starting point is that the A5H communities should be involved in managing the risks that could threaten their well-being. In this study we examined the role of communication in relation to the success of community capacity. There were two relevant constraints to this examination: (1) we do not know when, or even whether, a flood will occur; and (2) we are looking at the situation today, and therefore at the knowledge, experience, and resources (including communication resources) of today. We cannot, therefore, provide a comprehensive answer to the question of what constitutes 'good' communications. We have, however, drawn a number of conclusions which are likely to remain tenable in the longer term:

- In the initial ('cold') phase: official communications should be directed towards creating broad support. Explain the policies that are aimed at maximizing the effectiveness of measures intended to protect people and property and minimize risks. Scenarios are of limited use here; people are more open to experience than to fiction.
- During an flood (evacuation): rely on positive human behaviour in emergency situations (Dynes 1994) and stimulate this with clear, unambiguous messages through channels that civilians can easily use and consult. Think about how best to approach people and advise them on their specific situation. A strong leader can reinforce solidarity and convey the importance of coherent action. Facilitate civil initiatives through joint communication actions on social media, factual information, and reliable news updates. Do not underestimate the power of social media while these are still available (Metaxa-Kavouli *et al.*, 2018).

- After the flood (rescue): communicate about remaining risks and delayed effects. Restoring order: who, what, how, when? Liability, social assistance, trauma counselling.

In all communications, take account of the fact that ‘what the community accepts’ is more important than ‘what’s needed’.

6.2 What does A5H teach us about the Netherlands and north-west Europe?

A5H lessons for the Netherlands

With regard to community capacity in an imminent flood, Alblasserwaard Vijfheerenlanden is a unique area. The water safety situation is unusual, given the very low likelihood of flooding but its enormous potential impact, in part because of the area’s ‘bathtub’ geography. It is also an unusual area in social terms, with very small villages (often around 2000 inhabitants) and an urban area characterized by large villages rather than cities.

Despite the uniqueness of the situation in A5H, this study does indeed yield information that is relevant to other areas in the Netherlands. The most important findings are the four principles of community capacity: mutual self-reliance, clarity and unambiguity, leadership, and partnership in responsibility. These principles apply in general to the community capacity provided during threatened or actual floods. On the basis of these principles it is relatively easy to identify the opportunities and risks of community capacity for other areas. In this study we carried out this exercise for A5H (see §2.3), and the same exercise can be carried out for other areas. We recommend that alongside the authorities directly involved (e.g. the Safety Region, the emergency services, the municipalities, the water board(s), and the province), experts and others drawn from the community are included in such exercises.

We can also give a number of relevant recommendations at the national level. For instance, practising the formulation of requests for help (recommendation 6) and messages (recommendation 7) is relevant to all exercises surrounding the threat of flooding. Building an app or another online platform to support decentralized coordination is best done at the national level. Finally, there are two recommendations which touch on the way all Safety Regions work: making a small number of people explicitly responsible for linking professional aid with community capacity during large crises or disasters (recommendation 13), and the way organizations discuss and consider community capacity (recommendation 15).

FRAMES: A5H lessons for north-west Europe

A5H and the issue of imminent flooding in the Netherlands is also unique in the perspective of FRAMES, whose pilot locations are distributed across Belgium, Denmark, Germany, the Netherlands and the UK. At the same time it is precisely the differences between these countries which mean that there are relevant lessons for resilience and multi-layer safety in the face of flooding (FRAMES stands for *Flood Resilient Areas by Multi-layer Safety*).

First of all we can see that the relationship between state and society has an influence on the potential for community capacity. Dutch water safety culture, in which the government promises ‘dry feet’, means that civic awareness of and preparation for flooding are almost non-existent in

the Netherlands. In A5H we can also see, besides this limited awareness of the risk of flooding, active entrepreneurship and a certain mistrust of government. In the UK, for instance, this mistrust is less marked, in part because there is a culture in which civilians are co-responsible for water safety (conversations with FRAMES partners). With regard to this cultural dimension, international FRAMES partners can provide valuable reflection on Dutch practices.

Secondly, many FRAMES partners have confirmed that equality, mutual understanding and partnership between state and society are important factors contributing towards flood resilience (conversations with FRAMES partners). This is confirmed by this study, and we have called this principle ‘partnership in responsibility’. We recommend that the FRAMES partners examine how this insight could be embedded in national and regional water safety policy and practice.

Thirdly, this study has shown that communication and coordination based on the ‘many to many’ principle has great potential. The rise of modern communication technologies is making this form of decentralized coordination ever easier. Working by the principle of ‘many to many’ instead of ‘one to many’ is not limited to Dutch borders, and we recommend that the FRAMES partners examine how this principle might bring about a change in crisis and disaster management (the 3rd layer of multi-layer safety).

Finally, this study has emphasized the social dimensions of multi-layer safety, since multi-layer safety is not only concerned with the physical characteristics of an area and a water system, but also with the social dynamics of its communities. The point is to develop a picture of the community and to identify how best the government can capitalize on the community capacity offered by this community. This question is also touched on in the scientific literature on community resilience (e.g. Forrest *et al.*, 2018; López-Marrero, 2010; Patel *et al.*, 2017). The social dimension of multi-layer safety deserves further implementation in research and practice.

6.3 In conclusion

In the course of this study the most telling remark made during interviews was “*Let’s hope it never happens.*” Thankfully, there is a very low likelihood of flooding following a breach in the dikes surrounding A5H. The impact of such flooding, however, would be enormous, not least because of its great depth and the small number of higher-lying locations in the area. If the A5H area were to be faced with imminent or actual flooding with this kind of impact, official disaster response capacity would soon be overwhelmed and helping hands would be badly needed. The appreciation of the enormity of this impact therefore leads to an appreciation of the need for, and potential of, community capacity.

In this study we have identified the potential of community capacity in A5H. We conclude that it has great potential: people are prepared to help, their personal networks are strong, and the A5H area has a great deal of equipment and entrepreneurship. It is impossible for governmental authorities to be fully equipped to deal with a disaster on this scale. It is possible, however, for the government to strengthen and enhance community capacity, allowing professionals and inhabitants to work side by side to contain the threat of flooding.

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Appendix 2. Interviews and design sessions

<i>Date</i>	<i>Interviewee(s)</i>	<i>Organization</i>
17 April 2019	Mr. van den Berg Ms. Bolwijn	Molenlanden municipality
7 May 2019	Mr. Brandwijk Mr. Kwakernaak	Blauwzaam Foundation (regional network for sustainability)
20 May 2019	Mr. Fazzi	Stedin (regional energy network manager)
27 May 2019	Mr. Sikkema	IV Infra (civil and traffic engineers)
3 June 2019	Mr. Glerum Mr. Knopper	Oasen (drinking water supply)
5 June 2019	Mr. Huijbers	Herik (hydraulic engineers)
13 June 2019	Ms. Franse	Papendrecht municipality
18 June 2019	Mr. Kruis Mr. De Bruin Mr. De Boer	Huis 't Bosch, Lexmond (event location) Lexmond Business Association Oranjevereniging Lexmond (social association)
20 June 2019	Ms. Kuup	Korfbalvereniging Vriendenschaar (sports club)
25 June 2019	Ms. Heikoop	Reddingsbrigade Hardinxveld-Giessendam (water rescue)
26 June 2019	Mr. Kroos Mr. Jonker	PKN De Morgenster (church) Voetbalvereniging Papendrecht (football club)
27 June 2019	Mr. Sneep	Province of South Holland
5 July 2019	Ms. Moens	Rijkswaterstaat (Public Works and Water Management)
8 July 2019	Ms. Zoethout Mr. Hazenoot Mr. Van de Waart	Rivierenland Water Board
9 July 2019	Mr. Ernstsen	Defence/Safety Region of South Holland South
5 Sep 2019	Mr. Mourik	Fire Service/Safety Region of South Holland South
Date	Session	
8 May 2019	First design session	
4 June 2019	Second design session	
1 July 2019	Third design session	