Strengthening and Redesigning European Flood Risk Practices
Towards Appropriate and Resilient Flood Risk Governance Arrangements

Analysing and evaluating flood risk governance in Sweden
Adaptation to climate change?

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Preface

This report is a deliverable of the EU 7th Framework Project STAR-FLOOD (www.starflood.eu). STAR-FLOOD focuses on Flood Risk Governance. The project investigates strategies for dealing with flood risks in 18 vulnerable urban regions in six European countries: England, Belgium, France, The Netherlands, Poland and Sweden. The project assesses Flood Risk Governance Arrangements from a combined public administration and legal perspective, with the aim to make European regions more resilient to flood risks.

Work Package 1 provided an extended problem analysis related to Flood Risk Governance in Europe. Work Package 2 focuses on how Flood Risk Governance in Europe can be researched. Work Package 3 forms the empirical core of the project, in which analyses, explanations and evaluations of each country, including three case studies, have been performed. This report constitutes deliverable D3.5 and is a summary of the research conducted in Sweden, including the case studies of the municipalities of Karlstad, Gothenburg and Kristianstad. On national level, flood risk governance in Sweden is characterised by a lack of a distinct policy domain, where the actors, rules, resources and discourses pertaining to floods and flood risk are spread across several policy areas including spatial planning, environmental protection and emergency management. A key feature of the Swedish system is municipal self-government, which is important both in terms of governance and implementation of Flood Risk Management Strategies (FRMSs). Although a distinct flood policy domain cannot be observed on national level, the three case studies evidence a more integrated management of flood risks. These case studies were selected on the basis of these municipalities’ special vulnerability to, and experience of, floods, as well as their relatively well developed FRMSs. The insights provided by the Swedish report on the management of flood risks in particular and the implementation of climate adaptation in general, may however also be useful in other local settings.

The six country reports, including case studies, of WP3, together with D3.1, the report on the case study workshops in each country, form the main input for the last two Work Packages of STAR-FLOOD, being WP4 and WP5. WP4 focuses on a systematic comparison between the STAR-FLOOD consortium countries and WP5 on the identification of design principles for appropriate and resilient Flood Risk Governance.

We trust that the current report is of interest for a broad readership with an interest in Flood Risk Management and governance. The content of this report may inspire researchers and professionals with an interest in social scientific and legal research into Flood Risk Management, Disaster Risk Reduction or climate change adaptation.

Yours sincerely,

Dr. Ann Crabbé
Leader of WP3

Dr. Kristina Ek
On behalf of the authors

Prof. Peter Driessen
STAR-FLOOD project coordinator
Overview of key findings

1. Main characteristics of flood risks in Sweden

Sweden is one of the largest countries in Europe with substantial variation across the country with respect to e.g. hydrological and geological conditions, as well as land use and population density. Therefore, the probability and consequences of floods vary significantly. According to the Swedish Civil Contingencies Agency (2011), fluvial floods are the most common type of flood in Sweden. This type of flood is usually associated with heavy rains, snow melting or ice plugs, with varying consequences, but generally not dramatic. The presence of hydropower dams provides an opportunity to store water, thus reducing flood risks in regulated rivers. The dams can however also potentially contribute to flood risks, if heavy rains affect areas where the reservoirs are filled. Furthermore, hydropower dams represent a risk in the case of dam failure, but the risks associated with such events are different from other flood risks in Sweden, given their low probability and extreme consequences. Pluvial floods, in the sense of floods caused by sudden and intense downpour, have become more common in recent times. These affect relatively small geographical areas, and while the local effects can be significant in financial terms, they do not normally impact society as a whole. In urban areas, flooding may result from storm water and sewerage systems not being able to handle the heavy rains. To illustrate the scale of the issue it can be noted that insurance claims (about 8,000 annually) together with the deductibles paid by individuals amount to about 400 million SEK annually (corresponding to about € 44 million) (Olshammar and Baresel, 2012:300).

Floods are however expected to occur with increased frequency in Sweden in the future as a result of climate change. The expected temperature rise in Scandinavian countries is expected to be greater than the global average. Precipitation is expected to increase mainly in the north and in the southwest, while the southeast part of the country will face increased periods of drought. The forecasted changes in temperature and precipitation will affect runoff into waterways.

2. Main characteristics of the Flood Risk Governance Arrangement

Flood risk management in Sweden does not at present constitute an independent policy area at national level. There is no national adaptation or flood risk strategy or plan, but there are e.g. a series of environmental objectives which are meant to be reached by 2020 and may partially touch upon flood risk issues, such as “flourishing lakes and streams”, “a good built environment” and “thriving wetlands”. The flood risk issue is scattered across different policy areas, each of which have their key legislative instruments. This does not mean that there are no points of connection among the different policy areas, as e.g. sewerage services and physical modifications of water bodies may not be decided or arranged in conflict with legally binding physical planning, but it may be beneficial for flood risk management to better and earlier consider these points of contacts. The same occurs in relation to measures that traditionally originate in other policy fields but that can also fulfil flood risk management functions, such as area protection which can serve environmental and recreational interests as well as flood risk management services. It is important to note that even if flood risk management lacks an integrated approach at national level, this is not necessarily the case for the local level, where the effects of flood are primarily felt and where many of the services relevant for
flood risk management are provided. However, this is heavily dependent on the availability of human, knowledge and financial resources at the municipalities. The issue is also more prominent in certain policy areas than in others. Within emergency management, flood risks are considered in both planning and operational functions, although they generally do not constitute the central type of emergency. Flood preparation can in this sense be considered institutionalised. Another key feature in Swedish flood risk management is the availability and prevalence of insurance which covers flood-related damages, implying that flood recovery is also of importance. There is also a long history of structural measures in Swedish waters, first in the form of ditching and land drainage favouring agrarian interest and later in the form of hydropower exploitation. These of course have effects on flood risk management to this day, but have not primarily come about for this purpose. Physical structures specifically for flood defence are usually of relatively small-scale. As for flood prevention and flood mitigation, flood risks have only in recent times been explicitly incorporated in physical planning and building legislation, but this has not necessarily translated into practice. While pipe-networks have a definite prevalence within storm water management, legislation has progressively made room for open solutions, though not yet with many results. Furthermore, different forms of area protection e.g. regarding shorelines and wetlands are available and applied, although mainly with an environmental and recreational objective.

There is reason to assume that the predominance of preparation, insurance and relatively small-scale defences is a consequence of the nature of the flood risk in Sweden. It has been claimed that “floods can vary in space and time very much; therefore floods are tackled when they occur, by temporary dikes and evacuating people” (Fiselier and Oosterberg, 2004). The fact that the Swedish Civil Contingencies Agency has been given the primary responsibility for the implementation of the Floods Directive supports the perception that flood risks are primarily a matter of societal safety.

Specific discourses can be discerned within each of the several policy areas that are concerned with flood risk management in Sweden. However, the following discourses seem to have had influence across the different domains: climate change concerns, environmental protection and sustainable development. For example, climate change is increasingly brought up not only in the planning and building sector, but also in relation to crisis management and dam safety, and even in relation to insurance premiums.

3. Explanations for stability and change

In general, the issue of flood risks can tentatively be considered as a growing national concern in particular as a result of an increased awareness of the impacts of climate change. An important event has been the work of the national “Commission on Climate and Vulnerability” (Official Reports of the Swedish Government 2007:60) which was initiated mainly as a result of the discussions about climate change and the expected results of the IPCC (2007) Fourth Assessment Report together with certain flood events, such as in Arvika 2000 and Lake Vänern 2000/2001. Also relevant are certain legislative developments in areas such as physical planning and dam safety.

The Floods Directive (2007/60/EC) was implemented through a Government Ordinance (Ordinance (1998:905) on environmental assessments), with national agencies at central and regional levels being assigned all responsibilities (preliminary assessment, maps and plans). The municipalities,
which are actually the key actors in flood risk management, have only a consulting role in the implementation process, and have no actual legal obligation to perform the measures included in the flood risk management plans. The work with the Directive is however expected to at least raise awareness and trigger some action (Johannessen and Granit, 2014).

4. Evaluation of resilience, efficiency and legitimacy

The main actors within the different areas relevant to flood risk management exist at the local level and in this sense, flood risk management in Sweden is decentralised. The local level (i.e. the municipalities) carries the main responsibility within emergency management and spatial planning as well as water and sewerage. The local level is supported and supervised by national agencies at regional level i.e. the County Administrative Boards. National agencies at central level, including the Swedish Civil Contingencies Agency, the National Board of Housing, Building and Planning as well as the Environmental Protection Agency, contribute through regulatory guidance and knowledge development. The Swedish Meteorological and Hydrological Institute acts mostly as a consultant and provider of data, forecasts, simulations, analyses and weather warnings. The decentralised approach has both positive and adverse implications. On the one hand, decisions and action can be tailored to local conditions, but on the other hand, municipalities which are vulnerable to flood risks but that do not have sufficient resources (financial and knowledge) are at a disadvantage.

The roles and responsibilities of the individual in flood risk management are complicated. While emergency and crisis management legislation build upon the principle that individuals have the primary responsibility to take and finance protective measures in relation to their property as well as to be prepared, this is not always acknowledged by the individuals themselves. Contracting appropriate insurance is also up to the individuals, which in itself is quite established. This could however be because flood related damages are covered by basic home insurance policy, and not necessarily imply an active choice by the insured. Insurance companies are therefore also key actors at least within flood recovery.

Municipalities finance their operations, e.g. emergency services, planning and building and sewerage, mostly through local taxes and charges. The local level receives some financial support from the central level, mainly for investigative or defensive measures, crisis preparedness and recovery, but these funds are perceived as insufficient. Thus, as for distributional effects between the different levels of government, costs for flood risk management seem to be borne largely by those who enjoy its benefits considering the local nature of the risks. On the contrary, the presence of uniform insurance premiums implies that costs are borne by the collective irrespective of individual flood risk.

The inclusion of flood risk into the different policy areas at national level has in general been done with little concern for accomplishing an integrated flood risk management approach. It is possible that the lack of a national agency at central level with overarching responsibility for climate change adaptation has accentuated this dispersed nature of flood risk management.

The fact that flood risk management does not constitute a specific policy domain at national level may have resulted in a lesser development of knowledge in the subject than what is the case with established policy domains. However, some areas relevant to flood risk management are knowledge-
wise more developed than others; there is e.g. more expertise regarding dam safety than sustainable urban drainage systems, at least in terms of flood risk.

5. Good practices, options for improvement and recommendations

The Commission on Climate and Vulnerability (Official Reports of the Swedish Government 2007:60) was an important driver for change which contributed to the development of flood risk governance in Sweden. This study however indicates that flood risk governance in Sweden is still highly fragmented and that the national level is perceived as being relatively passive; representatives from not least the local level claim that they would like to see clearer goals together with more support and guidance from the national level. A revised and updated national climate strategy where goals are clarified could potentially contribute to a more coherent and distinct flood risk management in the country.

The local level, i.e. the municipalities, accounts for the lion’s share of the implementation of concrete flood management measures in Sweden. Although there are pros and cons associated with the strong municipal self-government, it does not seem necessary to restrict the local self-government with reference to flood risk management issues. In fact, the substantial variations across the country with respect to e.g. geological, hydrological and socio-economic factors imply that flexibility is essential for efficient and legitimate flood risk governance.

There is, however, a need for increased public awareness with respect to the impacts of climate change in general and flooding in particular, as well as enhanced understanding of the individual responsibility in terms of flood measures. A large part of the instruments related to preparedness and recovery is based on individual responsibility and it is therefore necessary that people are aware of what they are facing both in terms of risks and opportunities. Increased awareness also entails opportunities for changed preferences which are imperative for institutional change and to rupture the path dependence.

Finally, the relatively comprehensive existence of measures that have a mitigating or protecting impact in relation to floods and flood risk, but that have not been established for this purpose, could be considered as potential actual flood mitigation or defence strategies. Wetlands could for example be established specifically for the management/mitigation of flood risk, and the many dams installed e.g. for the purpose of hydropower production can also be directed towards flood protection.
Table of contents

1. Introduction .......................................................................................................................... 1
  1.1 Introducing flood risk governance in Sweden ................................................................. 1
  1.2 Research aims and questions ......................................................................................... 1
  1.3 Research approach and methods .................................................................................... 2
  1.4 Outline of the report ....................................................................................................... 6
2 Analysis of national flood risk governance ........................................................................ 7
  2.1 Introduction ..................................................................................................................... 7
  2.2 The context level ............................................................................................................ 7
    2.2.1 Physical circumstances ............................................................................................. 7
    2.2.2 Historical events and related responses .................................................................... 8
    2.2.3 General characteristics: demographic, socio-cultural and socio-economic context .... 9
    2.2.4 Administrative structure ......................................................................................... 10
    2.2.5 Political and administrative culture ......................................................................... 11
    2.2.6 Legal context regarding floods ............................................................................... 12
    2.2.7 Legal status of water and soil ................................................................................ 12
    2.2.8 Sustainable development as guidance for the judicial practice ............................ 13
    2.2.9 Implementation of the Floods Directive in Sweden ............................................... 13
  2.3 Flood Risk Governance in Sweden .................................................................................. 14
    2.3.1 Introduction ............................................................................................................ 14
    2.3.2 Overview of Flood Risk Management Strategies ..................................................... 14
    2.3.3 Flood Prevention ..................................................................................................... 15
    2.3.4 Flood Defence .......................................................................................................... 17
    2.3.5 Flood Mitigation ....................................................................................................... 19
    2.3.6 Flood Preparation .................................................................................................... 21
    2.3.7 Flood Recovery ......................................................................................................... 24
  2.4 Explanations for stability and/or change in Flood Risk Governance in Sweden ............... 25
    2.4.1 Characterizing flood risk governance in Sweden .................................................. 25
    2.4.2 The extent of governance dynamics in Sweden .................................................... 26
    2.4.3 Explanatory factors for change and stability in Sweden’s flood risk governance ....... 27
  2.5 Evaluations at the national level ..................................................................................... 27
    2.5.1 Societal resilience .................................................................................................... 27
    2.5.2 Efficiency ................................................................................................................ 28
    2.5.3 Legitimacy ............................................................................................................... 28
3 Case study: Karlstad .............................................................................................................. 31
  3.1 Introduction and scope of the analysis .......................................................................... 31
  3.2 Main characteristics of the case study .......................................................................... 31
    3.2.1 Physical and socio-economic circumstances .......................................................... 31
    3.2.2 Historical events and related responses .................................................................. 32
    3.2.3 Administrative structure ......................................................................................... 33
  3.3 Analysis of flood risk governance in Karlstad .................................................................. 33
    3.3.1 The local flood management programme in Karlstad ......................................... 34
    3.3.2 Flood Prevention ..................................................................................................... 36
    3.3.3 Flood Defence .......................................................................................................... 38
    3.3.4 Flood Mitigation ....................................................................................................... 40
    3.3.5 Flood Preparation .................................................................................................... 42
    3.3.6 Flood Recovery .......................................................................................................... 43
  3.4 Explaining dynamics in flood risk governance at the case study scale ............................. 43
References ................................................................. 77
Annex I: List of Interviewees ...................................................... 89
List of figures

Figure 1.1: Overview of the five FRM strategies identified within STAR-FLOOD 2
Figure 1.2: Overview of research approach 3
Figure 1.3: Areas identified as vulnerable to significant flood risks in Sweden 4
Figure 2.1: Expected percentage change in amount of water in watercourses 8
Figure 2.2: Schematic overview of the strategies present at the national level in Sweden 14
Figure 3.1: Flood-map of Karlstad (100 year flood in river Klarälven) 32
Figure 3.2: Flooding in Karlstad, 1916 33
Figure 3.3: Schematic overview of the strategies present in Karlstad 34
Figure 4.1: Map of Göta River from Lake Vänern to Gothenburg 46
Figure 4.2: Schematic overview of the strategies present in Gothenburg 48
Figure 5.1: Kristianstad: Flood risk at highest calculated flow in Helge River 58
Figure 5.2: Differences in water levels during the flood in 2002 59
Figure 5.3: Schematic overview of the strategies present in Kristianstad 60

List of tables

Table 1.1: Key characteristics of selected case studies and research motivation 5
Table 2.1: Historical events in Sweden and related responses at national level 8
Table 2.2: Major demographic characteristics of Sweden 10
Table 2.3: Main governmental levels for flood risk management in Sweden 11
Table 2.4: Overview of FRMSs and associated measures in Sweden 15
Table 7.1: An overview of how the Swedish NFPR scores on the evaluation criteria 69
Table 8.1: Opportunities and barriers to strengthening flood risk governance in Sweden 74

List of boxes

Box 1.1: Research questions of the STAR-FLOOD project 1
Box 2.1: Examples of proposed adaptation measures for planning and building 20
Box 2.2: Extreme weather warnings 23
Box 3.1: Example of how flood risk can be considered in the planning process 37
1. Introduction

1.1 Introducing flood risk governance in Sweden

Sweden has been relatively fortunate when it comes to serious consequences of floods. The substantial variations across the country with respect to e.g. geological, hydrological and socio-economic factors also imply that the tendency and vulnerability to floods vary substantially. However, since the late 1990s, in connection with discussions on climate change and the occurrence of several larger flood events, the issue of flood risk has moved up on the political agenda. Thus, while flood risk governance is not a distinct policy domain at country level, the issue has grown in importance. In some municipalities, in which the flood problem is patent, flood risk management has been given significant space in local politics. In this report, national flood policies and regulations as well as local flood risk governance in three selected municipalities are analysed. The so far limited involvement of the national level may limit the capacity of the flood risk governance systems on different levels to change and adapt to future challenges associated with climate change.

1.2 Research aims and questions

This report is a deliverable of the EU 7th Framework Project STAR-FLOOD (see www.starflood.eu for an outline of the project). STAR-FLOOD focuses on Flood Risk Governance. The project investigates how current flood risk governance arrangements can be strengthened or redesigned to enhance societal resilience to flooding. To this end, it is assessed to what extent governance arrangements support or constrain the diversification of Flood Risk Management Strategies as well as the extent to which such a diversification of strategies enhances societal resilience to flooding. Empirical research is carried out in six European countries – England in the UK, Belgium, France, The Netherlands, Poland and Sweden – and eighteen vulnerable regions in these countries. The project is assessing Flood Risk Governance from a combined public administration and legal perspective.

This report is deliverable D3.5 of the third Work Package of STAR-FLOOD. While the first Work Package provided an extended problem analysis related to Flood Risk Governance in Europe and the second Work Package focused on how Flood Risk Governance in Europe should be researched, Work Package 3 reports the main results of the empirical research. It does so through six country-specific reports, which each identify the architecture of flood risk governance, analyse flood risk governance and evaluate current arrangements of governance in terms of resilience, efficiency, and legitimacy. These findings are supported by inter-disciplinary research conducted at the national and case study scale.

Box 1.1 below lists the research questions that are being addressed in this report. In Work Package 4, similar research questions will be addressed, but from a more comparative perspective.

Box 1.1: Research questions of the STAR-FLOOD project

<table>
<thead>
<tr>
<th>National level research questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How is the National Flood Policies and Regulations System (NFPRD) in Sweden structured? To what extent is there cohesion between sub-Flood Risk Governance Arrangements?</td>
</tr>
</tbody>
</table>
2. To what extent are the 5 Flood Risk Management Strategies distinguished within STAR-FLOOD (see below) embedded in the NFPR? Is there evidence to suggest efforts are being made to diversify Flood Risk Management Strategies and measures employed within these strategies?

3. In what ways are the National Flood Policies and Regulations System linked to other relevant policy domains? In what ways do these enable or constrain flood risk governance?

4. How has the NFPR changed over time? What explanatory factors account for periods of stability and/or change?

5. To what extent can the current NFPR be characterised as resilient, efficient and legitimate? How has this changed over time?

Case study research questions

6. To what extent do the governance arrangement(s) in selected case studies reflect those evident in the NFPR?

7. To what extent are the 5 FRMSs embedded in the governance arrangement(s) in selected case studies?

8. How have arrangements for flood risk governance evolved over time? What are the driving forces for stability and/or change? In what ways do these compare to those seen at the national scale?

9. To what extent can the governance arrangement(s) in selected case studies be characterised as resilient, efficient and legitimate?

10. To what extent do the governance arrangement(s) in the NFPR enable or constrain innovative initiatives in selected case studies?

1.3 Research approach and methods

To analyse stability and change in Flood Risk Governance Arrangements, the STAR-FLOOD project draws on the Policy Arrangements Approach (PAA). Policy arrangements have been defined as “a temporary stabilisation of the content and organisation of a policy domain” (Van Tatenhove et al., 2000). Since NFPR does not constitute a distinct policy domain in Sweden, the analysis in this report is focused on the implementation of management strategies rather than on governance arrangements measures/instruments within the strategies (see Figure 1.1 for examples of strategies and corresponding measures/instruments).

Figure 1.1 Overview of the five Flood Risk Management Strategies identified within STAR-FLOOD

The implementation of strategies is described and analysed over the relevant dimensions of policy domains (actors, discourses, rules and resources) at different scales, including local, regional, national and international. The analysis focuses on institutional constellations and interplay between actors and actor coalitions involved in the policy domains most relevant for flood risk management—including spatial planning, risk and safety management and energy management; their dominant discourses; formal and informal rules of the game; and the power and resource base of the actors involved (Hegger et al., 2013). By studying the development of these strategies and whether they have become more or less integrated over time, the degree of stability or change in flood risk gov-
Governance can be analysed. Moreover, by examining the flood risk management measures grouped into the strategies we can test our starting assumption that diversity is a necessary feature of resilient governance.

Figure 1.2 Overview of research approach

At a national level, flood policies and regulations in Sweden do not at present constitute an independent policy area. Possible shifts are thus likely to occur as a result of changes in several policy areas as well as after changes directly related to floods risks or flood experiences. For this reason, a single base year for the analysis cannot be established. The main part of the report is however focused on the period from the late 1990s and onwards. This is the period in which the awareness of the need for adapting to climate change has taken off, not least as a result of the increased occurrence of floods in some parts of the country.

Although a distinct flood policy domain cannot be detected on national level, circumstances on the local level may be notably different. Sweden is a large country with substantial local variations with respect to e.g. geological, hydrological and socio-economic characteristics and the tendency of and vulnerability to floods therefore also varies substantially over the country. As a result of the implementation of Directive 2007/60/EC on the assessment and management of flood risks, areas in which both the probability of a flood and the consequences thereof would be significant were identified in 18 of 290 Swedish municipalities (see Figure 1.2 below) (Swedish Civil Contingencies Agency, 2011:8).

The case studies, the municipalities of Karlstad, Gothenburg and Kristianstad, were selected on the basis of their characteristics as: (a) particularly vulnerable to floods (all three were identified among the 18 with significant risks and consequences of floods); b) significant experience of floods; and c) municipalities expected to be forerunners with relatively well developed strategies for flood risk management that may provide important lessons for other municipalities as well as for the country as a whole. With respect to socio-economic characteristics the case studies represent medium size or large municipalities with stable populations and income levels. The results of the case study analyses are consequently not representative for Swedish municipalities in general.
Figure 1.3 Areas identified as vulnerable to significant flood risks in Sweden  
*Source: Swedish Civil Contingencies Agency (2011)*

The case-studies are based on 19 semi-structured interviews with representatives from national, regional and local level regarding the management of flood risks, including six officials at the County Administrative Boards of Värmland and Västra Götaland, eight municipal officials (at departments with responsibilities for spatial planning, water and sewerage, and crisis management), and two officials at the Rescue Services in each municipality. In addition, two interviews with representatives from the National Board on Housing, Building and Planning and the Swedish Civil Contingencies Agency have been conducted. All interviews were recorded and transcribed in their entirety. To increase openness in discussion, all interviewees were guaranteed that no results or responses would be presented in a way that made it possible to identify individuals.

With regard to document analysis, all legal studies in the report are qualitative studies based on positive analytical jurisprudence, defined here as the study of the concept or nature of law, *i.e.*, the “existing legislation” (*e.g.* Austin, 1832; Hart, 1961), understood here not only as the legal texts and associated preparatory works and case law, but also voluntary instruments and policy that have a significant (and persistent) influence on the legal situation. The policy analysis is mainly based on public documents and broader literature survey.
### Table 1.1: Key characteristics of selected case studies and research motivation

<table>
<thead>
<tr>
<th>Population in municipality</th>
<th>Case study 1: Karlstad</th>
<th>Case study 2: Gothenburg</th>
<th>Case study 3: Kristianstad</th>
</tr>
</thead>
<tbody>
<tr>
<td>88,000</td>
<td>540,000</td>
<td>82,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Properties at risk from flooding</th>
<th>Karlstad</th>
<th>Gothenburg</th>
<th>Kristianstad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objects at risk include central hospital, water and sewerage systems, telecommunications, the railways and parts of the electrical power supply.</td>
<td>Emergency services, transport infrastructure, water and sewerage systems, polluted land areas, and protected water and land areas.</td>
<td>Objects at risk include water and sewerage system, regional hospital, and the Rescue Services.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of flooding</th>
<th>Pluvial, fluvial, dam failure</th>
<th>Coastal, fluvial, pluvial</th>
<th>Pluvial, fluvial, dam failure</th>
</tr>
</thead>
</table>

| Elevation | Karlstad municipality has experience with flooding and has been working actively with flood risk management for at least 10 years. Local flood management programme for Karlstad. | Gothenburg has experience with flooding and has been working actively with flood risk management for at least 10 years. Large scale flood protection project is underway. | Kristianstad is one of the most flood prone areas in the country and flood risk management is clearly visible on the local political agenda. Kristianstad has been claimed to be a role model for Swedish flood risk management. Defensive measures established. |

The empirical research reported in this document, both at country and case study level, comprises the following steps: (i) analysis of flood risk governance, including stability and change therein; (ii) explanations for the dynamics (both stability and change) found; and (iii) evaluations thereof. For the analysis of flood risk governance, the four dimensions of the policy arrangements approach (actors, discourses, rules, resources) have been used. Details on the operationalization of the four dimensions and the indicators used can be found in Larue et al., 2013. Explanations have been made by looking for five types of explanatory factors: (i) physical circumstances; (ii) physical and social infrastructure; (iii) structural factors; (iv) characteristics of agency and (v) shock events. We have taken in mind that these five factors may be found within but also external to flood-relevant policy domains (an example of the latter concerns e.g. major developments in political culture at the national level). We also bear in mind that each factor may contribute both to stability and to change.

Evaluations of flood risk governance have been made using the following evaluation criteria: resilience, effectiveness, efficiency and legitimacy. The criterion of resilience has been used to address the question of whether and to what extent (i) a diversified set of Flood Risk Management Strategies is actually in place at country and case study level (ii) the strategies have been linked together and aligned; and (iii) there is a proven capacity to learn and adapt (i and ii refer to the capacity of the object of evaluation to resist floods, respond to them and recover from them. iii refers to the object
of evaluation’s adaptive capacity). The criterion of resilience is linked to the other criteria in various different ways. Most notably, effectiveness (e.g. of strategies, measures) in terms of problem solving and goal achievement is seen a necessary precondition for resilience. Several other relationships between the evaluation criteria have been conceptualised, both in terms of synergies and trade-offs.

1.4 Outline of the report
The outline of this report is as follows. Chapter 2 focuses on an understanding of the National Flood Policies and Regulations System (NFPR) in Sweden. After elaborating on relevant context-related variables, a review is provided of current flood risk governance and the implementation of Flood Risk Management Strategies (FRMSs). To understand how and why governance has formed in this way, section 2.4 aims to provide explanations for the outlook of the current flood risk governance arrangement including the stability and change in the national arrangement and relevant legal factors. This chapter raises interesting questions to be taken up at case study level. Chapters 3-5 analyse, explain and evaluate developments in the case studies of Karlstad, Gothenburg and Kristianstad respectively. Based on chapter 2-5, chapter 6 provides overarching explanations and chapter 7 provides overarching evaluations of the developments studied. Chapter 8 concludes this report by providing suggestions for strengthening and redesigning flood risk governance in Sweden.
2 Analysis of national flood risk governance

2.1 Introduction
This section focuses on understanding national flood policies and regulations (NFPR) in Sweden and provides insights into the main features of the governance of flood risks in the country. Unlike the other STAR-FLOOD countries, there is no distinct flood policy domain at the national level in Sweden; flood risk governance is instead generally embedded into other policy areas (e.g. risk and safety, climate, energy and spatial planning). This is likely because, although floods do occur in Sweden, the risks are at least at present relatively limited. After elaborating on relevant context-related factors (2.2), a review is provided of developments in Flood Risk Governance (2.3), including prominent characteristics and possible developments in how the flood issue is discussed in Sweden and the degree in which features of these discourses may have become institutionalised through a possible evolvement of (shifts in) actors, rules, and resources (2.4). In Section 2.5 the resilience, legitimacy and efficiency of the national Flood Risk Governance is discussed. Section 2.6 concludes this chapter.

2.2 The context level

2.2.1 Physical circumstances
In comparison to other countries, Sweden has been relatively fortunate when it comes to serious consequences of floods. According to the Civil Contingencies Agency’s database over natural disasters (2015), 36 significant floods have occurred in the country between 1950 and 2015 (http://ndb.msb.se/). The most common problems associated with flood events are damages to property and infrastructure. Flood events seldom lead to deaths in Sweden; for the period 1901-2010 there has been loss of human life on seven occasions, with one to three deaths reported at each occasion (Swedish Civil Contingencies Agency, 2012a:4). This number is relatively low, considering that the annual global average is 5400 people (Swedish Civil Contingencies Agency, 2012a:26).

The most common type of flood in Sweden is fluvial floods, i.e. flooding along rivers and lakes. The highest flows usually occur during spring in connection to snow melting. Most of the major watercourses in Sweden are regulated for the purpose of hydroelectric power generation. Although these dams have not been built for the purpose of reducing flood risks, they provide an opportunity to store water, thus reducing flood probability in regulated watercourses. If heavy rains affect an area where the reservoirs are filled, the dams can however also contribute to flood risks. Hydropower dams furthermore represent a risk in the case of a dam failure. Pluvial floods, caused by heavy rains, have become more common since the end of the 1990s (e.g. Official Reports of the Swedish Government 2007:60), but generally affect relatively limited geographical areas, in particular areas with a high proportion of hard surfaces where the storm water systems are not designed for extreme rainfall, and do not normally have a significant impact on society. Coastal floods are rare (Swedish Civil Contingencies Agency, 2011:28-29).

Both fluvial and pluvial floods are expected to occur with increased frequency in Sweden in the future as a result of climate change (Official Reports of the Swedish Government 2007:60). The expected temperature rise in Scandinavian countries is expected to be greater than the global average. Figure 2.1 shows the expected percentage change in the amount of water in all watercourses for the
periods 2021-2050 and 2069-2098 (compared to 1963-1992). The figure displays that precipitation is expected to increase mainly in the north and in the southwest (marked in blue), while the southeast part of the country will face increased periods of drought (marked in red). In addition, the southwestern parts of the country are pointed out as being the most vulnerable to floods and landslides.

Figure 2.1 Expected percentage change in amount of water in watercourses
Source: Swedish Meteorological and Hydrological Institute, 2014b

2.2.2 Historical events and related responses
Table 2.1 summarises important events and related responses relating to flood risk management in Sweden. As a result of certain domestic flood events,¹ which led to a formal request from the county level to the Government on how to manage flooding in the large lakes, as well as the then upcoming report from the Intergovernmental Panel on Climate Change (IPCC, 2007), in 2005 the Swedish Government appointed a Commission to investigate societal risks and vulnerabilities with regards to extreme whether events and long-term climate change. The Commission took the name “Commission on Climate and Vulnerability”.

The final result of the investigation was the 2007 report Sweden facing climate change – threats and opportunities (Official Reports of the Swedish Government 2007:60), which stated that the risk for floods, landslides and erosion was increasing to such extent in certain areas that it warranted enhanced measures. Moreover, the report identified risks for adverse effects in relation to water quality in lakes and water courses, and for the ecosystems of the Baltic. The commission made several

¹ In the autumn of 2000 the west of Värmland was hit by a severe flood. As a result of heavy rainfall, water levels rose to more than three meters above the normal level. The waterfront properties in Arvika were flooded and large damage was caused to roads and other infrastructure, individual properties and farmland. The total costs amounted to 306 million SEK (€ 33 million) (Gustavsson, 2001; SOU 2006:94). The heavy rains also led to a sharp increase in the water level in Lake Vänern. Problems with flooding started in the middle of November, and by the time the water level culminated in January 2001, significant measures were taken to protect important societal functions such as water and sewage, roads, houses etc. Nevertheless, the damage in many of the surrounding municipalities was significant (Blumenthal, 2010; SOU, 2006:94).
proposals for *e.g.* legislative reforms, agency responsibility, public financing of adaptation measures and research, many of which have since then been set in motion.\(^2\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/2001</td>
<td>Floods in Lake Vänern and Arvika</td>
<td>Formal request to the Government from County level</td>
</tr>
<tr>
<td>2005</td>
<td>Discussions regarding coming IPCC report</td>
<td>National commission on risk and vulnerabilities with regard to climate change initiated</td>
</tr>
<tr>
<td>2007</td>
<td>Final report from national commission on risk and vulnerabilities with regard to climate change published.</td>
<td>Legislative and investigative measures <em>e.g.</em> within planning and building (changes to the Planning and Building Act and commissioning to National Board for Housing, Building and Planning).</td>
</tr>
</tbody>
</table>

Parallel to the work of the Commission on Climate and Vulnerability, the matters of security, safety and crisis management were also under revision. In 2009, the Swedish Civil Contingencies Agency was formed, with the objective of developing and supporting society’s capacity to deal with contingencies and emergencies. The then existing Rescue Services Agency (SRV), Emergency Management Agency (KBM) and the Swedish Board of Psychological Defence (SPF) were consequently all shut down. There was a need to develop crisis coordination at national level in order to better assist the local and regional level (Department series, 2006:1, p.11-13). By forming one new agency out of the three previous, the government hoped to create rationalization- and synergy effects (Government Bills, 2005/06:133, p. 95-96).

### 2.2.3 General characteristics: demographic, socio-cultural and socio-economic context

Sweden is sparsely populated, with a population density that varies significantly across the country; the capital city of Stockholm holds 4600 people per square kilometre, whereas the smaller cities in the northern parts only inhabit one person in an area of that size (Statistics Sweden, 2013:65-75). The annual income in Sweden is above the European average (EU 28 countries). After a crisis in the 1990s the Swedish economy has been relatively stable, with a strong national budget and slowly increasing employment. This should imply that the nation is financially relatively well prepared for dealing with costs arising in case of natural disasters such as larger floods.

According to the six dimensions of national culture developed by Hofstede, Sweden is a highly consensus oriented, egalitarian and fairly individualistic country with relatively weak controlling social norms (Hofstede, 2001). Hofstede’s model also suggests that the population is not particularly risk averse. People have lived in peace for more than 200 years and the Swedish state has played an active role in developing the social security system during the last decades. These factors may have

\(^2\) On behalf of the Swedish Government, the Swedish Meteorological and Hydrological Institute has recently conducted an analysis of the work on climate adaption after the Commission on Climate and Vulnerability in 2007. The overall conclusion is that coordination between actors should be improved and that roles and responsibilities need to be clarified (Andersson *et al.*, 2015).
contributed to the somewhat relaxed attitudes towards uncertainty and indulgence as suggested by the results of Hofstede.

Table 2.2: Major demographic characteristics of Sweden

<table>
<thead>
<tr>
<th>Year</th>
<th>#residents</th>
<th>#households</th>
<th>#residents per household</th>
<th>Population density/km²</th>
<th>Average age</th>
<th>Average household income (€)/month</th>
</tr>
</thead>
</table>

Source: Statistics Sweden: www.scb.se

2.2.4 Administrative structure

Swedish democracy is realized through a representative and parliamentary form of government and through municipal self-government (Ch. 1, s., Instrument of Government). The Government is assisted by about 400 administrative agencies. These are guaranteed a certain degree of independence; neither Parliament nor the Government may determine how an agency will decide in a particular case or exercise its powers (Ch. 12, s. 2, Instrument of Government).

The municipalities are responsible for local matters of public interest and may levy tax for the management of their affairs (Ch. 14, s. 1-2, Instrument of Government). The politically elected municipal assemblies decide on municipal matters such as goals and guidelines, local taxes, the budget and the organization and procedures of the committees (municipal boards) (Ch. 6, s. 7, Local Government Act) The assembly designates the committees to execute the municipal activities in accordance with legislation, goals, ordinances, and guidelines, decided by the assembly (Ch. 6, s. 7, Local Government Act) The committees govern the different departments, which handle administrative matters, implement decisions, and run day to day operations. Municipal administrations are covered by the mentioned constitutional independence principle (Ch. 12, s. 2, Instrument of Government). Table 2.3 lists the key actors for flood risk management on national, regional and local level, as well as their main responsibilities in this context.
Table 2.3: Main governmental levels relevant for flood risk management in Sweden

<table>
<thead>
<tr>
<th>Level</th>
<th>Most important authority</th>
<th>Main responsibility in flood risk management</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>Swedish Civil Contingencies Agency</td>
<td>Competent Authority for the Implementation of the Floods Directive</td>
<td>Responsible for flood mapping Educates public agencies and municipalities Provides information to the government Provides (limited) funding.³</td>
</tr>
<tr>
<td></td>
<td>National Board for Housing, Building and Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional</td>
<td>County Administrative Boards</td>
<td>Ensure that national goals are reached at the county level</td>
<td>Support and supervise municipalities in e.g. planning matters and emergency management</td>
</tr>
<tr>
<td>Local</td>
<td>Municipalities</td>
<td>Central operational responsibility for flood risk management</td>
<td>Spatial planning Emergency planning Water and sewage</td>
</tr>
</tbody>
</table>

2.2.5 Political and administrative culture
The Swedish administrative culture is characterised by a strong central government and a large governmental sector. The faith in the government is relatively strong and the public welfare system is comprehensive (Lundmark et al., 2009:18-22). Since the 1970s there has been a gradual change towards a higher degree of decentralisation. This trend does not imply that government control is removed, but should rather be seen as a transition to a more indirect and less detailed control. Since the 1990s the municipalities have the authority to define their internal organisation and to distribute the governmental grants. In addition, as a result of a growing critique in the 1980s of what was perceived as an overly centralised and bureaucratic public sector, a move towards deregulations and privatisation of the public sector commenced.

The results of public opinion surveys regarding defence and security policy suggest that the interest of the general public in issues related to civil protection and emergency preparedness has increased during the latest years: almost 60 percent of the respondents report that they have a very large or fairly large interest in these issues (Swedish Civil Contingencies Agency, 2012b:9-10). The public perceives nature catastrophes, such as larger flood events, as unlikely to occur in Sweden in the near future and the public concern for such events is also small (Swedish Civil Contingencies Agency, 3).

³ The Civil Contingencies Agency annually provides government grants for measures taken to adapt Sweden to climate change, including flooding (Civil Contingencies Agency, 2013:3). The municipalities may apply for support, and if approved, the grant will constitute 60% of the total cost, or 60% of the vulnerable object’s value (Civil Contingencies Agency, 2013:3). However, the grants available have declined in recent years. In 2011 the grants constituted to about 50 million SEK (€ 5.3 million), but from 2013 and onwards they amount to 20 million SEK per year (€ 2.1 million) (Proposition 2012/13:1:109)Civil Contingencies Agency, 2014).

⁴ Respondents were however not explicitly asked about their concern for floods and it is therefore possible that they included floods under the heading of natural disasters or under the heading of climate change. It is also possible that some respondents did not include floods under any of the headings in the questionnaire.
There is, however, a larger extent of reported concern regarding more long-term threats such as climate change, which implicitly also may include concern for increased risk of floods (Swedish Civil Contingencies Agency, 2012b:20-21).

Less than half of the respondents believe that the emergency preparedness of the authorities will be sufficient in the event of a natural disaster. Although the confidence in Swedish authorities’ emergency preparedness is quite low, there seems to be a strong opinion that the responsibility for helping and rescuing individuals who are affected by emergency situations such as nature catastrophes and accidents lies with Swedish authorities (95 percent supported this idea). About half the respondents claim that it is the responsibility of Swedish authorities to help and rescue an individual even if they voluntarily put themselves in danger (Swedish Civil Contingencies Agency, 2012:34). Moreover, responses to questions addressing flood events specifically reveal that the public believes that the authorities have not learned sufficiently from previous flood events (Swedish Civil Contingencies Agency, 2012:32).

2.2.6 Legal context regarding floods
Scandinavian Law is generally considered either as a subgroup of the Civil Law family or as a separate legal family altogether (Bernitz, 2007:15). Although the Swedish legal system is based on statutory law, there is no general civil code in the German or French meaning. Instead, there are a certain number of acts that deal with the basic aspects of private law and a strong reliance on case law and analogies to resolve the legal problems not covered by statutes (Bernitz, 2007:20). As a result of the ideological influence of Legal Realism, Scandinavian legal scholars tend to avoid “undue conceptualism and the construction of large-scale integrated theoretical systems” (Bernitz, 2007:19), in favour of a practical approach to the law.

The main sources of law consist of statutes, case law, legislative preparatory works and legal doctrine. The most important statutes are the four constitutional acts which set the rules for the organization and exercise of public power as well as define the fundamental rights and freedoms of the people. Other statutes, namely acts, ordinances and regulations, may not conflict with the constitutional acts. The traditional Swedish hierarchy of sources of law has been modified by the influence of International and European Law.

There are three kinds of courts in Sweden: General courts, which decide on matters of civil and criminal law; General administrative courts, which resolve disputes between private persons and public authorities; and Special courts for specific areas of the law. Five of the general (district) courts are also Land and Environment Courts, which have competence to hear in environmental, planning and building, as well as water issues.

2.2.7 Legal status of water and soil
Land in Sweden is to great extent owned by private persons (43 percent). Also Swedish companies and the Swedish state are significant landowners (30 and 18 percent, respectively) (Julstad, 2011:16). Swedish legislation ties the ownership of the land to the right to the water in that land. The principle is thus that water is private. It is generally considered inappropriate to state that the owner of the land “owns” the water too. Instead, the term “disposition” is used to characterize the landowner’s right to use the water that at that moment is within the limits of his land (Michanek and Zetterberg, 2012:292) and to take measures either to exploit it or to eliminate or reduce the damages associated
with it (Strömberg, 1984:34). However, the exploitation of water resources and the protection against water hazards are matters that do not exclusively concern individual landowners, but society in general. Therefore, public interests in relation to water are, in the same manner as they are in relation to land, safeguarded through various limitations to the individuals’ disposition over their water (Ljungman and Sjernquist, 1970:54), e.g. in the form of substantive (environmental) rules and the requirement of permit for certain activities (water operations).

The Act (1950:595) on Boundaries to Public Water Areas allows for the identification of what is instead considered public water. Public water is the exception and only applies to the territorial sea and the great lakes (Vänern, Vättern, Hjälmaren and Storsjön); the so-called public water areas. Up to 300 metres from the shoreline the water is however normally private even if it borders on public water areas (s. 2, Act on Boundaries to Public Water Areas). The public water areas are governed – but not owned – by the state, which thereby has the right to decide in matters concerning use and exploitation.

2.2.8 Sustainable development as guidance for the judicial practice

The issue of sustainable development has, primarily since the advent of the Environmental Code in 1998, gained ground in Swedish environmentally related legislation. The overall aim of the Code is to promote sustainable development “which will assure a healthy and sound environment for present and future generations” (Ch. 1, s. 1) and the law shall be applied so that natural resources are used in a way that guarantees long-term sustainable development. Sustainable development is also guiding the application of other relevant pieces of legislation, such as the Planning and Building Act (Ch. 1, s. 1), which entails that e.g. adaptation to climate change (for example in the form of considering flood risks) is an important factor to consider in the balancing of different interest and deciding on land use. Since 2003, a call for all public institutions to promote sustainable development is also laid down in the constitution (Ch. 1, s. 1, Instrument of Government).

In addition, the Swedish Parliament has decided on a number of objectives which are meant to guide the country’s environmental policy, also on the local level. The overarching objective is the Generational Goal, which entails handing over to the next generation “a society in which the major environmental problems in Sweden have been solved, without increasing environmental and health problems outside Sweden’s borders” (Swedish Environmental Protection Agency, 2012:3). This goal is completed by 16 Environmental Quality Objectives of which several are relevant in the context of flood risk management, for example: Reduced Climate Impact, Thriving Wetlands and Good Quality Groundwater (www.miljomal.se).

2.2.9 Implementation of the Floods Directive in Sweden

The Floods Directive was implemented in Sweden primarily through Ordinance (2009:956) on Flood Risks. The Swedish Civil Contingencies Agency has the overall responsibility for the implementation of the Directive and has conducted the required preliminary flood risk assessment as well as produced the flood hazard maps for the 18 areas that have been identified as vulnerable to significant flood risks.\(^5\)

\(^5\) It can be noted here that while most watercourses in Sweden are located within national borders, some are shared with Norway and Finland. There are several historical agreements between these countries regulating water-related issues. In some cases, flood risks are dealt with specifically, as e.g. the 2009 transboundary rivers
Flood risk maps have been elaborated by the five County Administrative Boards that are designated water authorities for the river basin districts in Sweden. The preliminary flood risk assessment covered only fluvial floods, with coastal floods expected to be included in the 2018-2022 revision cycle. The aim of the assessment was to identify the areas where the consequences of floods are significant (Swedish Civil Contingencies Agency, 2011).

In relation to flood risk management plans, the objective is to identify key conclusions on the basis of the flood hazard and flood risk maps as well as possible needs for measures. There are in principle four categories of measures defined in the Guidance for Flood Risk Management Plans: prevention, protection, preparation and recovery (Swedish Civil Contingencies Agency, 2014a:25-27). A fifth category of “other measures”, e.g. knowledge development, can be included as long as it cannot be classified under the four main categories. The first flood risk management plans are expected to include knowledge-related measures to a considerable extent (Swedish Civil Contingencies Agency, 2014a:24).

2.3 Flood Risk Governance in Sweden

2.3.1 Introduction
The subsequent sub-sections elaborate on the various facets of National Flood Policies and Regulations (NFPR) in Sweden. First, an overview of Flood Risk Management Strategies (FRMSs) and associated typical measures is presented. Then, the developments in these strategies and measures mainly from the 1990s until now are discussed. Each strategy is analysed through the four dimensions of the Policy Arrangements Approach: rules, actors, resources and discourses.

2.3.2 Overview of Flood Risk Management Strategies
Table 2.4 and figure 2.2 outline the available FRMSs and the associated measures in Sweden and indicates their relative importance. The term “purpose measure” signifies that the measure is taken with the specific objective of managing flood risks. Non-purpose measures imply instead that the measure has principally come about to fulfil other objectives, but can still be relevant for FRM.

<table>
<thead>
<tr>
<th>Flood risk strategies in the Swedish FRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Prevention</td>
</tr>
<tr>
<td>2015</td>
</tr>
</tbody>
</table>

Figure 2.2: Relative importance of strategies at the national level in Sweden
*Dark blue indicates institutionalised strategies, medium blue emerging strategies.*

agreement with Finland. Cooperation is also reflected in relation to the Floods Directive, where Sweden, Finland and Norway held a common ground in the work leading to the formulation of the Directive, which resulted in the inclusion of the preliminary assessment as a national process to select areas vulnerable to significant flood risks (Swedish Civil Contingencies Agency, 2011:15). In the Swedish assessment, the area of Haparanda was indicated as significantly vulnerable to floods at least partly because the city of Tornio, which is located on the other side of the Torne River, had been identified as flood prone by Finish authorities, and it was agreed that the risk should be dealt with in a holistic manner.
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Measures</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prevention</strong></td>
<td>Spatial planning</td>
<td>Emerging: Has recently gained ground in legislation and practice; does not necessarily mean that flood risk areas are avoided due to substantial room for discretion in application.</td>
</tr>
<tr>
<td></td>
<td>Requirement to consider flood risks, guidelines for building, EIA, SEA.</td>
<td></td>
</tr>
<tr>
<td><strong>Defence</strong></td>
<td><em>Purpose measures</em></td>
<td>Emerging. Hard to establish extent: scale and responsible actor varies according to object protected.</td>
</tr>
<tr>
<td></td>
<td>Dredging, ditches and embankments.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Temporary measures</em></td>
<td>Used by emergency services and individuals.</td>
</tr>
<tr>
<td></td>
<td>Sandbags, pumps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Non-purpose measures</em></td>
<td>Historically related to agriculture/forestry (ditches) and hydropower (dams). Increased focus on environmental concerns (protecting water resources) and safety.</td>
</tr>
<tr>
<td></td>
<td>Dams and ditches</td>
<td></td>
</tr>
<tr>
<td><strong>Mitigation</strong></td>
<td><em>Purpose measures</em></td>
<td>Emerging. Increased opportunities through reformed legislation in recent years, not yet much implementation.</td>
</tr>
<tr>
<td></td>
<td>Open urban drainage, planning and building, green infrastructure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Non-purpose measures</em></td>
<td>Measures mainly aimed at preserving habitats but also reduce flood risks.</td>
</tr>
<tr>
<td></td>
<td>Area protection.</td>
<td></td>
</tr>
<tr>
<td><strong>Recovery</strong></td>
<td>Insurances</td>
<td>Highly institutionalised (95%). Private market.</td>
</tr>
<tr>
<td></td>
<td>Government grants</td>
<td>Municipalities can receive grants for costly emergency events and after catastrophic events.</td>
</tr>
</tbody>
</table>

### 2.3.3 Flood Prevention

#### Introduction

Flood prevention measures aim to minimize the exposure of people, buildings, infrastructure, etc. to flooding, *i.e.* to “keep the people away from the water”. Here, planning instruments can be used to reduce flood risk by *e.g.* excluding development in flood prone areas.

Flood prevention in the form of physical planning as a strategy for flood risk management in Sweden can be considered *emerging*. While it is considered important to avoid building on areas where there is a risk of flooding (Official Reports of the Swedish Government 2007:60:561), this notion has only recently been transposed into legislation, and not necessarily fully translated into practice, partly due to the large room for discretion in the design of the regulatory framework.

#### Discourses

Planning and building legislation in Sweden builds upon the notion that, in principle, *all land use should be controlled* by the public organs (Bengtsson, 2010:37). The system has since the 1980s become increasingly *decentralised*, transitioning from a system in which the legal effects of the plan-
The matter of flood risk has progressively been discussed within spatial planning, and was explicitly included in legislation in 2008 (Act 2007:1303 reforming the Planning and Building Act). Reducing flood risk through spatial planning has, however, at local level come into conflict with the interest of building attractive waterfront property. According to The National Board of Housing, Building and Planning (National Board of Housing, Building and Planning, 2012a:26) planning has developed from a system where plans were mainly implemented by municipalities, to a system influenced by individual consumer demand. Thus exploitation interests have been given more focus. As for the traditional rule of law, land may be developed only if it is deemed suitable for that purpose from the perspective of the public interest. However, the law also indicates that private interests must be considered (Ch. 2, s. 1 and 4, Planning and Building Act). The tension between private and public interests is a “recurring theme” in this context, which can often translate into a conflict between added property value and safety, and between the traditional rule of law and the need to plan in a consistent and effective manner (Bengtsson, 2010:39).

The advent of the Environmental Code also affected the planning system. Although the Planning and Building Act did not become part of the Code, amendments to adapt the act to the Environmental Code were made. Specifically, sustainable development is expressed as the overarching objective also of the Planning and Building Act. There is an understanding that the development of society plays a central role in the efforts to achieve a sustainable society (Government Bill 1997/98:90, pp. 158-159). Spatial planning must therefore be carried out in a way that contributes to sustainable development, for example by adopting measures to prevent flooding as part of the climate change adaptation strategy.

Rules

The Planning and Building Act (2010:900) regulates the planning of land and water areas as well as building. The provisions concern planning, permitting and supervisory procedures as well as a number of substantial provisions regarding interests which must be considered when planning and building.

The aims of the Planning and Building Act are primarily realized through physical plans. Questions regarding land use with implications for more than one municipality may be coordinated by regional plans, while the overall land use and infrastructure within the borders of the municipality should be regulated in comprehensive plans. The comprehensive plans shall set out the direction for the long-term land use, including the development and preservation of built-up areas (Ch. 3, s. 2, Planning and Building Act).

Legally binding planning takes the form of detail plans (or area provisions for limited areas not covered by a detail plan), which has legal effect also in relation to individuals. The purpose of a detail plan is to examine the area’s suitability for development and regulate its design (Ch. 4, s. 2, Planning and Building Act). Of particular interest here is that development and buildings must be located in
land which is suitable in relation to flood risks (Ch. 2, s. 5, Planning and Building Act). Unlike the development of comprehensive plans, detail plans can be initiated by companies or private persons (Ch. 5, s. 1, Planning and Building Act).

**Actors and resources**

The central actors in relation to spatial planning, and in consequence flood prevention, are municipalities, developers, the County Administrative Boards and the National Board of Housing, Building and Planning.

Though it is a municipal matter to plan the use of land and water, developers hold a relatively strong position and local planning is largely adapted to market demands. The building of attractive residential areas is in the interest of both developers and municipalities, and important for the economic development in the regions (National Board of Housing, Building and Planning, 2012a). The County Administrative Boards acts in the planning process both as Government Agent, making sure that e.g. flood risks are taken into account, and as a collaborator, providing advice to the municipalities. The Planning and Building Act specifically orders County Administrative Boards to comment on whether building development is unsuitable with respect to e.g. the risk of floods or erosion in the consultation processes (Ch. 3, s. 10 and Ch. 5, s. 14, Planning and Building Act). The Boards can even come to revoke a plan or provision unsuitable from a flood risk perspective (Ch. 11, s. 10, Planning and Building Act).

The National Board of Housing, Building and Planning is the administrative authority for issues concerning planning and urban and building development (s. 1, Ordinance 2012:546). The Board provides regulatory guidance e.g. on how to handle flood risk with respect to planning and building and is responsible for supervising the application of the planning legislation (Interview 1). The Board e.g. suggests that the detail plan is used to: level land and buildings; streets low and houses high; protective measures against e.g. flooding as a condition of planning permission; account for dewatering possibilities; and to make room for the water in the plan (National Board on Housing, Building and Planning, 2010a:32).

### 2.3.4 Flood Defence

**Introduction**

Flood defence aims at decreasing the likelihood or magnitude of floods by “keeping the water away from the people”. Ditches and dams constitute the major part of structural flood defence in Sweden, even – as explained above – if they are not purposefully installed for flood defence reasons. There are also examples of embankments, primarily in areas exposed to significant and frequent floods.

**Discourses**

As in many countries, Swedish waters have historically been the object of many different, often conflicting interests. During the 19th century, the Swedish state favoured farmers and agrarian interests by delivering legislation favourable to ditching, drainage and reclamation and providing grants and loans for these purposes (Jakobsson, 2013:359). In the beginning of the 20th century, a new actor came into play: the hydropower industry. However, their intended use of water required damming and storing, which conflicted with the interests of agrarian actors (and the dominant legislation at the time) (Jakobsson, 2002:47). The hydropower industry would end up imposing itself, as evidenced
by the 1918 Water Act which is considered an exploitation-focused piece of legislation (Michanek and Zetterberg, 2012:70). The developments in which the barriers to exploit the water resources were removed or reduced, thus represents a shift away from strong private property rights in favour of the development of hydropower (Vedung and Brandel, 2001).

The beginning of a second “shift” can be detected already in the 1940s when concerns regarding the deteriorating conditions of the water quality in lakes and bays were raised. In 1952 legislative measures against water pollution were introduced (Michanek and Zetterberg, 2012:60), but it would take until the 1960s for the emerging environmental discourse to really institutionalise itself. In this and the following decade, the hydropower expansion was met with fierce public opposition (Kaijser and Hedin, 1995:55-58), the hydropower companies’ position was weakened by several minor changes to the existing legislation (Vedung and Brandel, 2001:164) and in 1972, a national decision to protect the large unexploited rivers in the north was accepted by parliament (Government Bill, 1972:111).

In the early 1990s the environmental discourse boosted again and work began with the development of an Environmental Code to e.g. broaden environmental legislation in the interest of sustainable development. One of the pieces of legislation that was (partially) incorporated in the Environmental Code was the Water Act, which thus came under the umbrella of the objective of sustainable development. In the later part of the 1900s and during the 2000s, much of the attention has thus shifted towards the protection of the water resources.

**Rules**

The central piece of legislation in connection with flood defence is the Environmental Code. It defines and regulates a number of water operations, which are all physical measures in surface water or groundwater that affect water conditions, for example constructions in water, land drainage, and measures with the purpose of changing the depth or position of the water (Ch. 11, s. 3, Environmental Code). The principle is that the undertaking of water operations requires a permit.

In addition to the general rules of the Environmental Code there are some requirements that are specific to water operations. In particular, it is stated that water operations may only be undertaken if the benefits are greater than the costs and damages associated with the operation (Ch. 11, s. 6, Environmental Code). This entails that water operations also must be socio-economically motivated. The Environmental Code also regulates the maintenance responsibility of the owners of water structures (Ch. 11, s. 17-18, Environmental Code). According to the newly enacted reforms, dams will be classified according to the possible consequences of a dam failure, and safety levels will be established through cost-benefit analyses. The supervisory authorities are moreover given the power to issue orders and prohibitions regarding dam safety measures, even if the issue has been handled in the permit (i.e. the water-rights ruling) (Ch. 26, s. 9, Environmental Code).

**Actors and resources**

The actors and resources connected to structural defence measures, purpose as well as non-purpose, range between government agencies and individual land owners.

As the central administrative authority for environmental issues, the Environmental Protection Agency is responsible for regulatory guidance in relation to the Environmental Code, including water op-
erations. The County Administrative Board is responsible for the supervision of about 2000 hydropower dams, 10,000 other dams, 50,000 drainage ventures, as well as other water operations, and Svenska Kraftnät together with other government agencies argue that not enough resources are allocated for this work (Svenska Kraftnät, 2014).

Water operators include a broad range of actors including individual property owners, municipalities and developers. A precondition for managing a water operation is that the water operator either dispose of the land by owning it or has an agreement with the owner. Also dam-owners represent a broad category of actors, including property owners, hydro-power companies and municipalities. The dam-owner as well as the operator of the dam has extensive responsibilities and is required to maintain the dam to prevent damage to public or private interests by changes in the water conditions. In the event of a dam failure, the maintenance manager is strictly liable for the consequences (Svenska Kraftnät, 2013).

2.3.5 Flood Mitigation

Introduction
The placement of infrastructure in floodplains and the elimination of storage, wetlands and natural vegetation etc. have increased societies’ exposure to flood risks (Kundzewicz, 2002). Flood risk management measures aimed at prohibiting or discouraging development in flood risk areas fall under the category of flood risk prevention. Efforts to otherwise accommodate water are considered flood mitigation. This concept includes soil conservation, vegetation cover management and afforestation, and implies both increasing storage in river systems and “catching water where it falls” by e.g. enhancing infiltration and reducing impermeable surfaces.

In Sweden, measures which specifically aim to have a mitigating effect in relation to floods in urban areas can be found in the realms of urban drainage systems, planning and building regulations and green infrastructure. It is mostly in relation to climate change concerns that these issues have slowly began to gain ground in legislation and practice. They should thus be considered as emerging measures within flood risk management.6

Discourses
While the environmental discourse has its origin in the interest of protecting different natural habitats and species, and green infrastructure is still maybe more valued for its aesthetic features than its flood mitigation capacities, the climate issue has added a perspective to the function of such measures. This is also evident in relation to building-requirements, where such adaptation measures are considered an important precondition for building sustainable communities (National Board of Housing, Building and Planning, 2009b). So far, relatively limited attention has been given to green infrastructure in Swedish urban areas. Although measures to accommodate water in the cities are present, the National Board of Housing, Building and Planning has argued that there is a need to in-

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6 In addition, there are a number of other instruments whose implementation, while having a more environmental protection than flood risk management objective that can nonetheless result in a significant flood mitigation effect. These include shoreline protection, land conservation and purposely created or restored wetlands.
tensify this development, not least in view of climate change (Board of Housing, Building and Planning, 2010b).

In the field of urban drainage, on the other hand, a more technocratic discourse is dominant. The prevailing type of sewerage system in Sweden is duplicate networks where storm water and wastewater are diverted through different pipe-networks (Swedish Water and Wastewater Association, 2007:9-12). It has been argued that one of the difficulties with using open storm water management is the lack of quantitative knowledge of the capacity of such solutions to delay water, which may be one reason why technical solutions are preferred (National Board of Housing, Building and Planning, 2010b).

**Rules**

The Public Water Services Act (2006:412) is the central piece of legislation regarding water services, *i.e.* water supply and sewerage. The services must be provided through “public” water supply and sewerage facilities, *i.e.* facilities over which municipalities have legally determining influence (s. 2 and 6, Public Water Services Act). The act does not establish any specific design requirements on public water services facilities, other than that the owner must arrange the devices “needed for the facility to serve its purpose and meet reasonable safety demands” (s. 13, Public Water Services Act). The responsibility to arrange for pipes and other devices to and from each connection point includes also devices for diverting water through, for example, retention basins (s. 2 and 13, Public Water Services Act). It is thus possible for municipalities to comply with their obligations through other means than closed pipe networks. Sustainable drainage systems thus have some degree of recognition in Swedish legislation.

Regulations regarding the contents of physical plans are important from the perspective of flood risk mitigation. Public places, such as streets, parks and squares which are meant to cater to common needs can be used as reservoirs, wetlands or ponds to handle storm water (National Board on Housing, Building and Planning, 2013c). According to the National Board on Housing, Building and Planning, existing legislation is an effective instrument for adaptation of new development, but it is significantly more difficult to use for additional buildings in developed areas, and simply not designed to deal with climate change effects in relation to existing settlements. For these, the Board recommends *e.g.* construction of barriers and revision of disaster management strategies (National Board on Housing, Building and Planning, 2009b).

**Box 2.1: Examples of proposed adaptation measures for planning and building**

<table>
<thead>
<tr>
<th>Measures in comprehensive plans:</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Account of protected areas, such as water protection areas</td>
</tr>
<tr>
<td>✓ Identification of flood risk areas</td>
</tr>
<tr>
<td>✓ Recommendations for how stability and ground conditions should be considered in detailed plans</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measures in detail plans:</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Disposition on the plan area</td>
</tr>
<tr>
<td>✓ Basin, cofferdam, embankment</td>
</tr>
<tr>
<td>✓ Ditches</td>
</tr>
<tr>
<td>✓ Prohibition of basements</td>
</tr>
<tr>
<td>✓ Plus elevation</td>
</tr>
<tr>
<td>✓ Facade materials</td>
</tr>
</tbody>
</table>
Measures for protection of new buildings:
- Basements built using waterproof concrete and without windows or other openings
- Open spot-footing fundaments or exterior air-ventilated foundation
- Permeable materials on the grounds around building
- Green roofs
- Overflow spillway on roof and routines for cleaning wells

Measures for protection of existing buildings:
- Toilets and wells in basements can be fitted with temporary blockages
- Basement windows can be secured or boarded over
- Temporary flood protection in exterior doors
- One-way valves or pumps on lower flood sewage drains accessible for inspection

Source: National Board on Housing, Building and Planning 2009c:13

Actors and resources
The municipalities are responsible to arrange water services through public water supply and sewerage facilities. The services are financed through water charges paid by the users, which may not exceed the amount needed to cover the necessary costs associated with the services (s. 30 Public Water Services Act). The County Administrative Boards have supervisory powers and can also mandate municipalities to provide public water supply and sewerage (s. 9, Public Water Services Act).

The municipalities play a central role in the context of physical planning. If the municipality is willing to allow developments in flood prone areas, the detail plan is an important tool through which developers may be required to take certain measures to secure the building (National Board on Housing, Building and Planning, 2010a:30). The County Administrative Board, in turn, has the authority to revoke detail plans if the area is considered inappropriate for development given e.g. the risk of floods, or if the technical requirements are inadequate to reduce the flood risk to an acceptable level (National Board on Housing, Building and Planning, 2010a:34).

In 2009, 47 percent of the municipalities were planning for green infrastructure. The plans were more common in larger municipalities such as Stockholm, Gothenburg, and Malmö than in smaller and more rural areas. This may be a result of differences in demand as well as in terms of resources: large municipalities generally have better access to relevant knowledge and expertise (National Board on Housing, Building and Planning, 2009a). The municipal demand for tools to make cost benefit analysis to quantify and clarify the values and services provided by green infrastructure measures is, however, increasing and there are examples of municipalities buying land alongside waterways and marshlands to establish wetlands to function as river flow equalizers and water purifiers (National Board on Housing, Building and Planning, 2010b).

2.3.6 Flood Preparation

Introduction
Flood preparation measures aim at enhancing human capacity to prepare or respond to flooding. In Sweden, key issues relevant to flood preparation are discussed under the broader subjects of “emergency management”, “crisis management” and ultimately “societal safety”. Preparation for emergencies, extraordinary events and crises does thus not target floods specifically, but consists rather of a larger umbrella of societal preparation.

Flood preparedness in the form of emergency management can said to be highly institutionalized in Sweden. Given the relatively low probability of floods, it is reasonable that emphasis has been put on having efficient procedures to deal with flooding when it occurs (Fiselier and Oosterberg, 2004:27).
A cornerstone in the Swedish system at large is that the individual (natural or legal person) has the primary responsibility to protect themselves and their property (e.g. Official Reports of the Swedish Government 2007:31). This applies also in relation to events that risk affecting important societal functions, such as larger floods, where individuals thus have a duty to as far as possible take responsibility for their own safety and preparedness (Swedish Civil Contingencies Agency, 2012c). In addition hereto, the model for Swedish emergency management is based on the fact that all crises, no matter what type of emergency, occur at local level and both preparedness and ability to manage emergencies must therefore be built bottom up (Government Bill, 2001/02:158). Pursuant to the principles of responsibility, parity and proximity, and in line with the individual responsibility, the basis for the capacity to prevent and manage emergencies and crises in Sweden is therefore normal conditions. This entails that the individuals or organisations assigned to a task or area of activity under normal circumstances are also responsible in times of emergency, and that emergencies and crises should be managed where they occur and by those most closely affected by them (Government Bill 2001/02:158).

Emergency management in Sweden has moreover gone towards a more holistic approach, i.e. where strategies to prevent, manage and recover from emergencies are better aligned, with the overall ambition of reducing the number of emergencies (Official Reports of the Swedish Government 2007:31). In 2009, when the Swedish Civil Contingencies Agency was formed, it was with the ambition to have a single agency with competences within emergency management, crisis management and civil defence, which would be able to have functions before, during and after a damaging event (Official Reports of the Swedish Government 2007:31:32-33).

The laws of particular importance in this context are the Civil Protection Act (2003:778), which regulates primarily emergency prevention and emergency services, and the Act (2006:544) on Measures to be taken by Municipalities and County Councils in Preparedness for and during Extraordinary Incidents during Peacetime and Periods of Heightened Alert, where general provisions on crisis management can be found. The term “emergency” is defined as: “sudden events that have led or can be expected to lead to damages” and includes both nature events and events that depend on the action or omission of man (Government Bill, 1985/86:170). An “extraordinary incident” is instead defined as event that deviates from that which is normal, representing a serious disturbance or an imminent risk for a serious disturbance of important social functions and demanding urgent action (Ch. 1, s. 4 Act on Extraordinary Incidents). Floods have been defined more recently as “natural disasters” (Government Bill, 2001/02:158) and can fall both under the category of “emergency” and of “extraordinary incident” (Andersson, 2009:19).

Under Swedish law, individuals have the primary responsibility to protect themselves and their property, and, consequently, to take and finance the measures necessary to prevent the occurrence of an emergency and/or to mitigate the consequences of an emergency that has occurred (Official Reports of the Swedish Government 2007:31). The obligation for municipalities to perform rescue operations exists only in situations where it is motivated by reason of the need for a quick intervention, the importance of the interests at risk, the costs for the intervention and the circumstances in general (Ch. 1, s. 2, para. 3, Civil Protection Act).
To reduce vulnerabilities and have a good capacity to manage crisis situations, municipalities are obliged to perform a risk and vulnerability analysis accounting for the extraordinary incidents that can occur within their borders, and, on the basis that analysis, establish a plan for how to manage such incidents (Ch 2, s. 1, Act on Extraordinary Incidents).

**Actors and resources**

The municipalities and the County Administrative Board have extensive responsibilities also in the context of emergency and crisis preparation. The municipality is responsible for the dissemination of information on the capabilities in case of severe events (Ch. 1, s. 7, Civil Protection Act), as well as the conduction of risk and vulnerability analyses (Government Bill, 2002/2003:119, p. 48). During flood events, the municipal emergency service can intervene by pumping out water, building temporary embankments and, if necessary, evacuating properties. The County Administrative Board shall support the municipalities with advice and information, contribute to the work on risk and vulnerability assessments and assist in the event of an emergency and/or crisis situation. In case of a severe flood, or if several municipalities are affected, the Board can take over the responsibility for civil protection in order to facilitate cooperation and coordination (Räddningsverket, 2000:29).

On the national level the Swedish Civil Contingencies Agency supports municipalities and County Administrative Boards by producing flood risk maps and assisting with expertise to facilitate implementation of local measures (Interview 2). As a last resort, the Agency can also provide concrete assistance in an emergency situation in the form of temporary flood barriers, high capacity pumps and sandbags. The Agency also organises meetings for the exchange of experiences at national level and provides education for municipal rescue services and other agencies (Swedish Civil Contingencies Agency, 2010).

As the central agency for meteorological, hydrological and oceanographic issues in Sweden the Meteorological and Hydrological Institute is responsible for the metrological warning system and provides current estimates on river flows and scenario descriptions, which can be used locally to assess the risk of flooding and performs hydrologic modelling for determining dimensions of water flows in dams (Swedish Meteorological and Hydrological Institute, 2014a).

**Box 2.2: Extreme weather warnings**

<table>
<thead>
<tr>
<th>The Swedish Meteorological and Hydrological Institute issues warnings in case of extreme weather and extreme hydrological situations. There are three levels of alerts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Class 1: The weather situation is expected to involve certain risks to the public and disruption for some social functions.</td>
</tr>
<tr>
<td>• Class 2: The weather situation is expected to pose danger to the public, major property damage and major disruption of important social functions. The public is asked to follow the news on the Internet, radio or television.</td>
</tr>
<tr>
<td>• Class 3: Very extreme weather is expected which may pose great danger to the public and very large disturbances in important social functions. The public is asked to follow the news on the Internet, radio or television.</td>
</tr>
<tr>
<td>The criteria for heavy rains are:</td>
</tr>
<tr>
<td>• Class 1: &gt; 35 mm in 12 hours over large areas, risk of large bodies of water, floods in basements and in storm sewers.</td>
</tr>
</tbody>
</table>
- Class 2: > 70 mm in 12 hours over large areas, very high risk of floods in smaller water courses and storm-water systems. Risk of large bodies of water, in particular in basements and lower lying areas, may cause impassable roads, etc.
- Class 3: No warnings are issued for heavy rains, only for heavy snow together with strong winds.


### 2.3.7 Flood Recovery

#### Introduction

Flood recovery measures aim at strengthening the capacity of society to recover after floods. In Sweden, this entails primarily the insurance system and governmental grants.

#### Discourses

The major part of the flood recovery strategy in Sweden is operationalized via the private insurance sector. This has, however, been extensively debated and analysed and representatives for sectors that are particularly vulnerable to extreme weather and floods (e.g. agriculture and forestry) have argued that the responsibility of national authorities and the government should be extended. The topic was discussed and analysed both in the National Commission on Climate and Vulnerability (*Official Reports of the Swedish Government* 2007:60) and by a previous Commission on slope stability (1988-1996) although both concluded that it is important to keep the incentives for private insurances and that the state should not have larger responsibilities towards farmers than towards other entrepreneurs. The idea was also found to be in conflict with the principle of responsibility (*Official Reports of the Swedish Government* 2007:60).

According to a survey performed by the Danish Insurance Association there seem to be a relatively high level of trust towards the insurance industry among the general public in the Nordic countries (Rasmussen and Hansen, 2009). The survey results reveal that individuals in the Nordic countries are confident that their insurance company will cover also increasing claims in the future, due to e.g., more frequent storms and heavy rains as a result of climate change. It has, however, also been claimed that this is not the case and that in the long run municipalities as well as individuals need to improve their preparedness and to mitigate flood risks, otherwise it may be difficult for the insurance industry to provide the same level of coverage as today, without having to introduce significantly higher insurance premiums (e.g. Moberg, 2012).

#### Rules

Given that it falls upon individuals and companies to protect their property, the most important rules are the insurance conditions and the rules regarding the compensation to which municipalities can be entitled in relation to the state.

Insurance conditions in general cover damage as a result of heavy rains, snow melt, rising lakes or rivers, resulting in a flow of water entering the property. Property insurances do generally not cover damage caused by deficiencies in the foundation or waterproofing surfaces in walls and floors, water damage from discharge from drainage systems or roof pipes (Olshammar and Baresel, 2012:300; *Official Reports of the Swedish Government* 2007:60). Since the municipalities are responsible for providing facilities for water and sewage, they are liable for flood damages resulting out of failure to meet the demands of “reasonable safety”. In relation to e.g. flooding of basements, the rule is that the system must cope with a ten year flood (Olshammar and Baresel, 2012:12).
Municipalities can receive compensation from the state (for the portion of the costs that exceed a deductible) if a rescue operation has resulted in significant costs (Ch. 7, s. 3, Civil Protection Act). The compensation possibility for rescue operations thus functions as a form of “insurance” meant to protect municipalities from the kinds of costs that can result from large and longstanding rescue operation (Swedish Civil Contingencies Agency, 2009).

Government grants may be provided after severe events. These grants are decided on a case to case basis and are rarely provided. After storm Gudrun, the government paid remuneration to the worst exposed.

**Actors and resources**

The most important actors involved in flood recovery measures are individual households, companies, insurance companies and public authorities.

Insurances of private homes are not mandatory but most Swedish households (95 percent) are insured (Insurance Sweden, 2013). Water damages related to natural causes amounts to about 8,000 claims and costs about 300 million Swedish krona (SEK) annually (about € 32 million), excluding deductibles paid by individuals, costs for emergency services and uninsured property.

The share of water damage of the total insurance costs is not visible for the individual consumer. The insurance premium is thus not differentiated with respect to the risks for different natural disasters. The risk sharing entails a lower premium for the insured household that is exposed to high risks than if risk were differentiated, while it of course also means that all insured contribute to cover premiums (and costs) for insured households exposed to high risks. It has been claimed that the uniform insurance premiums reduce costs in general since the insurance company can avoid costly risk evaluations (Official Reports of the Swedish Government 2007:60). It can however also be argued that the lack of differentiation with respect to flood risks masks the costs caused by e.g. floods and may therefore contribute to continued exploitation of flood prone areas.

### 2.4 Explanations for stability and/or change in Flood Risk Governance in Sweden

**2.4.1 Characterizing flood risk governance in Sweden**

There is no national flood risk strategy or plan in Sweden, and flood risk governance does not in itself constitute a policy area. Instead the issue of flood risk is scattered across different policy areas, each of which comprises key actors and resources as well as dominating discourses and legislative instruments. The issue is moreover more prominent in certain policy areas than in others. Within emergency management, flood risks are for example considered in both planning and operational functions, although they generally do not constitute the central type of emergency. Flood preparation can in this sense be considered institutionalized, a notion that is supported by the fact that the main responsibility for the implementation of the Floods Directive has been placed with the Swedish Civil Contingencies Agency. With respect to flood recovery, the availability and prevalence of (home) in-

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7 The exchange rate prevailing on May 15, 2015, when 1 Euro corresponded to 9.3 Swedish kronor (SEK), has been used for conversions from SEK to Euro throughout the report (Sveriges Riksbank, 2015).
urance that also covers flood related damages, indicates that also this area of flood risk management is institutionalized.

Disregarding the non-purpose defence against flooding provided by the many hydropower dams, flood defence is not a primary concern at national level in Sweden. It is, however, possible for the municipalities to apply for financial support from the Swedish Civil Contingencies Agency for the development of permanent structural flood defence measures. The grant is, however, primarily targeting climate change adaptation measures in general and the budget is relatively limited (see footnote 2 above). In terms of national flood risk management strategies, structural defence measures can thus at the most be considered emerging.

Also the integration and coordination of the flood risk management strategies, including their corresponding measures or instruments, is limited at the national level. Nevertheless, the rules and guidelines governing spatial planning are largely overlapping and the strategies and measures for flood prevention and mitigation are thus to some extent integrated, in particular on the local level where they are implemented in practice.

Some national support for a broadening of the flood risk management strategies can be detected via the National Board of Housing, Building and Planning’s recommendations for climate change adaptation. While, according to the Board, the existing system for spatial planning can be an effective instrument for climate change adaptation of new developments, it has not been designed to manage increased flood risk in relation to existing settlements. For these, the Board instead recommends e.g. construction of barriers and revision of emergency and crisis management strategies, thus endorsing an expansion of management strategies in relation to planning and building (National Board on Housing, Building and Planning, 2009b).

2.4.2 The extent of governance dynamics in Sweden

In the absence of a distinct national policy domain in which the flood risk management strategies are arranged, the assessment of the governance dynamics in the Swedish case primarily implies evaluating and reflecting on whether there is any evidence of change within the different flood risk management strategies.

Since the late 1990s and the introduction of the Environmental Code there has been a shift towards increased emphasis on sustainable development in Swedish legislation. Sustainable development is for instance declared as the overarching objective also of the Planning and Building Act, even if the act is not part of the Environmental Code. The basic notion here is that the development of a sustainable society is crucial for sustainable development, and that spatial planning therefore must be carried out in a way that contributes to this development. The matter of flood risk has been increasingly discussed within the field of spatial planning, and in 2008 a requirement to consider flood risks in planning was explicitly included in legislation. While there is nothing that indicates that this addition has implied any changes to the actor dimension of the strategy (the actors and actor coalitions are the same), the obligation gives the County Administrative Board the requirement to revoke a proposal for detail plan that does not properly address the flood risk issue, thus slightly shifting the powers on the side of the regional authority.
Also the mitigation discourse has been affected by the shift towards sustainable development. Though green infrastructure may above all be valued for its aesthetic features and for its impact on urban water quality, the increased interest for such measures can also be attributed to increased concern for climate change. According to the National Board of Housing, Building and Planning, the use of measures to accommodate water in the cities should increase (National Board of Housing, Building and Planning, 2009c). Although measures to this effect are yet not frequently used in practice, a wish to diversify the mitigation measures used can be discerned. This may, however, have implications in terms of increased need for knowledge about the capacity of green infrastructure and measures to accommodate water.

Change can thus be identified within the rules dimension of the prevention and the mitigation strategies, primarily driven by climate change and the call for adaptation measures. There is however no indication that the actor or resource dimensions have changed as a result of the change in legislation. On the subject of flood defence, it should be mentioned that a comprehensive regulation of issues regarding dam safety was introduced in the Environmental Code July 1, 2014. Regarding preparation and recovery no evidence of change specifically related to flood risks governance has been discerned.

2.4.3 Explanatory factors for change and stability in Sweden’s flood risk governance
The limited visibility of the national level can possibly be attributed to the rather limited experience of severe floods so far: floods generally affect relatively small geographical areas and while local effects can be significant they do normally not impact society as a whole. The historical investments in large-scale hydropower have, although unintentionally, reduced fluvial flood risk and can also help explaining the limited presence of a national flood defence strategy.

Both the increased visibility of flood risks in spatial planning and the objective to broaden mitigation measures used can be traceable back to two explanatory factors outside the governance system. The first can be directly related to flood risk: the floods in Värmland 2000/2001 led to a formal request from the county level to the Government on how to manage floods. The second factor can be related to a rising national concern for climate change and the expectations on the upcoming IPCC (2007) report rather than a rising concern for floods specifically. In 2005, these factors made the Government appoint a commission to investigate societal risks and vulnerabilities with regards to extreme weather events and long term climate change. The amendments to the Planning and Building Act described above were made as a direct result of Commission and its proposals. In addition, both the final report and its proposals were conducive in making the issue of climate change and its consequences increasingly visible on the national political arena. Stability and change in flood risk governance in Sweden seem thus to have been driven mainly by exogenous factors.

2.5 Evaluations at the national level

2.5.1 Societal resilience
There are a range of strategies and measures dealing with flood risks in Sweden although they are relatively often collected under a broader umbrella of societal risks (e.g. extreme weather) and/or developed for other purposes than to reduce the risk or consequence of floods (e.g. hydropower generation).
At national level the alignment between and across strategies and measures is limited, as they belong to different sectors. It is possible that the lack of a national agency at central level with overarching responsibility for climate change adaptation has determined or accentuated the dispersed nature of flood risk management at national level. This does not mean that there are no points of connection between the different policy areas, as e.g. sewerage services and physical modifications of water bodies may not be decided or arranged in conflict with legally binding physical planning. It would however be beneficial for flood risk management to better and earlier consider these points of contacts. The same occurs in relation to measures that traditionally originate in other policy fields but that also has capacity to fulfil flood risk management functions, such as area protection which can serve environmental and recreational interests as well as flood risk management services. It is important to note that even if flood risk management lacks an integrated approach at national level, this is not necessarily the case at local level, where the effects of floods are primarily felt and where many of the services relevant for flood risk management are provided. However, this is heavily dependent on the availability of human, knowledge and financial resources at the municipalities.

In terms of decision-making capacity, in particular in relation to risk analyses and knowledge building, the governmental assignment of the Climate and Vulnerability Commission can tentatively be interpreted as an indication of a commitment to support decision-making and of a capacity to, at least to some extent, implement changes perceived as necessary. Regarding knowledge building, it is also possible that the fact that flood risk management does not constitute a specific policy domain at national level has resulted in a lesser development of knowledge on the subject than what is the case with established policy domains. However, some areas relevant to flood risk management are knowledge-wise more developed than others; there is e.g. more expertise regarding dam safety than sustainable urban drainage systems, at least in terms of flood risk.

2.5.2 Efficiency
It is furthermore reasonable to believe that the predominance of preparation, insurance and relatively small-scale defences is a consequence of the nature of the flood risk in Sweden. As floods vary significantly in time and space it may well have been considered resource efficient to deal with them by temporary defences and by evacuating people when and where floods occur, instead of building permanent defence structures (Fiselier and Oosterberg, 2004).

Developments of permanent defence structures fall under water operations which may (see Section 2.3 above) only be undertaken if the benefits are greater than the costs and damages associated with the operation (Ch. 11, s. 6, Environmental Code). This entails that water operations also must be socio-economically motivated and a that cost benefit analysis in which all major impacts are included has to be accomplished before necessary permits are given.

2.5.3 Legitimacy
The principle of public access to official documents is of central importance in the Swedish constitutional and legal system. A document which is kept by a public agency and that has either been received or drawn up by the agency is considered official. Official documents are, as a rule, public. Every individual has a right to request and study public documents, without having to reveal their identity or state for which purpose they require the document. Information and consultation stages are required in planning and building as well as environmental legislation, although these do not always occur at a time where they can actually influence the final decision. Administrative decisions can, as a
rule, be appealed, although both the review instance and the issue of legal standing vary with the issue at hand. The municipal appeal is for example available to every member of the municipality whose authorities made the decision, but constitutes a limited form of control (only legality) whereas the administrative appeal, which requires that the appellant is negatively affected by the decision, entails a more extensive control (legality and suitability). Environmental decisions, such as permits for water operations, can be appealed by e.g. individuals directly affected by the decision, or environmental NGOs.
3. Case study: Karlstad

3.1 Introduction and scope of the analysis
This chapter provides an analysis, explanation and evaluation of flood risk governance in the Swedish municipality of Karlstad. This case study aims to provide insights into the main features of the local governance for fluvial and pluvial floods and, to a limited extent, to flood risks associated with hydropower dams. After elaborating on relevant context-related matters a review of the developments in flood risk management strategies primarily during the last decade is provided (3.2). This is followed by an analysis of dynamics (stability and change) in the flood risk management strategies and their embedding in local/regional sub-arrangements (3.3). We go on to explain these dynamics (3.4) and to evaluate them (3.5), before providing our conclusions for this case study.

3.2 Main characteristics of the case study

3.2.1 Physical and socio-economic circumstances
The city of Karlstad is located on a river delta. It can be flooded by the river, Klarälven, and by Lake Vänern. The delta area is continuously affected by processes of erosion and sedimentation. The highest flows usually occur during spring in connection to snow melting and/or ice plugs, and during fall, caused by frequent/intense rains. High flows in Klarälven may occur rapidly and last for a relatively limited time, while on the contrary high flows in Lake Vänern occur more slowly and may last for months (Karlstad municipality, 2014a). High water levels in Klarälven are judged to affect more people than high levels in Vänern (Karlstad municipality, 2010:38). The landscape around the river is relatively flat, with heights in the north and east, which means that pluvial floods can occur as a result of heavy rains (Karlstad municipality, 2010:7). Finally, in the event of a dam failure in Klarälven, the water will reach Karlstad approximately 26 hours after, and affect about 23,000 residents (Karlstad municipality, 2010:34). The return period of such an event is approximated to be more than 10,000 years (Karlstad municipality, 2010:34).

Flood risks in Karlstad are higher than in many other municipalities in Sweden and climate change is expected to increase these risks. In the first step of the implementation of EU Floods Directive, 18 areas with significant flood risk have been identified, one of which is Karlstad (Swedish Civil Contingencies Agency, 2011).

Karlstad is a medium-sized Swedish municipality with a population of approximately 88,000 inhabitants (Statistics Sweden, 2014). There are no major differences from the national average regarding the average income (249,000 SEK, or € 26,000), average age (41), and employment rates (74%) (Statistics Sweden, 2014). The population in Karlstad has been growing slowly but steadily over the last decades. Since 1950 the number of inhabitants has increased by 60 percent.

The most vulnerable social functions of Karlstad municipality in case of floods are the water and sewerage system, the hospital, telecommunications, the railways and parts of the electrical power supply (Karlstad municipality, 2010:21). All of these are affected in their functions at relatively low
water levels. Figure 3.1 illustrates Karlstad at a so-called 100 year flood\(^8\) (red areas are flooded). According to the Flood management program (Karlstad municipality, 2010:11) a 100 year flood is estimated to imply costs of about 10.5 billion SEK (€ 1.1 billion) and about 25,000 people would have the homes flooded.

![Figure 3.1 Map of Karlstad (above) and flood-map of Karlstad (100 year flood in river Klarälven)](image)

<source: Karlstad Municipality, 2010>

### 3.2.2 Historical events and related responses

Karlstad has been exposed to several large floods from river Klarälven during the last century (1916, 1957, and 1958) (Swedish Civil Contingencies Agency, 2012a). After the establishment of the hydro-power dam (Höljesdammen) in the early 1960s the river Klarälven has been less prone to floods.

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\(^8\) A 100 year flood is expected to occur every 100 year. As a result of climate change, a 100 year flood is likely to become increasingly frequent, e.g., what is considered a 100 year flood today is expected to occur every 20 years by the end of this century.
The latest larger spring flood in river Klarälven occurred in 1995 while the latest larger flood in Lake Vänern occurred in 2000-2001 (Swedish Meteorological and Hydrological Institute, 2014). In 2000-2001 persistent autumn rains led water levels significantly above the average water level of Lake Vänern for several months (Swedish Meteorological and Hydrological Institute, 2014). The flood was dealt with by changing the discharge of the lake and by installing five kilometres of temporary embankments, plugging storm water pipes and pumping in several places in Karlstad (Flood management program, 2010:5).

3.2.3 Administrative structure

There are 13 committees with subordinate departments in Karlstad, each with its specific area of responsibility. Three of these committees have responsibilities related to flood risk management:

- The Technical Services and Property Management Committee, responsible for e.g. the development, management and operation of municipal land, buildings and facilities;
- The City Planning Committee, responsible for e.g. local planning and building permits;
- The Crisis Management Committee, responsible for the municipality’s operational management only in case of extraordinary events (such as major floods).

The municipalities of Forshaga, Grums, Hammarö, Karlstad and Kil have together formed a common Emergency Services to comply with their statutory obligations relating to emergency preparedness and emergency services. The association is referred to as the Rescue Services for the Karlstad Region and is mostly financed (85%) by yearly contributions from the member municipalities (Rescue services, n.d.). The County Administrative Board of Värmland is a national agency, which works to ensure that national goals are reached also in the county of Värmland.

3.3 Analysis of flood risk governance in Karlstad

Karlstad municipality has experiences with flooding and works actively to reduce flood risk. Most notable is the local flood management programme for Karlstad, where a common approach to flood risks is taken. Figure 3.3 gives a rough sketch of the strategies and their relative importance.
### 3.3 The local flood management programme in Karlstad

The work regarding the local flood management programme was initiated in 2006 by the municipal assembly in Karlstad after the 2000/2001 flood (Karlstad municipality, 2010) and the national investigation on major risks and vulnerabilities associated with climate change (Official Reports of the Swedish Government 2007:60). The interviews (Interviews 1, 5, 6) at the local level confirm the importance of the flood and the national report for the management programme initiative.

The flood management programme was primarily developed by the Technical Services and Property Management Committee and the Municipal Management Offices. Several other organisations were, however, involved in the development of the programme, where the most important ones were the City Planning Committee, the Emergency Services, and the County Administrative Board of Värmland. The overall aim of the programme is to establish how Karlstad municipality is to work in order to face present and future flood risks: “Karlstad municipality shall in the short and long term, have a preparedness to deal with floods and to minimize the damages resulting from floods” (Karlstad municipality, 2010:7). In particular, the programme states that the municipality will achieve the above-mentioned objective by (Karlstad municipality, 2010:7):

- Building up knowledge about the effect of different water levels on various social services;
- Working to prevent flooding through technical adaptation measures;
- Preparing organisationally and operationally to minimize the consequences of floods;
- Planning Karlstad’s continued expansion on the basis of an informed risk assessment;
- Together with other actors, working on increasing drainage of Lake Vänern;
- Disseminating knowledge and information to help property owners and operators reduce the risks in their respective areas.

A municipal flood risk manager responsible for coordinating the work related to reducing flood risks is located at the Technical Services and Property Management Committee, the committee organising the major part of flood management in Karlstad. The flood risk manager is responsible for coordinat-
ing the work regarding flood risk within the municipal departments, contributing to increase the level of knowledge in the matter (Karlstad municipality, 2010:18), and also for annually following up and reporting on the progress of the implementation of the Flood management programme (Karlstad municipality, 2010:11). There are also financial resources in the budget earmarked for flood risk related investments. The flood risk manager disposes over these resources, 10 million SEK (€ 1 million) (Karlstad municipality, 2012a:27). This amount can be considered as relatively high, compared with the annual budget of the Swedish Civil Contingencies Agency for their grants which amounts to 20 million SEK (€ 2.1 million).

The programme emphasises the need for coordination and well-functioning cooperation, especially between the Rescue Service in Karlstad and the Technical Services and Property Management Department (Karlstad municipality, 2010:6). There are several examples of formal groups as well as informal arrangements where people meet regularly to discuss issues related to floods. One such example is the so-called Delta group which consists of representatives from different municipal departments, municipal companies (e.g., the electricity company, Karlstad Electricity Network AB) and the emergency service (Karlstad municipality, 2010:19). The Delta group meets twice a year to discuss and exchange experiences (Karlstad municipality, 2010:19). In addition, the Rescue Service in Karlstad organizes a special water group where officials from their units meet to discuss flood risk related issues (Karlstad municipality, 2010:19). This water group has also initiated an internal education series in spatial planning, insurances and risk analysis to improve their knowledge on the subject (Karlstad municipality, 2010:19).

Informal contacts between actors primarily involved in flood prevention (e.g. Technical Services and Property Management Department, the Rescue Services and the County Administrative Board) are relatively frequent. Officials at these three organizations described how they used to visit each other regularly for a coffee and informal talk (Interviews 3, 6, 7). This was, at least to some extent, explained by officials having switched positions across departments and organizations (Interviews 4, 6).

Cost-benefit analyses are performed when flood defence or flood mitigation measures are planned, often by external consultants (Technical Services and Property Management Department, 2014:29; SWECO, 2014). An official at the Technical Services and Property Management Department (Interview 5) also describes how the municipality tries to find synergy effects when considering different measures so as to use resources efficiently, for instance by planning an elevated pedestrian- and cycle path which will also protect the central hospital (Karlstad municipality, 2013:3). It was however claimed by one official at the County Administrative Board (Interview 4) that cost-benefit analysis still is an underutilised instrument, and that a more consistent use would most likely lead to more cost efficient investments.

National legislation sets the requirements on access to information, participation and appeals in local decision-making. The interest of the general public towards participating in discussions about planned flood risk measures seems however to be quite limited. It is perceived by local officials that the interest of the general public is mainly expressed when floods are occurring (Interviews 2, 4, 6).

The flood risk that Lake Vänern constitutes has declined somewhat as a result of increased drainage (i.e. the hydropower company reduces water levels when considered necessary). This may, however,
not be sufficient given the expected impacts of climate change. The increased risk of future floods affects several municipalities located alongside Lake Vänern. These municipalities have engaged in joint activities under the heading “Municipalities in cooperation for water regulation of Lake Vänern” with the purpose of raising the awareness of the national government and, in the long run, to find technical and financial solutions that facilitate to reduce water levels more than what is feasible today (DN, 2014; Karlstad municipality, 2010:20). In addition to representatives from the affected municipalities, the County Administrative Boards (of Värmland and Västra Götaland) and the Centre for Climate and Security, Karlstad University participate in these activities (Karlstad municipality, 2010:20).

3.3.2 Flood Prevention
The City Planning Committee is responsible for local planning and building permits in the municipality. In connection with the development of the flood management programme, the Committee revised their guidelines for planning and building permits (Karlstad municipality, 2010:8). The most important rules and guidelines is the Comprehensive plan and “Rising Water – A handbook for physical planning in flood prone areas”, a regional guideline document that has been developed by the County Administrative Boards of Värmland and Västra Götaland (Stigande vatten, 2011).

The previous Comprehensive plan, in force between 2006 and 2012, did not provide any specific guidelines in relation to flood risk, but merely encouraged water front development (Karlstad municipality, 2010:8). The new Comprehensive plan, adopted in 2012, specifies that the premises for the guidelines for planning and developing are the conservation of the function of homes, offices, industries and the functioning of water, sewerage, electricity, heating and transport and infrastructure. The municipality applies the following guidelines (Karlstad municipality, 2012b:92):

- For class 3 objects (essential societal functions such as waterworks, treatment plans and major roads), the return period of floods must be over 1000 years. Since calculating the water level at a 1000-year flood event is in practice considered impossible, the highest calculated flood (approx. 10 000-year flood) is instead used as a guideline;
- For class 2 objects (homes, offices and other activities) the accepted return period is 200 years;
- For class 1 objects (less sensitive constructions), a shorter return period can be accepted.

The ambition is to use the water to increase the attractiveness of Karlstad. Thus the Comprehensive plan still has a strong profile of waterfront residential living (Karlstad municipality, 2012b:8) The Comprehensive plan (Karlstad municipality, 2012b:93) states that if the guidelines in the flood management programme cannot be followed, development must however be preceded by a detail plan based on a risk analysis (Karlstad municipality, 2012b:93). The risk analysis must contain an identification, assessment and valuation of the risks, the reduction measures proposed to be undertaken and a validation that the proposed measures will reduce risks. This possibility to “side-step” the guidelines gives flexibility to build in flood risk areas, provided that the risk can be reduced by technical measures and/or building specific measures. This room for discretion is appreciated by the City Planning Department. It is perceived that the value associated with waterfront accommodation may offset the risk of shorter periods of flooding (Interview 1).
A discursive conflict between reducing flood risk and developing attractive waterfront properties can thus be identified and it is also acknowledged that fulfilling these different objectives can be conflicting for the municipal officials (Interview 1).

Another important actor is the County Administrative Board. The County Administrative Board needs to approve the detail plan before development can start. The County Administrative Board is also active during the planning process, where consultations under the Planning and Building Act are held with the municipality. The authority further holds the right to revoke municipal plans (Ch. 10, s. 10, Planning and Building Act). This is, however, rarely done in practice, primarily as a result of the extensive previous consultations (Interview 1). It has, for instance, been stated that “they [the County Administrative Board] honk before they run you over” (Interview 1). What is implicit in this statement is that the involvement in the planning process implies opportunities to raise concerns if necessary. Although the County Administrative Board seldom uses its right to revoke plans, the experience is that there is a lack of knowledge at the municipal level and that municipalities too often give building permits in areas that preferably should be avoided because the risk of flooding is significant (Interview 2). It is also claimed that society (i.e. municipalities) should adapt and avoid vulnerable areas rather than building technical solutions (Interviews 2 and 3).

Other municipal departments are also able to influence the planning process (such as Culture and Leisure, Technical Services and Property Management, Children and Youth, the Emergency Services and the Environmental Department) by being part of the planning project groups, where the departments are asked to give comments on the plan (Interview 1). It is then up to the planning committee to balance the different interests.

The issue of flood risk was raised during the planning process of the residential area Kanoten (see box 3.1).

**Box 3.1: Example of how flood risk can be considered in the planning process**

Kanoten is a residential area located in the city centre of Karlstad, which the municipality wants to develop into a new residential area (City Planning department, 2010a:4). The issue of significant flood risk of the area was raised during the consultation period by e.g. the Rescue Services, the Technical Services and Property Management Department and by Karlstad Electricity Network AB (City Planning Department, 2010b:10-11). In particular, the County Administrative Board found that, given that the municipality itself had stated that new development should be able to cope with a future 100-year flood, it was “surprising” that the programme did not propose any specific measures in regards to this, nor an action plan in case of a flood (City Planning Department, 2010b:3).

After the consultation, a flood risk analysis was commissioned by technical consultants, which concluded that further development without protective measures would lead to increased vulnerability (SWECO, 2010:1). The consultant suggested that the issue of flood risk should be dealt with by placing a sluice gate in the entrance to the inner harbour, which can be closed in the event of high water levels (SWECO, 2010:2). In 2010, the City Planning Committee approved a planning programme for the area (City Planning department, 2010a:1). The programme was produced by representatives of the Technical Services and Property Management Department, the City Planning Department, the Rescue Services, the Environment Department and the real estate company (City Planning department, 2010a:26). A detail plan was finally adopted by the municipal assembly in 2013 (Municipal Council of Karlstad, 2013:1), which clearly states that building permits are not to be given before flood protection measures are taken. The financing of protective measures will be regulated by an agreement between the municipality and the developer/land owner (Karlstad municipality, 2013).
The opinions about whether additional guidance from the national level is necessary are somewhat divergent. From the municipal level it is claimed that there is no need for additional regulations or guidance from the national level as physical planning to be adapted to local conditions (Interview 1). This view is however not fully supported by the County Administrative Board who asserts that the National Board for Housing, Building and Planning should provide clearer rules regarding the planning process and that the level of knowledge regarding flood prevention and physical planning at the municipal level in general should be developed (Interview 4). Having all the County Administrative Boards and municipalities setting up their own guidelines is not considered to be most efficient (Interview 4).

### 3.3.3 Flood Defence

Presently few permanent defence solutions exist in Karlstad but in the flood management programme a number of permanent technical solutions were proposed; *e.g.* dredging in the delta of Klarälven, safeguarding accessibility to the hospital by implementing structural permanent defences, embankments and pumps to reduce flood risk of the Skåre area, and defence measures in connection with new developments in flood prone areas (Karlstad municipality, 2010:21, 61-63; Interview 6). These proposed measures are still in the planning stage and have been analysed in separate projects (Interview 5). Further the hydropower dams, although not intentionally constructed for the purpose, can help to equalise water levels in both the river and lake and thus constitute a non-purpose defence structure (Karlstad municipality, 2010:34, 12). An important actor in relation to permanent defence is the Technical Services and Property Management Department in their role as responsible actor for the implementation of the programme (Karlstad municipality, 2010:6), and also the City Planning Department in their role as establishing qualitative provisions of flood risk reducing measures in relation to building permits. Other actors may also be important in relation to specific issues and projects such as the County Administrative Board, hydropower companies, and the County Council (acting as owner of the central hospital) as briefly described below.

Some of the planned defensive measures in Karlstad are:

- The municipality together with the County Council are planning to build a dike, an elevated pedestrian- and cycle path, to protect the central hospital (Karlstad municipality 2013:3). The project is planned to start in year 2016 (Karlstad municipality, 2014b);
- Skåre, which is a flood prone residential area in Karlstad, is also under investigation (Karlstad municipality, 2010:62). The municipality has so far dealt with floods by means of temporary defences (*e.g.* pumps and sandbags), but is now discussing the implementation of a permanent defence measure (Karlstad municipality, 2010:62);
- Karlstad municipality, with the Technical Services and Property Management Department in charge, has developed a dredging plan for Klarälven to reduce sandbars and clogging of the river pathways (Karlstad municipality, 2014b:2);
- Regarding temporary flood defences, the Technical Services and Property Management Department is responsible for storing and installing pumps and temporary barriers, and for plugging sewerages and storm water outlets (Karlstad municipality, 2010:60). If the situation is acute the emergency services also have temporary barriers available (Karlstad municipality, 2010:21).

The hydropower dam *Höljes* provides an opportunity to store water in the river Klarälven (Karlstad municipality, 2010:34). The interviews, both at regional and local level, indicate that the cooperation works well between the hydropower company, the County Administrative Board, the Emergency Services, and the Technical Services and Property Management Department. Information on irregularities in the water levels and planned water releases are for instance forwarded from the hydropower company to the County Council.
power producer to the aforementioned parties regularly (Interviews 3 and 5). Officials at the County Administrative Board also describe how the power producer has voluntarily helped to minimise flood risk in the river Klarälven by retaining water in situations with high flows, despite no such formal responsibility and despite the fact that this negatively affected electricity production and revenue (Interviews 3, 4).

Regarding flood risk in Lake Vänern, in 2012 the County Administrative Board in Västra Götaland came to an agreement with the hydropower company on a modified drainage strategy for the lake, which reduces the water levels in the lake by 40 centimetres (Karlstad municipality, 2010:12). The agreement is renewed annually (Karlstad municipality, 2010:12). As a result, the lake has become a less serious threat to the city (Karlstad municipality, 2010:52).

Since the person responsible for an activity or resource under normal conditions is also responsible under a crisis situation (Official Reports of the Swedish Government 2001:41, pp. 43-44), private property owners are obliged to be prepared in the event of a flood (or other natural disasters), which may include defensive measures. The individuals thus have the primary responsibility to protect themselves and their property (Official Reports of the Swedish Government 2007:31, p. 58). The same reasoning applies to public parties (i.e. primarily the municipality, but also to other governmental agencies). Measures should also be funded by the body responsible to take protective measures against e.g. the flood, implying that measures are funded either through the individual property owner and/or public taxes. A result of this allocation of responsibilities and limited support regarding funding (or knowledge) is that property owners, including municipalities, may have difficulties to implement defensive measures to reduce flood risk.

The governmental funds provided by the Civil Contingencies Agency are also mentioned in the municipal budget as well as in interviews (Strategisk plan och budget 2013-2015, 2012:13; Interviews 5, 7). An official at the County Administrative Board argues that the Civil Contingencies Agency is absent at the regional and local level, and is not doing enough regarding the financial resources (Interview 4).

The above-presented measures all have different financial solutions, where the municipality and/or private persons (natural or legal) carry the cost, as a result of ownership, legal obligations, responsibility of an activity, or a combination thereof. When the municipality partly or wholly finances large scale defensive measures, the financial means are requested by the responsible Committee to the City Council and are thus funded directly from the municipal budget (Karlstad municipality, 2012a:24-26). Measures used in case of more limited and reoccurring flood events, i.e., installing temporary flood defences or clearing streets from local pluvial floods, are funded via the budget of the Technical Services and Property Management Department (Karlstad municipality, 2010:15; Interview 5).

To the same extent as the municipality is financially responsible for defensive measures, they also hold the responsibility of acquiring the knowledge needed. It is described by a local official that it is very much up to the municipality, and individual departments, to build their own knowledge as it is hard to find elsewhere (Interview 5). The absence of a distinct flood policy domain at national level may have resulted in a more limited development of knowledge in the subject than what is the case in countries where flood risk governance is a more established on the policy agenda. An official at the municipality believes that there exists expertise at the national level within specific issues such as
hydrology and geology, while knowledge on how to reduce flood risks more specifically and practically, e.g. developments regarding what measures that are available and suitable, is more limited (Interview 5). The municipality frequently engages external technical consultants, but also the Swedish Meteorological and Hydrological Institute and the Swedish Geotechnical Institute are often consulted to support the municipality (Karlstad municipality, 2010:16).

3.3.4 Flood Mitigation
The measures described in this section relate to the design and planning of urban areas and to the accommodation of water. The measures include building instruments, green infrastructure and urban drainage systems. Central actors are the City Planning Department and the County Administrative Board. In the detail plans, the municipality has the opportunity to establish qualitative provisions in terms of building requirements to accommodate water (Ch. 4, s. 10, Planning and Building Act) and green infrastructure. The City Planning Committee is also responsible for developing a revised Green Plan (Lindström, 2013). The County Administrative Board provides materials and advice to the municipalities, such as the “Rising water” handbook (2011), and is also a reviewer of detail plans in relation to e.g. flood risks (Ch. 5, s. 22 Planning and Building Act). The Water and Sewage Unit, which is a part of the Technical Services and Property Management Department, is also involved in flood mitigation related activities and measures. The formal rules relevant for flood mitigation measures on the local level are the same as on the national level (see Section 2.3.5 above). The attention at the case study level is therefore focused on the local and regional guidelines, i.e., the Comprehensive Plan (Karlstad municipality, 2012b), the Water and Sewerage Plan (Karlstad municipality, 2014c), and the Green Plan (Lindström, 2013), developed by the municipality and the County Administrative Board. These documents help concretise the law on the local level, and will thus guide officials in their decisions.

Regarding discourses, although the measures are presented separately below, a common shift in discourse seems to be apparent; a slow move from technical solutions exclusively towards a combination of measures. Although flood mitigation measures are not visible in the flood management programme, there is evidence of increased focus towards measures accommodating water such as open storm water retention and green infrastructure e.g., in a revised Water and Sewerage Plan (Karlstad municipality, 2014c), in the project description for the Green Plan (Lindström, 2013) and in the County Administrative Board’s guidance documents (Interview 5). It is believed that this change, at least to some extent, can be attributed to climate change (Interview 5).

Building requirements and Green Infrastructure
Regarding building requirements related to flood mitigation, provisions on minimum floor levels have since long been applied in areas with flood risk (Flood management programme, 2010:21). A central guiding document in relation to building requirements is the 2011 guidelines “Rising Water – A handbook for physical planning in flood prone areas” (County Administrative Board of Västra Götaland and County Administrative Board of Värmland, 2011) which contain several examples of measures of water accommodation and water resilient building design.

Below a number of examples of building requirements that have been used in Karlstad are given:
- Provisions on minimum floor levels in buildings has since long been applied in areas with flood risk (Karlstad municipality, 2010:21);
- Provisions on the placement of critical infrastructure have been introduced (Karlstad municipality, 2010:21);
Flow path ways, i.e. elevating properties and thereby forming a slope down to a designated path, where rain water is diverted via the surface in a controlled manner (County Administrative Board of Västra Götaland and County Administrative Board of Värmland, 2011);

12 two-story floating houses, built on pontoons, have been constructed by the municipal housing company KBAB (KBAB, 2014).

Green infrastructure measures can, for instance, consist of green roofs, vegetation-covered walls, street trees, pocket parks, flood irrigation beds and infiltration beds. As a result of a high exploitation pressure and revised national environmental goals for green areas, the City Planning Department is developing a new plan for green development (Lindström, 2013). The revised plan will have a stronger focus on green areas and storm water management. The purpose of the plan is to complement the comprehensive plan and guide future planning of the municipality. It will also contain an inventory and analysis of present green areas.

The level of knowledge is primarily developed internally, though supported to some extent by the County Administrative Board and by external consultants (Karlstad municipality, 2010:21). Costs associated with the implementation of mitigation measures are paid by the one who has the responsibility to protect property against floods, which in turn is dependent of ownership, legal obligations and responsibility of an activity. In practice, measures of this nature may come to provide flood risk reducing benefits, as well as other benefits (e.g. aesthetics, air-purification, cooling) and there may thus be additional motives for implementing green infrastructure measures than a goal to limit flooding in case of for instance heavy rains.

**Urban drainage systems**

The Technical Services and Property Management Department is responsible for supplying drinking water, diverting storm water and purifying wastewater, including the construction, operation and maintenance of the water and sewerage system (Karlstad municipality, 2012c). Public water services are financed through water charges paid by the users.

As discussed in chapter 2, it is important for the relevant municipal departments to as early as possible participate in the planning process when new areas are developed for residential and/or commercial purposes (National Board of Housing, Building and Planning, 2010b). Being involved in the early stages of the planning process gives an opportunity to design water and sewerage systems in a more efficient way, instead of having to design second best solutions in a later stage of the process. The intention in Karlstad is that storm water infrastructure issues to a larger extent than before should be considered already in the planning process (Karlstad municipality, 2012d).

In 2014, Karlstad municipality developed a water and sewerage plan (Karlstad municipality, 2014c), which is an amendment to the Comprehensive plan, providing guidelines at local level. The plan has a strong focus on the piped systems due to an already undersized existing piped network, expected continued growth in local population and sharpened dimensioning requirements for storm water sewers. The plan however also expresses that the municipality should strive for a sustainable storm water management, implying that the municipality to a larger extent should try to mimic the nature's way of handling storm water within the urban environment (e.g. through evaporation, delaying and infiltration) (Karlstad municipality, 2014c:27). Diverting runoff water via different local storm water measures has at least so far been used sparsely (Karlstad municipality, 2012d). Other important guid-
ing documents are recommendations provided by the Swedish Water and Wastewater Association, SWWA (Interview 8).

One of the difficulties regarding using open storm water management is the lack of quantitative knowledge of the capacity of green infrastructure to delay water (National Board of Housing, Building and Planning, 2010b). A municipal official stated that “one must dare to try” implying that there seem to be some degree of uncertainty but also a wish to work more actively with these kinds of solutions (Interview 5). Another municipal official (Interview 8) conveys that the municipality lacks knowledge regarding measures to delay and infiltrate water and therefore external technical consultants are often used. It was, however, the official’s view that alternative measures to piped solutions are relatively unfamiliar for the external consultants as well. This may explain why technical solutions still are dominating in spite of the striving towards a more sustainable storm water management.

3.3.5 Flood Preparation
Preparedness work in Karlstad with respect to floods includes the development of contingency plans (Karlstad municipality, 2010:60), monitoring water levels, building knowledge about the municipality’s vulnerability at different water levels and informing the citizens about flood risks (Karlstad municipality, 2010:61-65).

Important actors are the Technical Services and Property Management Department (primarily involved in the construction of models and monitoring of water levels), the Rescue Services (developing Contingency plans), and the City Planning Department (developing Flood risk maps) (Karlstad municipality, 2010:60-65). As mentioned in section 3.3.1, there seems to be well-functioning cooperation between these actors (Interviews 3, 6, 7). This was, at least to some extent, explained by officials switching positions between the departments and organisations (Interviews 4, 6).

The Technical Services and Property Management Department and the City Planning Department have development flood risk maps (showing how Karlstad would be affected if water levels are high both in Klarälven and Lake Vänern at the same time). The maps can be linked to the municipality’s GIS-system which is used on a daily basis by e.g. city planners and emergency services (Karlstad municipality, 2010:18). Within the EU-funded project SAWA, the Technical Services and Property Management Department has developed a hydrological model that can be used to simulate situations with high flows (Karlstad municipality, 2009). The SAWA project aimed at developing strategies on how to deal with floods in the member states of the North Sea region (Norway, Sweden, UK, the Netherlands and Germany) (Goltermann and Marengwa, 2012). The SAWA-project included researchers from universities and institutes and officials from different administrative levels. From Sweden, Karlstad University and the County Administrative Board of Värmland participated in the project (Goltermann and Marengwa, 2012).

The municipality has been supporting the development of the multidisciplinary research centre, Centre for Climate and Security, situated at Karlstad University, which is also an important actor in flood preparation. The centre focuses on research on societal risks and vulnerabilities associated with climate change in general and on flood risks specifically (Karlstad University, 2014).
The Rescue Services have developed two different contingency plans related to floods. The first is a plan for how the municipality should organise and operationally prepare to minimise the consequences of floods when they occur (Karlstad municipality, 2010:20) and the second is a plan for extraordinary incidents (such as a dam failure) that can disrupt essential social services (Karlstad municipality, 2010:20).

In several interviews (Interviews 3, 4, 5, 6, 7) the individual citizen is pointed out as an important, yet somewhat absent and perhaps unaware, actor. There is a concern both from the municipality (Interviews 5, 6, 7) and the County Administrative Board (Interviews 3, 4) that the level of preparedness at the individual level is too low and that the individuals have too high expectations on the municipality’s responsibilities and possibilities to support private people in general in case of a severe flood. The local flood management programme recognises the need to improve the knowledge and preparedness of the citizens significantly. Examples of measures undertaken with this aim are; information on the municipal webpage (Karlstad municipality, 2010:18); “Flood walks” whereby the municipality, the Centre for Climate and Security at Karlstad University and the County Administrative Board jointly organised citizens walks in the city, where they pointed at the risks (and opportunities) of living near the water (Karlstad municipality, 2014d); and “Floodville”; and a physical topographic model over Karlstad, in which floods can be simulated. Participants are asked to install barriers to protect objects and functions in the city. Participants have limited resources and are forced to discuss and make strategic choices in their design of flood protection. Floodville was developed by the research group at Karlstad University and is used as a learning tool for various groups such as students, and municipal officials (Karlstad University, 2012).

3.3.6 Flood Recovery
The strategy of recovery entails primarily measures and instruments which are handled by the national level. There are national grants, which Karlstad Municipality received after the flood of 2000/2001. The temporary defence measures constituted a major cost for the municipality, amounting to almost 7 million SEK (about € 0.7 million) (Karlstad municipality, 2010). The municipality of Karlstad was compensated for these costs by the national government. No national compensation was however made for damages to private individuals and companies, as this was handled via the private insurance market (Blumenthal, 2010:20).

3.4 Explaining dynamics in flood risk governance at the case study scale
Karlstad is one of the most flood prone municipalities in Sweden and therefore the management of flood risk has been on the agenda, at least to some extent. It was, however, not until 2010, with the flood risk management programme, that flood risk management has become more structured and integrated. The flood event of 2000/2001, together with the national investigation on major risks and vulnerabilities associated with climate change, have been important drivers for change in Karlstad (as well as on the national level), and contributed to the establishment of the flood management programme in 2010. The Flood management programme implied an important change in Karlstad’s work regarding flood risk. Flood risk management has moved from mainly having an organisation for flood events, i.e. being prepared, to also incorporating defensive, and to some extent preventive strategies.

The flood mitigation strategy is not part of the Flood management programme but has recently gained in interest and can be considered emerging. This tendency towards increased significance of
3.5 Evaluating flood risk governance at the case study scale

3.5.1 Societal resilience
A diversity of flood risk management strategies can be identified in the municipality of Karlstad: the knowledge base on flood risks is improving; planning instruments oblige to account for flood risk; structural measures of diverse scale are implemented in flood exposed areas; emergency and crisis organisations are in place; and insurance is available both for the municipality and private persons.

After the large floods in the early 2000s and the national investigation on major risks and vulnerabilities associated with climate change, the municipal policy has shifted towards a more structured and integrated flood risk management, e.g. by the establishment of the flood management programme, the assignment of a flood risk manager, and a specific item in the municipal budget earmarked for reducing flood risk. The local flood management programme also stresses the importance of knowledge building and close cooperation across actors. In particular the prevention and mitigation measures which are both highly related to spatial planning, involving about the same actors and governed by similar regulatory framework, are integrated at the municipal level. In addition there are examples of frequent formal and informal contacts across actors involved in flood risk preparation (e.g. the River groups and Delta group mentioned above). Flood risk management in Karlstad is thus integrated and aligned to a higher extent than on the national level.

There is also a tendency towards broadening the strategies and measures used in Karlstad. The increased focus towards measures accommodating water such as open storm water retention and green infrastructure (although not yet much practiced) is one example of a wish to broaden the types of mitigation measures adapted. The planning and development of permanent purpose defence structures (as described above) constitute another example of a tendency towards diversifying also the flood risk strategies used in Karlstad.

3.5.2 Efficiency
Cost-benefit analyses are performed and the municipality tries to find synergy effects when considering different flood risk defence or mitigation measures so as to increase efficiency, for instance by planning an elevated pedestrian- and cycle path which will also protect the central hospital (Karlstad municipality 2013:3). It is however also claimed that evaluations of the expected costs and benefits associated with different measures/instruments should be accomplished more frequently (Interviews 4, 8).

3.5.3 Legitimacy
National legislation sets the requirements on access to information, participation and appeals in local decision-making. The interest of the general public towards participating in discussions about planned flood risk measures seems however to be quite limited. Karlstad is moreover actively trying to raise awareness on flood and other risks.
4. Case study: Gothenburg

4.1 Introduction and scope of the analysis
This chapter provides an analysis, explanation and evaluation of flood risk governance in Gothenburg (Göteborg). This case study aims to provide insights into the local governance for fluvial, pluvial and coastal floods in a municipality that can be considered to be on the forefront of flood risk knowledge and management in Sweden. We will first provide the main characteristics of the case study area (4.2). This is followed by an analysis of dynamics (stability and change) in the flood risk management strategies and their embedding in local/regional sub-arrangements (4.3). We go on to explain these dynamics (4.4) and to evaluate them (4.5), before providing our conclusions for this case study (4.6).

4.2 Main characteristics of the case study

4.2.1 Physical and socio-economic circumstances
The municipality of Gothenburg is located in the County of Västra Götaland, on the Swedish west coast, where Göta River flows into a sea area known as the Kattegat. It has a total area of approximately 460 km², of which 3 percent are inland water areas. Population-wise, it is the second largest municipality in Sweden, with about 540,000 inhabitants. The population density in the central areas of Gothenburg can be as high as 6,000 inhabitants per km². The port of Gothenburg is the largest port of Scandinavia and quite important for Swedish economy as almost 30 percent of Swedish foreign trade passes through the port (Gothenburg Port Authority, 2015). Several large industries such as AB Volvo, Volvo Cars and SKF have their headquarters and even some of their factories in the municipality. Other leading branches are information and communications technology (ICT), medical industry and tourism. The municipality also houses two prominent universities: University of Gothenburg and Chalmers University of Technology.
Gothenburg is vulnerable to coastal, fluvial and pluvial floods. The predominant soil type in the Göta river valley is clay, which makes the area also quite prone to landslides. Tidal variations in the Kattegat are small. Extreme sea water levels are associated with strong westerly and south-westerly winds, but these events are usually of short duration (Swedish Meteorological and Hydrological Institute, 2012). Rising sea levels as a result of climate change are a major cause for concern. There is still significant uncertainty regarding the scale of the effect, particularly in relation to extreme water levels. A sea level increase of 0.9 meters in combination with a storm event like Gudrun could have major consequences for areas close to the maritime coast and central areas along the river (Executive Offices of the Municipality of Gothenburg, 2006:1).

The metropolitan area of Gothenburg has been indicated as significantly vulnerable to fluvial flood risks in the preliminary assessment performed under the EU Floods Directive. Objects at risk include an emergency service centre, a polluted land area, a water protection area, a nature reserve and Natura 2000 areas (Swedish Civil Contingencies Agency, 2011:56). Flood hazard and flood risk maps are produced for Göta River and two of its tributaries, Säveån and Mölndalsån. While the maps for the tributaries are based on return periods calculated through the statistical analysis of water flow series, the maps for the Göta River relate to different discharge levels from the Vargön hydropower dam. It is however the sea level which primarily determines the scale of the water spreading in Gothenburg (Swedish Civil Contingencies Agency, 2013b, 2013a). The combination of high flows in the watercourses and high sea water levels could be disastrous for the municipality.

Extreme discharges from Lake Vänern are not at present estimated to affect Gothenburg in terms of flood risks, but are instead significant in regards to landslides (Executive Offices of the Municipality of
Gothenburg, 2006:1). The Climate and Vulnerability Commission’s sub-report on climate effects on the greater lakes of Sweden stated however that future warmer climate and increased precipitation will affect water flows in Göta River since the maximal allowed discharge from Lake Vänern will have to be used more often (Official Reports of the Swedish Government 2006:94:177-178). Estimations show that both high and low levels of drainage from the lake will be more common in the future (Swedish Geotechnical Institute, 2012).

Gothenburg has a generally mild weather, averaging approximately 600 millimetres of rain per year. Heavy downpours can and do occur in the summer. For the Göta River valley it is predicted that both average and extreme precipitations will increase in the future.

4.2.2 Historical events and related responses
The issues of floods, weather events and climate change have been noted in meetings, reports and plans from the municipality of Gothenburg in the last fifteen years. Interviews at the municipal level (1, 3, 4 and 5) have implied however that the taking of measures is more reactive than proactive; something is done once something happens. Events that seem to have drawn municipal attention towards flood issues are storm Gudrun in 2005, the Gårda flood in 2008 and the heavy rains of 2011. Gudrun affected Gothenburg by an increase of the sea water level by one and a half meters, flooding parts of the port areas. The Gårda flood was caused by a technical failure in a dam in Mölndalsån and severely affected the fire station and main office building of the emergency services, flooding the basement where two dozen vehicles were kept. In 2011, Gothenburg experienced a 100-year rainstorm that resulted in 200 flooded basements corresponding to € 1.6 to € 2.1 million in damages (Gothenburg Water, 2012).

The final report of the Climate and Vulnerability Commission, which is important at a national level, is referred to in some local documents. According to a municipal official (Interview 1) the report was, however, not of much use to Gothenburg since it did not cover sea-related risks, and also because the municipality was knowledge-wise “ahead” of the national investigation. Interviews at local level also indicate that the Floods Directive has had limited impact on the municipality (Interviews 1, 2 and 3). The municipality has however contributed to the County Administrative Board’s work in connection with the implementation of the directive. Interviewees at the Board have expressed uncertainty regarding how flood risk management plans will be enforced in relation to municipalities given their non-binding character (Interviews 7 and 9).

4.2.3 Political and administrative structure
There are several committees and subordinated departments with competences specifically relevant for flood risk management. First and foremost are the Building Committee and the Urban Planning Department, which are responsible for spatial planning, building permits and for coordinating climate change adaptation work within the municipality. A particular individual within the department has personally participated in the production of several documents of relevance and has moreover been pointed out in various interviews as an important driver for flood risk management in Gothenburg (Interviews 3, 4, 5 and 6). Other important local authorities and their responsibilities include: the Water and Cycle Department (water supply and sewerage services); the Traffic Office (roads and tracks); the Parks and Nature Department (green areas); Emergency Services for Metropolitan Gothenburg (emergency services); the Municipal Executive Committee and the Crisis Coordination Group (crisis management).
Several units within County Administrative Board of Västra Götaland are relevant for flood risk management in the county: the Urban Development Unit assists and supervises the municipality in planning and building issues; the Unit for Protection and Safety supports the municipalities’ work with crisis and emergency management; and the Water Conservation Unit works with water quality, quantity and use issues. The Board is also the designated Water Authority for the Skagerrak and Kattegat Water District.

4.3 Analysis of flood risk governance in Gothenburg

Figure 4.2 provides a rough sketch of the strategies present in Gothenburg and their relative importance.

<table>
<thead>
<tr>
<th>Flood risk strategies</th>
<th>Risk Prevention</th>
<th>Flood Defence</th>
<th>Flood Mitigation</th>
<th>Flood Preparation</th>
<th>Risk Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark blue indicates institutionalised strategies</td>
<td>medium blue emerging strategies</td>
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</tbody>
</table>

4.3.1 Flood Prevention

The Municipal Assembly adopted the comprehensive plan currently in force in 2009 (Municipality of Gothenburg, 2009, ÖP 2009). The main focus of the plan is on developing Gothenburg from the centre outwards, by complementing built-up areas in the core of the city with new buildings, as well as by creating new links and concentrating development at strategic nodes.

The comprehensive plan includes a map indicating flood vulnerable areas (ÖP 2009, Map 2). A specific theme and objective in the plan relates to Gothenburg as a robust community and building safely is listed as one of the strategies associated with robustness (ÖP 2009, Part 1:60). The plan states that, in order to avoid new risks, the localisation and execution of building development must take into account the risk for landslides, subsidence and floods. Moreover, the plan indicates the required lowest foundation level for new development in the central areas of Gothenburg: +2.80 meters, which is one meter over estimated present-day extreme water level. Exceptions must be preceded by an assessment and implementation of special protective measures (ÖP 2009, Part 2). This foundation level was actually decided in connection with the adoption of the 2003 municipal Water Plan (Municipality of Gothenburg, 2003) and is half a meter higher than what was previously required.

In connection with investigations on extreme weather events and as newer estimations on sea level rise became available, the necessity to further raise the safety marginal in relation to critical infrastructure was discussed, and in 2010 the Municipal Assembly adopted a decision encouraging all relevant authorities to consider climate effects in planning and budgeting, as well as to strive to achieve a safety level of one additional meter above the required level for the central areas of

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9 A summary in English of the comprehensive plan for Gothenburg is available at the website of the municipality: [http://goteborg.se/](http://goteborg.se/).
Gothenburg in case of specially critical services (Municipal Assembly of Gothenburg, 2010). The required lowest foundation level for these is then +3.80 meters.

The County Administrative Board has not always been entirely satisfied with the manner in which Gothenburg accounts for flood risks and climate change in its planning. Officials at both the municipality and at the Board agree that, in recent years, the Board has been more active in its control of planning instruments in relation to flood risks, especially in relation to present and future sea level (Interviews 1 and 6). The interviews also reveal the reason for this: an increase in the resources at the County Administrative Board for these matters. The main disagreement seems to be that while the Board insists on adaptation to worse-case-scenario, the municipality wants to work more flexibly (Interview 1). The provisions on flood risk in the Planning and Building Act are considered insufficient or inadequate both at local (Interview 1) and regional level (Interview 6).

4.3.2 Flood Defence

Flood defence measures seem to be at the centre of flood risk management in Gothenburg. There are several potential reasons for this: the municipality wishes to develop central, densely constructed areas; diverse purpose defence measures have recently been implemented; and large-scale plans are under discussion. There are moreover several non-purpose flood defence structures which affect Gothenburg. A number of actors are involved as the measures can be undertaken by both private persons and public bodies.

The second phase of the investigation on extreme water events in Gothenburg (Municipality of Gothenburg, 2008) calculated the potential costs of protecting the central area of Gullbergsvass to the levels of half a meter and one meter over present-day extreme water level. The report discussed different types of defence measures, particularly asserting that, from a safety perspective, permanent measures are preferable (p. 17). An interviewee (1) at the municipal Urban Planning Department also stated that, in relation to coastal flood risks, flood defence measures are the only viable option. In March 2014, a feasibility study consisting of a risk based cost-benefit analysis of large scale flood defence measures in Gothenburg were completed (SWECO, 2014). Two alternatives were studied: a) embankments along Göta River in the central areas of Gothenburg, and b) movable barriers at

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10 In 2014, the detail plan for the central area of Lindholmen was taken up for revision by the County Administrative Board since it was not considered to follow the guidelines for planning in flood prone areas (County Administrative Board of Västra Götaland och Värmland, 2011). The planning levels required by the Board for areas near the maritime coast are based on future-day extreme water levels (+2.90 meters) in combination with safety margins of half a meter (level 1) or one meter (level 2) (County Administrative Board of Västra Götalands län, 2012). In the detail plan originally prepared for consultation, barriers to protect the area from high water levels in the Göta River were considered, but were left out in the version that was later subjected to public announcement (Urban Planning Department, 2013a), which was noted by the Board (Urban Planning Department, 2013b). The municipality responded that building barriers or raising the land-level in the area was not reasonable at that stage, and that larger-scale protective measures for the whole municipality were investigated. The detail plan finally adopted by the municipality (Urban Planning Department 2013c) mentions these potential measures: one alternative is an outer barrier that provide protection against future flood risks (in a 50-year perspective) and is expandable in order to allow for flexibility in decision-making. The County Administrative Board ultimately did not revoke the detail plan, which has now come into force. The Board has recently also modified their planning recommendations for areas near the maritime coast on the basis of newer climate analysis of the sea water level (County Administrative Board of Västra Götalands län, 2014).
the Älvsborg Bridge and Jordfall Bridge. The analysis showed that the second alternative would be preferable, but it was pointed out that the study was incomplete and associated with significant uncertainties. Since then a more detailed study regarding the outer barriers have been completed (SWECO, 2015) according to which the estimated costs amounts to between € 394 and € 843 million (SWECO 2015, p. 94). The matter of the financing of the measure is quite controversial, and certain legal issues, in particular pertaining existing water rulings, also pose a challenge. In relation to this project, an official at the Urban Development Unit at the County Administrative Board (Interview 6) warns that while it may seem to the developer as the simpler option, it will not protect Gothenburg from fall and autumn and spring flows or from heavy rains; “water comes from all sides”.

Issues pertaining flood protection were also discussed under the Mistra Urban Future pilot project “Climate adapted urban infrastructure: scenarios for future Frihamnen”, which aimed at analysing the ecological, economic and social advantages and disadvantages of three alternatives for climate adaptation – Attack, Retreat and Defence – for the development of a central area of Gothenburg, Frihamnen. The retreat strategy consists of avoiding infrastructure and buildings in vulnerable areas. The defence strategy implies constructing protective barriers against the water. The attack strategy entails using the water as a surface on which to build. The project found that, based on which dimension of sustainable development is prioritized, different strategies are better or worse suited to inspire development of the area (Roth et al., 2011:57-60). From an ecological perspective, the retreat strategy was seen as ideal. If the priority is instead to increase the economic return for the municipality, then the defence and attack strategies were considered more appropriate. It was pointed out that to promote sustainable development in all dimensions it is necessary to find a balance in the prioritisation, and that several adaptation strategies might be appropriate. Combining different strategies was also believed to result in increased cost-efficiency (Roth et al., 2011:22). An interviewee at the Urban Planning Department (1) stated that while the project broadened the perspective on climate adaptation, focus remains on the defence strategy because the ambition is to develop the central parts of the municipality.

Finally, the regulation of Göta River has consequences for flood risk management in Gothenburg. Four hydropower dams are in operation along the upper course of the river, and several of the water rulings contain provisions relevant for flood and landslide risks in Gothenburg, for example regarding the highest and lowest limits of the water levels in Lake Vänern. For the periods when water is stored in the lake by reducing discharge, a set of movable barriers must be used to maintain the water flow levels to prevent saltwater from advancing up the river, which is crucial since Göta river is a drinking water source for about 700 000 people. There are also provisions to limit discharge in case of high sea water levels. Since 2008 a new discharge strategy to reduce higher water levels in the lake is applied.

4.3.3 Flood Mitigation
There are around 2.500 kilometres of sewerage pipes in the municipality of Gothenburg. While combined sewerage networks predominate in the older, central areas, the newer, surrounding areas primarily have duplicate or separate systems (Municipality of Gothenburg, 2003:23). The water and

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11 The water intake has to be closed numerous times per year to secure water quality. Saltwater is not the only reason, the overflowing of the sewerage system is also problematic.
sewerage system has been found to be vulnerable to extreme weather events; in periods of intense rains, the capacity of the system can be exceeded and lead to flooding of basements and as well as overflows of untreated storm water and wastewater into watercourses (Municipality of Gothenburg, 2006:41). In connection with new development, the rule is therefore to use duplicate systems which are dimensioned for a 10-year rain, following the recommendations of the Swedish Water and Wastewater Association. Storm water is also to some extent treated locally, principally through infiltration or detention (Water and Water Cycle Department, 2010:5). Storm water management facilities, both in the form of piped systems and open solutions (e.g. ditches), are operated and administered by the Water and Water Cycle Department and operations are financed though fees paid by landowners, administrators of public areas and road maintainers, which are in turn responsible for measures taken within the limits of the property, public area or road area.

There seems to have been three main developments in storm water management in Gothenburg in the last twenty years. The first development relates to local treatment of storm water, initially targeting purification but in later years is also seen as an alternative for flood risk management. The second development entails promoting the consideration of storm water management issues early in the planning processes, both when it comes to new development and to expansion of already existing development. The third development entails planning for extreme rain events, by calculating where the water will be headed once the capacity of the system is exceeded and if possible redirecting it (Interview 2). A number of documents supporting these developments have been adopted, including the 2003 Water Plan and in particular the handbook “Storm water management, this is how we do it!” (Water and Water Cycle Department, 2010). According to this policy document, storm water management should be considered already in connection with the comprehensive planning and detail plans should include a storm water investigation, showing the current capacity of piped systems and watercourses, as well as the potential consequences of extreme weather events. Storm water detention within the limits of the property is currently prescribed in all detail plans and building permits (Handbook, p. 16-17).

All in all, while knowledge, investigations and projects on local treatment of storm water are plentiful in Gothenburg, these have not extensively translated into practice. Interviewees at the municipality (1, 2 and 3) have pointed at difficulties associated with this kind of measures: the predominance of clay soils does not favour infiltration; drainage wells require a lot of space, which is not available in the central areas; the measures require a lot of maintenance and are also slow, which makes them insufficient when it comes to heavy rain.

Note that park and green areas in Gothenburg are still primarily thought of in terms of their aesthetic and recreational features, with their capacity to contribute to flood risk management only marginally discussed in policy documents (e.g. Municipality of Gothenburg, 2014). When asked about the role of the Parks and Nature Department in flood risk management, an official at that department expressed that they work to protect the municipality’s green areas and watercourses (mostly through small-scale measures against erosion) as well as maintain embankments at lakes (Interview 3). The interviewee also stated that the Park and Nature Department could eventually contribute to stormwater management in the municipality with land areas that can be used for water detention.
4.3.4 Flood Preparation
The Risk and Emergency Analysis for Metropolitan Gothenburg indicates the fluvial and coastal flood risks in its geographical competence area (Emergency Services for Metropolitan Gothenburg, 2011: 33-34). The creeks Mölndalsån, Kunnsbackaån and Säveån are considered the most vulnerable systems. The lower sections of these watercourses, as well as wharves, central areas and the southern archipelago of Gothenburg can be affected by high sea water levels. The analysis states, however, that a flood constitutes an “emergency” in the terms of the Civil Protection Act only if it is the result of a sudden event. The emergency services can intervene in such cases in order to prevent the water of rising and worsening the damages. The emergency services could also need to intervene in case of a major event outside of its geographical competence area at e.g. a dam failure in Göta River (p. 20). An interviewee at the Emergency Services for Metropolitan Gothenburg (Interview 4) has stated that a shift has occurred in the last fifteen years regarding the role that they believe they have in flood risk management. Before, the emergency services would rush out to place barriers and pumps in case of a flood, but since the 2000s they have maintained that this is not their task. The interviewee explains that “at the bottom, floods are a land ownership issue and a municipal responsibility issue”. Emergency services are obligated to intervene only under the conditions established in the Civil Protection Act.¹²

As for crisis management, the 2011 Risk and Vulnerability Analysis for the municipality of Gothenburg identified nine prioritized “risk areas” which should be dealt with by all actors at municipal level, in collaboration with actors at regional and national level. Extreme weather events, including deviating sea water levels, precipitation, as well as low and high water levels in the Göta River, constitute one of these areas. The municipality deems that its capacity to manage crisis is generally good. Interviewees at municipal level have pointed out that Gothenburg is probably better prepared than other municipalities because it has faced serious events in the past (Interview 1 and 5). According to the Risk and Vulnerability Analysis performed by the County Administrative Board (County Administrative Board of Västra Götaland – Unit for Protection and Safety, 2014), the Board considers itself to have overall good capacity to deal with extreme weather events like flooding from watercourses (p. 50-51) and is currently investigating the issue of dam failure (p. 54).

The different local, regional and national actors relevant for crisis management collaborate regularly within several networks. An interviewee at the division for Civil Protection and Preparedness, however, expressed that it is difficult to get industry and commerce actors to participate, which is especially problematic now that privatisation and outsourcing is common (Interview 5). The difficulties faced by municipalities when engaging private actors in crisis management was also pointed out by an interviewee at the County Administrative Board (Interview 8).

The municipality has been working intensely to build, update and communicate knowledge on flood risks, mostly under the broader issues of extreme weather events and climate change. After the rain event of 2011, the municipality began developing data models for different areas (Interview 2). In 2014, an integrated hydro-model combining the sea, rivers, streams, pipe-networks, tunnels and land

¹² Note that floods risks are not taken up in the action plan for prevention and emergency services adopted pursuant to the Civil Protection Act (Emergency Services for Metropolitan Gothenburg, 2011a).
was completed. The 3D-model CityPlanner\textsuperscript{13} allows users to see how central areas of the municipality would be affected by three extreme water levels.

### 4.3.5 Flood Recovery

Insurance constitutes a part of the municipal risk management (Municipality of Gothenburg, 2013). Municipal property and operations are insured through the municipality’s own insurance company, Göta Lejon. Noteworthy is that premiums are differentiated for the various municipal departments and companies based on the size of their insurance values, their exposure to risks and their damage control measures (Göta Lejon Insurance Company, 2013).

Recent rain events have renewed the discussion relating to flooding as a result of the capacity of sewerage systems being exceeded. In case of e.g. basement flooding, both the relevant insurance company and the Water and Water Cycle Department can conduct a damage investigation to determine if and to what extent compensation is due. A report following the damaging rains of 2011 stated that claim costs associated with basement flooding have been rising for three reasons: an increasing number of extreme rain events, more costly damages (villas are more expensively decorated) and a shift in the distribution of compensation between the department and the insurance companies (Gothenburg Water, 2012:5). The report further explained that, before, the insurance companies stood for the claim costs and the department (which is financed by user fees) compensated the deductible (about € 1,000), but that in the last decade, the insurance companies have begun to send regresses to the department.

Gothenburg Water reasoned that while they were left to compensate the claims from their own capital, having a robust system for leading away water under an extraordinary event is actually the responsibility of several municipal actors together, as e.g. foundation levels, road design, storm drains, ditches and streams are all relevant (Gothenburg Water, 2012:1). Moreover, the damages in these cases are difficult to predict and, once realised, they directly affect returns (Gothenburg Water, 2012:6). Therefore, the department considered that the risk for basement flooding should be considered not just a sewerage risk, but a municipal risk.

### 4.4 Explaining dynamics in flood risk governance at the case study scale

In the 2003 municipal Water Plan, the national environmental objective of “reducing climate change impacts” was reformulated to a local objective of “reducing the impact from climate change” (Municipality of Gothenburg, 2003:30). This objective was concretised by two sub-objectives: 1) promote higher foundation levels or other protective measures near the mouth of Göta River in connection with new development or renovation, and 2) use local treatment of storm water to a greater extent and, where not possible, increase the capacity of the system if necessary on account of flood risks.

In relation to the first sub-objective, safety levels for new developments have been adopted (and raised for critical infrastructure) via planning instruments, but many places in already built-up areas do not reach these levels. Future plans to develop and expand these areas have also contributed to put flood defence into focus. A number of investigative and defensive measures have been suggested to reduce vulnerability of infrastructure and technical systems. In relation to transport infrastructure,

\textsuperscript{13} http://cityplanneronline.com/cityplanner/project/webgl/index.do?uid=ZD1mr6Yb
measures such as raising quays, constructing embankments, rebuilding bridges across the Göta River and placing pumps has been considered necessary (Executive Offices of the Municipality of Gothenburg, 2006:60) and some of these measures have already been taken.

As for the second sub-objective, municipal efforts seem to be focused on gathering knowledge on how piped-systems and surrounding areas will react to extraordinary events and taking measures to mitigate damages. Though measures for local treatment of storm water are explored and prescribed, they are far from a prominent feature of storm water management in Gothenburg. New guidelines for the dimensioning of piped-systems are underway prescribing that storm water systems in metropolitan areas should be able to handle a 20-year rain and in central areas, a 30-year rain (Interview 2).

A somewhat broader consideration of flood risk management measures can be identified in the second report on weather events (Municipality of Gothenburg, 2008:8-9). The integrated hydro-model mentioned under Flood Preparation was proposed here as a tool important for planning, the dimensioning of defences and the development of a warning system. Other recommended measures at local level included determining responsibilities for warnings and temporary measures in case of a flood event, increasing cooperation between regional and state actors as well as developing evacuation plans. The report also discusses measures which could be taken at state level, such as proposing reforms to the existent regime of water operations, increasing government grants for measures against raising sea water levels, investigating matters relating to distribution of responsibility among actors, and providing more accurate prognoses. Nevertheless, the most patent effect of the reports in terms of measures is the launching of studies on potential large-scale flood defences in Gothenburg. The Urban Planning Department seems to be the strongest driver behind this project, which is, however, associated with legal and financial complications which will be hard to overcome.

All in all, Gothenburg is quite engaged in flood risk management, though in a somewhat dispersed manner. Change seems to be driven mainly by exogenous factors; concerns for climate change effects, in the form of rising sea levels and increased precipitation, as well as a series of damaging flood events, have contributed to bringing flood risks into the municipal agenda. Several interviewees have referred to the municipality as more reactive than proactive. The issue appears to be mainly driven from the bottom upwards, i.e. from departmental level towards political level, with a specific official being identified as a key actor. Shifts in perceived responsibilities at local level, from e.g. the Emergency Services for Metropolitan Gothenburg and the Water and Water Cycle Department, may also be contributing to flood risk being increasingly dealt with as a municipal, and not just a sectorial, concern. A more active regional level may have a role in this as well, but between the municipality and the County Administrative Board, issues pertaining flood risk are often subject to debate. These two actors have disagreed in matters such as safely levels, critical infrastructure, and prevention measures in protected areas. The issue of heavy rains is, however, now gaining ground on both the local and regional agenda. Interviewees at local level have implied that the national level is not “on board” when it comes to flood risk management and climate adaptation (Interviews 1 and 3).
4.5 Evaluating flood risk governance at the case study scale

4.5.1 Societal resilience
A diversity of flood risk management strategies can be identified in the municipality of Gothenburg: the knowledge base on flood risks is improving; planning instruments oblige to account for flood risk; structural measures of diverse scale are implemented in flood exposed areas; emergency and crisis organisations are in place; and insurance is available both for the municipality and private persons. As a whole, the municipality does not seem inclined to avoid flood risk, but instead aims to resist flood events and minimize damages. Critical infrastructure is prioritized from planning, protection, and emergency and crisis management perspectives. The management of future flood risk poses, however, significant challenges for the municipality.

The municipality contemplates issues of resource efficiency, as evidenced by the 2006 extreme weather report: “Risk management and ongoing prevention efforts reduce vulnerability but must be implemented within the economic framework. There is obviously a limit to how much one can prevent. The need for a conscious, reasonable level of risk remains, as does the awareness that it is impossible to predict everything.” What constitute possible and reasonable safety and preparedness efforts are also considered “best judged by those who are directly responsible for the operations” (Executive Offices of the Municipality of Gothenburg, 2006:8, authors’ translation).

While each municipal sector is responsible for long-term climate adaptation and the taking of prevention measures within its realm of operations, there is also increasing need for cooperation and coordination across different sectors. For example, current developments in storm water management imply that because it is not socio-economically reasonable to dimension the system to manage all weather events, consequences of extreme events can be mitigated by e.g. placing buildings at a level where they are not at risk or achieving a controlled diversion of surface water. This requires cooperation between different actors since “[a] consensus for increased robustness is needed” (Offices of the Municipality of Gothenburg, 2006:41, authors’ translation).

4.5.2 Efficiency
Cost-benefit analyses are performed and made available. A notable example is the large-scale project that is presently being investigated. One issue which repeatedly came up under interviews is the need for an event to actually take place for the municipality to implement measures. An interviewee at the municipal Civil Protection and Preparedness Unit explained that if a disturbance has occurred then there are always significant resources to take measures afterwards; if nothing occurs it is difficult to motivate certain measures (Interview 5).

Some controversy exists regarding who will bear the costs of flood risk management and climate adaptation. While the municipality acknowledges its responsibilities regarding new development, the matter of how the existing development (which moreover is not always municipal) will be protected is more complex.

4.5.3 Legitimacy
National legislation sets the requirements on access to information, participation and appeals in local decision-making. Gothenburg is moreover actively trying to raise awareness on flood and other risks.
5 Case study: Kristianstad

5.1 Introduction and scope of the analysis
This chapter provides an analysis, explanation and evaluation of local flood risk governance in the municipality of Kristianstad, which is an exceptional case in Sweden due to its high flood risks. We will first provide the main characteristics of the case study area (3.2). This is followed by an analysis of dynamics (stability and change) in the flood risk management strategies and their embedding in local/regional sub-arrangements (3.3). We go on to explain these dynamics (3.4) and to evaluate them (3.5), before providing our conclusions for this case study (3.6).

5.2 Main characteristics of the case study

5.2.1 Physical and socio-economic circumstances
Kristianstad is a medium-sized municipality in the south of Sweden with a population of approximately 82,000 inhabitants (Statistics Sweden, 2015). The river Helge runs through the metropolitan area of Kristianstad, flows into Lake Hammarsjön to its south and then continues towards the Baltic Sea. Most of the metropolitan area is actually built on the bottom of what once was the lake’s Nosaby bay (Nosabyviken), which was drained in the late 19th century through the construction of the Hammarslund embankment (Hammarslundsvallen). The lowest point in the area is 2.41 meters below sea level.

Kristianstad was identified as an area with significant flood risk in the first step of the implementation of EU Floods Directive (Swedish Civil Contingencies Agency, 2011). Both River Helge and Lake Hammarsjön constitute flood risks. The river flows into the Baltic Sea and can flood when discharge is high and/or the sea level is high. The municipality is also vulnerable to extreme rain events. At present, about 16,000 people and important societal functions such as the water and sewerage system, the regional hospital and the rescue services are situated in flood vulnerable areas (Municipality of Kristianstad, 2009:28). Increased precipitation and sea level rise as a result of climate change are expected to make flooding events more frequent. The municipality relies primarily on a system of embankments and pumps, which is currently being rebuilt and expanded.

There are no major differences from the national average regarding average income (249,000 SEK), age (41), and employment rates (74%) (Statistics Sweden, 2014). The population has been growing over the last decades. Since 1960 the number of inhabitants has increased by 27 percent.
5.2.2 Historical events and related responses
Kristianstad has a history of floods: 1912, 1917, 1928, 1980, 2002 and 2007. The largest flood event in recent times was the one in 2002. Following a period of persistent rain (about 4 times the normal amount), extreme water levels in Helge River and Hammarsjö Lake put the Hammarslund embankment at risk of collapsing. According to the information available at the Disaster Database of the Swedish Civil Contingencies Agency (Swedish Civil Contingencies Agency, 2008), the embankment was temporarily stabilised by building a berm of 50 000 tonnes of crushed rock, an operation that took five days and twenty-five shuffle trucks working around the clock. Existing levees along the river had to be raised and supplemented, and temporary barriers had to be placed in several areas of Kristianstad, around important societal functions such as a power plant but also residential buildings. Some streets and roads were also closed down. Besides the inconvenience of blocked roads, large

Figure 5.1 Kristianstad: Flood risk at highest calculated flow in Helge River.
Source: Municipality of Kristianstad, 2009 (Comprehensive plan)
stretches of crop fields and meadows were flooded, and the railway traffic between Kristianstad and Åhus was shut down for several months. After this flood, the municipality began its work to rebuild and expand its permanent defences. The ongoing construction of a ten kilometer embankment together with six pumps is the nation’s largest and most expensive project for reducing flood risk yet (Johannessen and Hahn, 2012).

![Normal water levels in Helge, Tivoliparken](image1.png) ![High water levels in Helge, Tivoliparken (2002)](image2.png)

**Figure 5.2 Differences in water levels during the flood in 2002**
Source: [www.vattenriket.kristianstad.se](http://www.vattenriket.kristianstad.se)

### 5.2.3 Political and administrative structure
Four of the nine municipal committees (and their subordinated departments) have responsibilities related to strategic planning regarding flood risk management in Kristianstad (Municipality of Kristianstad, 2011:15-19):

- The *Technical Services Committee* and the *C4 Technical Services* department, responsible for the construction and management of municipal infrastructure (including the embankments and pumps), buildings, open spaces (as e.g. parks) as well as for water and sewerage and traffic.
- The *Planning and Building Committee* and the *Urban Planning Department*, responsible for planning and building, where amongst other issues flood risks need to be considered.
- The *Municipal Executive Board* and the *Municipal Executive Office* have a leading and coordinating role in the municipality. Under the Board are even the municipal emergency services, which have operational capacity in emergency situations as well as support the work of the other municipal committees and departments regarding safety and preparedness.
- The *Environment and Health Protection Committee* and *Environment and Health Protection Department*, in charge of supervising various operations and safeguarding environmental and health protection interest.
- The *Rescue Services*, responsible for having an operational capacity in emergency situations, and supporting the municipal committees and departments in their work regarding safety and preparedness.

The County Administrative Board of Skåne works to ensure that national goals are reached within the county.
5.3 Analysis of flood risk governance in Kristianstad

This section is structured as follows. The first sub-section describes the 2011 Climate Strategy for Kristianstad (Municipality of Kristianstad, 2011), focusing on its goals and providing an overview of measures and responsible actors. The measures are then sorted into different flood risk management strategies and further developed. The most notable aspect of flood risk management in Kristianstad is the strong focus on defensive measures, where a construction of a 10 km embankment, together with 6 pumps, are the nation’s largest and most expensive project for reducing flood risk, (Johannessen and Hahn, 2012). Figure 5.3 provides a rough sketch of the strategies present in Kristianstad and their relative importance.

<table>
<thead>
<tr>
<th>Flood risk strategies</th>
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<tr>
<td>Risk Prevention</td>
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<tr>
<td>Flood Defence</td>
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<tr>
<td>Flood Mitigation</td>
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<tr>
<td>Flood Preparation</td>
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<tr>
<td>Risk Recovery</td>
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Figure 5.3: Relative importance of strategies in Kristianstad

Dark blue indicates institutionalised strategies, medium blue emerging strategies

5.3.1 The Climate Strategy for Kristianstad

Influenced by the national investigation on risks and vulnerabilities associated with climate change (Official Reports of the Swedish Government 2007:60), Kristianstad developed a Climate Strategy (Municipality of Kristianstad, 2011:6). The Climate Strategy contains goals not only relating to climate change adaptation, but also greenhouse gas emissions, efficient energy utilisation, fossil fuels, transports, etc. These will be considered to less extent in this report. The section regarding climate change adaptation was produced by the C4 Technical Services Department, in consultation with, among others, the emergency services (Municipality of Kristianstad, 2011b:3). These two actors are therefore considered central to the municipality’s work regarding flood risk. The County Administrative Board of Skåne is also seen as an influential actor: their climate goals have been a starting point for the municipality’s goals.

The overall goal for climate change adaptation in the municipality is that: “No later than 2012, all municipal committees and companies must take consideration of future climate change in their operations and planning. Adaptation refers to the reducing risks in existing operations/infrastructure as well as measures in new construction/planning” (Municipality of Kristianstad, 2011:2, authors’ translation). In particular, the strategy states that the municipality will achieve the above-mentioned goal through the implementation of climate adaptation measures (Municipality of Kristianstad, 2011:2). The Objectives and Action Plan document of the Climate Strategy mentions the following flood risk related measures (Municipality of Kristianstad, 2011b:15-19).

The C4 Technical Services department is responsible for:

- The completion of embankments;
- Inventory of road culverts, bridge height, drainage from roads and risks of erosion;
- Preparedness in relation to blocking roads and tunnels;
- Warning system for heavy rains;
• Inventory and measures regarding municipal water sources and their vulnerability of flooding;
• Reconstruction of the water and sewerage system, and ditches to handle increased precipitation;
• Pay attention to intentions to build embankments and regulate ditches and watercourses, so that measures in one place do not increase flood risks in other places;
• Inventory of low-lying buildings and infrastructure (primarily along the coast);
• Inventory and defensive measures for low-lying pumps.

The Municipal Executive Office is in charge of:
• Updating of the municipal webpage regarding crisis situations;
• Revision and adaptation of ditching companies to which the municipality belongs in relation to climate change effects.

The Rescue Services must:
• Analyse the vulnerability of municipal activities in relation to increasing flood risks.

The Environment and Health Protection Department will:
• Advice owners of private water source on defensive measures against floods;
• Consideration of flood risks in supervision of environmentally hazardous operations;
• Plan for an increased establishment of wetlands.

The Urban Planning Department will:
• In physical planning, consider increasing needs for storm water management as well as increasing risks for e.g. heavy rains;
• Hinder or adapt low-lying new construction along the coasts in consideration to rising seawater and groundwater level.

In relation to some of these measures, collaboration within the departments but also with e.g. the County Administrative Board and the Swedish Transport Administration is encouraged. Follow-up on the progress done by the municipality is performed every year and published on the municipal website (Municipality of Kristianstad, 2011b:19).

5.3.2 Flood Prevention
The Comprehensive Plan currently in force for the municipality of Kristianstad was adopted in 2013 and replaces the previous one from 1990, which was deemed out of date (Municipality of Kristianstad, 2013:13). A Developed Comprehensive Plan for the metropolitan area is in force since 2009 (Municipality of Kristianstad, 2009). The Developed Comprehensive Plan clearly states that its main objective is growth (Municipality of Kristianstad, 2009:8). The municipal vision at the time was that by 2025 the municipality would grow by 10,000 new inhabitants implying that about 300 new homes would need to be built annually (Municipality of Kristianstad, 2009:3).

A starting point in the Developed Comprehensive Plan is that the area within in the embankments is considered protected from flooding (Municipality of Kristianstad, 2009:28). It is, however, to some extent acknowledged that flood risk cannot totally be disregarded given the possibility of dam failure or sabotage. A +2.5 meter rise in the lake would imply that, if the projected defences fail, the water would reach the first floor of buildings placed at sea level (Municipality of Kristianstad, 2009:29). According to the plan, the issue of flood risk must be considered in relation to new construction and
there must be a possibility for residents to save themselves by *e.g.* ascending a floor (Municipality of Kristianstad, 2009:29). The plan shortly states that there might also be reasons to consider alternative locations, with respect to human safety and to avoid the spill of dangerous substances. As for flood risk areas not protected by the embankments, flood risk should be dealt with by separate defence measures, such as embankments, landfilling or flood resistant foundations and ground floors (Municipality of Kristianstad, 2009:29).

The municipality’s approach may be seen as somewhat naive. While the probability of the occurrence of a flood has been lowered by the embankments, the severity of the consequences, if the dam would fail, will increase if new buildings are constructed within the embankments. Johannessen and Hahn (2012) claim that having such faith in the embankments and further developing the city behind them may in the long run enhance vulnerability. According to the cited authors, the Swedish Civil Contingencies Agency has further criticised the municipality for having a “business as usual” mentality in this matter (Johannessen and Hahn, 2012). Further, according to Storbjörk (2007) the municipality does not reflect enough on uncertainties associated with flood risk probabilities. According to interviews with city planners performed by Johannessen and Hahn (2012), there is, however, an awareness of the limitations associated with considering embankments only as a measure and a will to take a more integrated and holistic approach to flood risks in the coming planning cycle.

### 5.3.3 Flood Defence

Flood defence is fundamental for Kristianstad. After the 2002 event, the municipality decided to both strengthen the Hammarslund embankment and to build 10 kilometres of new embankments around the metropolitan area with corresponding pump stations to remove storm water. Some planned flood areas are also included. The resulting defences should be able to withstand a 10,000 year flood: a combination of a river water level of approximately 3.7 metres above sea level, a river water flow of 527 m³/s and a sea water level of 2 metres above mean sea level. The project, which by 2014 is halfway done, is expected to be finalised in 2025 to a cost of almost 290 million SEK (corresponding to about € 32 million) (National centrum for climate adaptation, 2015). Delays can, however, be expected as the project advances and affects infrastructure and land which does not belong to the municipality (National centrum for climate adaptation, 2015). About 60% of costs will be financed with state resources, namely through the fund for preventive measures administered by the Swedish Civil Contingencies Agency.

Storbjörk (2007) has found several challenges to the flood defence project in Kristianstad. One of these challenges relates to the conflict between reducing flood risk and exploiting the proximity to and aesthetic properties of water. High embankments mean a lesser feeling of contact to the water for the citizens of Kristianstad. As the legitimacy of building the embankments (which was high in 2002) has waned over time, the municipality is left with the “balancing act” between, on the one side, applying a precautionary principle with high defences and better safety margins, and on the other side, keeping the defences low in favour of a better city environment (Storbjörk, 2007:462). The cited author has even identified challenges in relation to knowledge and responsibility for flood risk management measures. While the state considers that it provides the calculations on which the

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14 According to the website of the municipality, the project will be finalised in 2021 and cost about € 54 million (Municipality of Kristianstad, 2015).
defences are designed in its role as expert consultant, the municipality sees these calculations as non-negotiable and a condition to get state funding (Storbjörk, 2007:465-466). In short, “[...] there seems to be an unwillingness to touch upon the issue of adequacy in the figures used in risk management and planning, which leaves us with the problem of who takes responsibility if the calculations prove to be insufficient” (Storbjörk, 2007:465).

5.3.4 Flood Mitigation

The measures described in this section relate to the design and planning of urban areas as well as to the accommodation of water. The measures include wetlands, green infrastructure, building instruments, and urban drainage systems. Important actors are the Urban Planning Department, the C4 Technical Services Department and the Environment and Health Protection Department. Regarding rules, the attention is on local and regional guidelines as these documents concretise the law at local level and show municipal intentions regarding urban planning, thereby guiding decisions in such matters.

The municipal responsibility for arranging water supply and sewerage services falls upon the Water and Sewage Division of the C4 Technical Services Department. Public water services are financed through water charges paid by users. The Developed Comprehensive Plan describes the need for increased capacity of the current water and sewerage system (Municipality of Kristianstad, 2009:38). Large investments in the west part of the metropolitan area are judged to necessary to be able to cope with future urban development. The Plan further states that in relation to new construction, storm water should primarily be managed within the property. Because infiltration is both difficult and inappropriate in several areas of the municipality, the aim must be to achieve a controlled slowdown of storm water within the property to then be led off through ditches and other detention surfaces (e.g. green areas and basins) and ultimately pumped out to the river and lake (Municipality of Kristianstad, 2009:32). These issues should moreover be considered early in planning. In 2010, the municipality adopted a new Storm water Policy (Municipality of Kristianstad, 2010) proposing a systematic local management of storm water. The policy stresses the importance of reserving space for e.g. infiltration and retention surfaces in planning and building processes. The municipality is also currently working on a comprehensive water and sewerage plan, which will serve as a long-term strategic document for the management of piped systems, treatment plants and water sources (Municipality of Kristianstad, 2015a). Responsible departments are the C4 Technical Services Department, the Urban Planning Department and the Environment and Health Protection Department.

According to the latest follow-up of the Climate Strategy, the C4 Technical Department has performed calculations on the capacity of the storm water system in some areas and implemented measures in e.g. central Kristianstad. They have moreover completed calculations in relation to areas sensitive to extreme rainfall (Municipality of Kristianstad, 2014:3). The Urban Planning Department considers changing needs in storm water management and increasing pluvial risks “when this is relevant” in the context of ongoing planning (Municipality of Kristianstad, 2014:9). Many of the measures for climate adaptation in the urban sewerage system are yet to be initiated. However, some efforts in regards to heavy rainfall have been made: the department has completed calculations showing sensitive areas in Kristianstad in relation to extreme rainfall and partly carried out calculations regarding the local surface water capacity. Johannessen (2014) considers that although the initiation of the Storm water Policy shows an increased awareness and adaptive thinking, more actual implemen-
tation is needed. There seems to be an increasing alignment between risk practitioners and urban planners, whereby embankments cannot constitute the only solution to flood risks. This is a positive trend emerging from deliberations about past mistakes.

The municipality’s work regarding flood mitigation through building requirements is modest. Important guiding documents are the Developed Comprehensive Plan and the (proposed) Environmental Goals (Environment and Health Protection Department of Kristianstad, 2014). The two most influential actors in relation to these documents are the Urban Planning Department and the Environment and Health Protection Department. The Developed Comprehensive Plan mentions measures such as flood resistant buildings (Municipality of Kristianstad, 2009:29). The Environmental Goals advocate using green roofs and other green surfaces to adjust to climate change (Environment and Health Protection Department of Kristianstad, 2014:76-77).

Johannessen and Hahn (2012:387) view the municipal urban planning as “somewhat adaptive”. The municipality makes use of e.g. flood-proof cellars and retention areas to some extent, but does not employ more innovative measures such as elevated houses, floating houses or relocating sensitive activities, most likely because of the large faith put on the embankments and pumps (Johannessen and Hahn, 2012). Johannessen (2014:15) considers that central Kristianstad continues to expand without adaptive measures, but points out one example of more innovative techniques: the “nature room” Vattenriket, a visitor centre built on stilts in the wetland. Johannessen (2014:34) moreover considers that there also exists willingness at the Urban Planning Department to take a more holistic approach to flooding in the future as well as to learn about adaptive flood proofing from other countries such as the Netherlands.

Flood risks aside, water is viewed as an asset in Kristianstad. In 2005, the greater part of the municipality (about 100,000 hectares) became the first UNESCO Man and Biosphere Reserve in Sweden. This is known as the Kristianstad Water Kingdom (Kristianstads vattenrike). The area includes wetlands protected under the Ramsar Convention since 1974 and also several nature reserves and Natura 2000 areas.

The buffering capacity that the wetlands deliver by providing flood plains is acknowledged in the local (proposed) Nature Protection Programme (Environment and Health Protection Department of Kristianstad, 2014:22). However, an examination of the whole programme reveals that flood buffering capacities are given less attention in comparison to other ecosystem services such as recreation, outdoor activities, birdlife and biodiversity. Johannessen and Hahn (2012) also deem wetlands not an active flood risk management strategy in Kristianstad. They are generally seen as an element of the river Helge, providing natural flood risk reduction. However, interest in wetlands as a flood risk reducing measure might be rising: the Climate Strategy, the Environmental Goals and Nature Protection Program all call for the establishment of more wetlands. The Environment and Health Protection Department is currently underway with establishing wetlands in the river Vinneå (Municipality of Kristianstad, 2014:8). Regarding resources, there are possibilities for the municipality to apply to the County Administrative Board for funds for local water management projects (Lokala Vattenvårdsprojekt “LOVA”). “LOVA” financially supports the recreation of wetlands (and covers up to 50% of the costs), the program is administered by the County Administrative Boards, and annual funds constitute 75 million SEK (County Administrative Board of Skåne, 2013).
5.3.5 Flood Preparation
Flood risks have been included in the municipality’s risk analyses since 1999. The last risk inventory is from 2011. Flood risks are also included in the risk and vulnerability analysis of Region Skåne and of the County Administrative Board of Skåne.

Kristianstad has a single action programme for both emergencies and extraordinary events (Municipality of Kristianstad, 2012). The local emergency services perform emergency operations and support municipal safety and preparedness efforts. In accordance with the local Crisis Management Plan (Municipality of Kristianstad, 2012a), the resident Fire Protection Engineer at the municipal emergency services is also the local “officer on call” (tjänsteman i beredskap), who ensures local crisis preparedness at all times. In case of social disturbances that do not constitute an extraordinary event, the municipal Coordination Staff can be called in; otherwise, the Crisis Management Committee (which in Kristianstad is the Municipal Executive Board) comes into action. On the matter of operational capacity, the Plan states that within 3 hours from the first alarm the Stab/Committee must have capacity to coordinate and make decisions, information on the situation must be made available on Internet and the municipal switchboard must be manned. Moreover, crisis management rooms must be effective, resistant and reliable.

The municipality gets data on expected water levels in the river and the sea ten days in advance through the surveillance and prognosis system Flood Watch Kristianstad and moreover uses data from the Swedish Meteorological and Hydrological Institute and from the hydropower plant operated by E.ON (Municipality of Kristianstad, 2015b). The municipality counts with mobile defences and pumps available and has a possibility to obtain more from other municipalities and from the state (Municipality of Kristianstad, 2015c). The public is informed through a siren system, but there are plans to replace this with a pre-taped message system that will only be used in case of floods (Municipality of Kristianstad, 2015c). According to Johannessen, there are escape routes for residences situated below the critical level of 3.5 meters over sea level and measures (Johannessen, 2014:16).

5.3.6 Flood Recovery
In connection with the flood of 2002, the municipal emergency services of Kristianstad received about € 445,000 in state compensation for its seventeen week operation.

5.4 Explaining dynamics in flood risk governance at the case study scale
Flood risk management in Kristianstad has been influenced by local policy champions, national actors and investigations and legislative changes, concern for climate change as well as shock events. According to Johannessen and Hahn (2012), the municipality’s work with flood risk management started out in the mid-90s, driven by local policy champions. The issue was initially by local insurance broker and by changes in the Planning and Building Act though which responsibilities for risk, preparedness and safety were transferred to the municipalities. The main issue raised by the group was instability of the embankment, which lead to an application to the Swedish Civil Contingencies Agency for funds for its reparation. At this stage, the national agency became an actor and strongly influenced the decision by stating that the efforts were too small in relation to the flood risk. They urged the municipality not only repair the embankment, but to also extend it. According to Johannessen and Hahn (2012), this was perceived by the municipality as a prerequisite for acquiring the national grants. The flood of 2002 would help to give legitimacy to the project: the building of the flood defences commenced shortly after the flood. Important actors in terms of expert knowledge were the
Swedish Metrological and Hydrological Institute, the Swedish Civil Contingencies Agency, the Swedish Geotechnical Institute, and the Danish Hydraulic Institute (Johannessen and Hahn, 2012).

While the embankments are seen as a step forward in Kristianstad’s flood risk management (and are also the reason why the municipality has been attributed a leading role in Swedish flood risk management), they can also be seen as a stabilising factor. The development of other flood risk strategies, such as urban planning, may have been hampered by the construction of the embankments: too much trust is put into embankments, and thus construction within the embankments carry on as usual. With the exception of the buffering effect of wetlands, flood mitigation has until recently been somewhat missing in Kristianstad. Climate change seems to have been an important driver for the increased interest towards adaptive measures. This tendency is however visible primarily in written documents – so far the Developed Comprehensive Plan, the new Stormwater Policy, the Environmental Plan and Climate Strategy – but concrete examples in practice are still few.

5.5 Evaluating flood risk governance at the case study scale

5.5.1 Societal resilience
Kristianstad has been stated to be a role model of Swedish flood risk management (Johannessen and Hahn, 2012). As the most flood prone area in Sweden, the issue of flood risk is clearly visible on the local political agenda. What distinguishes Kristianstad are high flood risks, a strong focus on defensive measures and a limited implementation of more adaptive measures. Flood risk is seen as abated by the construction of the embankments, with urban development continuing behind the defences, with little consideration for adapting and accommodating water. There are, however, exceptions: Kristianstad has implemented an early warning system for floods and acknowledges the flood risk reducing services provided by the wetlands. There are thus indications of a broadening of the flood risk strategies used, towards a more adaptive and holistic approach to flood risk reduction.

Regarding the extent in which the national level enables or constrains the governance and innovations at the local level, Kristianstad constitute an example where the national level has enabled flood risk management by providing funds for the construction of the embankment. It is also important to emphasise that local self-governance implies that the municipalities are given considerable room for manoeuvre and power to act from local conditions.

5.5.2 Efficiency and legitimacy
Cost-benefit analyses are performed and made available. National legislation sets the requirements on access to information, participation and appeals in local decision-making.
6 Explanations for stability and change in flood risk governance

6.1 Introduction
The Swedish governance system is generally characterised by incremental change, with strong elements of path dependence. Both endogenous and exogenous factors may impact the system and change its path. During the last decades however, in particular exogenous factors like flood events, climate change and the subsequent Vulnerability Commission have contributed to putting the issue on the larger political agenda. While flood risk governance on national level is still strongly fragmented with no distinct policy domain, the studied municipalities show a somewhat more coherent management of flood risks, presumably as a result of both the increased risk of floods and the increased number of occurrence of floods, which mainly affect the local level. As a consequence of these characteristics, also the effects of the Floods Directive will be tied mainly to the local level.

6.2 Explanations for stability in flood risk governance
A plausible reason as to why flood risk management is mostly a local issue, and does not have its own policy domain at national level, relates to the nature and scale of the flood risk. In general, floods affect relatively limited geographical areas and do not have dramatic consequences. The limited significance of the flood defence strategy in Sweden may, in particular, be a result of the large variation in the occurrence of floods over the country and over time; investments in structural flood defence would have been very expensive (see also Fiselier and Oosterberg, 2004).

The limited significance of permanent purpose defence measures may, at least to some extent, be explained by the large-scale hydropower schemes which have, although unintentionally, reduced fluvial flood risk in many larger rivers.

6.3 Explanations for change in flood risk governance
There is at national level a growing concern regarding how flood risks will look in the future. As mentioned above, the national Climate and Vulnerability Commission was set in motion mainly as a result of the IPCC (2007) Fourth Assessment Report, together with the harmful flooding events that occurred in Sweden a few years before. The report produced by this commission helped to set the issue of flood risk in national focus, and to certain extent potentiated initiatives in the different policy areas relevant to flood risk management. Furthermore, several legislative reforms of relevance have taken place in the last decade. Formal and informal requests from local and regional levels for increased national assistance with flood risk management issues also seen to have intensified in recent times. There are however some difficulties with translating these changes into practice. It can be hard to achieve a balance of interests which satisfies all affected actors when a decision or measure is to be taken. For example, it can be observed that the issue of flood risk has gradually gained ground in discourses and legislation connected to physical planning, mainly as a result of climate change concerns, but that at the implementation stage this collides with waterfront development interests. Legal obstacles, path dependent practices and deficient knowledge are also relevant factors.
7 Evaluation of flood risk governance in Sweden

7.1 Introduction
The evaluation of the research conducted in the STAR-FLOOD project has been performed under the joint normative assumption that flood risk governance should: enhance societal resilience to flooding; be legitimate; and resource efficient. In this chapter, the outcome of the evaluations on national and local (case study) level is brought together in an overall assessment of the resilience, legitimacy and efficiency of Swedish flood risk governance.

Table 7.1: an overview of how the Swedish NFPR scores on the three evaluation criteria

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Feature of governance</th>
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| Societal Resilience | +  ▪ A variety of strategies in principle available and at the case study level integration amongst these is sometimes achieved  
▪ In principle, capacity to recover should a flood occur can be considered to be high  
▪ A gap between legal rules and their implementation can be observed |
|                     | -  ▪ Coordination of strategies and achieving synergies between them is difficult due to the large diversity of policy arenas involved  
▪ Capacity to learn and innovate is constrained by the limited flood experience |
| Efficiency          | +  ▪ High flexibility and room for local tailor-made solutions due to strong municipal self-government |
|                     | -  ▪ Human, knowledge and financial resources at the local level vary from place to place and especially for monitoring they sometimes seem to be lacking  
▪ Potential synergies may be overlooked because of the lack of a national approach  
▪ CBAs are not regularly used |
| Legitimacy          | +  ▪ Official documents are in principle public and available for citizens |
|                     | -  ▪ Public consultations do take place, but not always at moments when citizens can influence decision making  
▪ The public generally believe that authorities are responsible for flood risk management, but do not always trust that authorities can live up to these responsibilities. |

7.2 Assessment in terms of societal resilience
The capacity to prevent flood hazards from occurring in Sweden is somewhat ambiguous. Although a variety of strategies/measures for flood risk management are theoretically available in Sweden, the diversity of the policy areas involved can make it difficult to coordinate or appreciate potential synergies among these. At the case study level flood risk governance is however clearly visible on the political agenda and, at least to some extent, integrated across strategies.

Flood risk management in Sweden is based on preparation, insurance and, to some extent, defence measures, which is mainly a result of the nature of the flood risks in the country. However, in light of climate change and its effects on flood risk, there may be reason to reconsider whether this is the most effective and efficient choice and combination of measures. In this context, it should also be
mentioned that permanent defence structures are planned or under development in all three municipalities used as case studies.

As a result of the high penetration rate of insurance together with the national funds available in case of severe natural disasters, the capacity to recover from flood events can be considered as relatively high.

The limited experience of flood events constitutes a constraining factor for the capacity to learn and innovate. While certain areas of legislation pertinent to flood risk management have made progress in incorporating flood risk, climate change and environmental issues, others mainly have other purposes, e.g. legislation on physical modifications of water bodies, which is something that may hinder flexibility. A certain gap between the purpose of the (legal) rules and the actual implementation of these can also be observed. While legislatives changes have occurred in certain policy areas, for instance physical planning and sewerage, they have not yet translated into practice; this may be, at least partly, a result of conflicting interests (private vs. public, development vs. conservation etc.), path dependent practices (also resources and power structures; “From the perspective of power-sharing, the authorities that have come into existence as a result of existing institutional conditions are typically interested in sustaining that framework, knowingly or not” (Pettersson and Keskitalo, 2012) and a general lack of knowledge.

The capacity to learn and innovate could thus potentially be supported through the enhancement of knowledge on e.g. non-structural measures, since at present there seems to be some uncertainty about the flood risk management function that these could fulfil.

There are mechanisms for monitoring municipalities, dam owners and other individuals, but these have been subject to criticism. There is reason to believe that these deficiencies in monitoring are partly related to lack of sufficient resources.

7.3 Assessment in terms of efficiency
Given the substantial variation of flood risk across the country, flexibility is a key issue for the resource efficiency of flood risk management; measures and instruments must be adapted to local conditions. The strong municipal self-government implies that flood risk measures and instruments are primarily initiated, financed and implemented on the local level. However, resource efficiency is also heavily dependent on the availability of human, knowledge and financial resources at the municipalities and these resources varies significantly across the country. Moreover, the lack of an integrated approach may also result in overlooked synergetic effects and therefore an inefficient use of resources. Another issue relevant to effectiveness and efficiency is the extent and meticulousness in which cost benefit analysis is performed. Based on some interviews (e.g., Karlstad Interviews 4 and 8), there is reason to believe that in Sweden cost benefit analysis is not regularly used, and when used, it does not always include external costs and benefits e.g. environmental values. Still, legislation gives room for flexibility since it is not based on, or set fixed standards, but instead requires that measures are “reasonable” or “suitable”, which would be beneficial from a resource efficiency perspective.

Finally, deficient monitoring and enforcement, which is likely connected with insufficient resources, may result in inadequate consideration of flood risk.
7.4 Assessment in terms of legitimacy

The principle of public access to official documents is of central importance in the Swedish constitutional and legal system. A document kept by a public agency and that has either been received or drawn up by the agency is considered official. Official documents are, as a rule, public. Every individual has a right to request and study public documents, without having to reveal their identity or state for which purpose they require the document.

Information and consultation stages are required in planning and building as well as under environmental legislation, although the modalities for the consultation is not always conducive to real influence in the decision-making process. It has, for example, been pointed out that the consultations do not always occur at a time where they can actually influence the final decision.

In general, the public trusts public authorities to acknowledge and fulfil their obligations. However, when it comes to flood risk issues in particular, the public still believes that authorities have the main responsibility, but are less confident on whether they can actually live up to it. A yearly poll conducted by the Swedish Civil Contingencies Agency (2012b) found that less than half of the respondents believe that the preparedness of the authorities will be sufficient in the event of a nature disaster. Although the confidence in the Swedish authorities’ preparedness is low, there seems to also be a strong opinion that the responsibility for helping and rescuing individuals who are affected by situations such as nature catastrophes lies with Swedish authorities (95 percent of the respondents supported this idea). Moreover, these surveys reveal that the public perceives that the authorities have not learned sufficiently from e.g. previous flood events in relation to defining responsibilities across different actors, taking action quickly, informing the public and accounting for risk in societal planning. A key challenge for legitimacy in a long term perspective is hence the lack of awareness of the general public, with respect to flood risks in general and the individuals’ responsibility to protect themselves and their property in particular.
8 Moving forwards – suggestions for strengthening flood risk governance in Sweden

8.1 Introduction

Since Sweden has been largely spared from the consequences of large floods, and still has a relatively moderate flood risk, flood risk governance in the country does not constitute a well-defined policy domain. Instead, the actors, rules, discourses, and resources pertaining to floods and flood risk are spread across several policy areas including spatial planning, environmental protection and emergency management. While this fragmented handling of the issue does not necessarily imply a need for radical change, both actual flood events and an increased risk thereof, together with an amplified awareness of the impacts of climate change, points towards a need for a more comprehensive and holistic handling of the matter. Any discussion about how to strengthen flood risk governance must take account of these specific circumstances in order to properly assess the barriers and opportunities to such development.

This section highlights strengths and limitations of the Swedish arrangement for managing flood risk (section 8.2), and – on the basis of the national and case study analyses – identifies opportunities and barriers to strengthening flood risk governance in Sweden (section 8.3). Taking into account the specific situation in Sweden regarding floods and flood risk, a number of recommendations on how Swedish flood risk governance could be strengthened are presented (section 8.4).

8.2 Identifying the strengths and limitations of current flood risk governance

Like any institutional constellation, Swedish flood risk governance exhibits elements that can be viewed both as strengths and limitations. Given that the issue has emerged on the policy agenda in the country relatively recently, the function of many the factors in relation to floods is difficult to assess, and many of factors can be interpreted as both potential strong points and weaknesses.

- The municipal self-government – (+) gives an opportunity to adjust measures to local risks and circumstances. (-/+?) However, when conflicting interests are weighed, flood risk measures may be considered less urgent than promoting economic development, e.g. building vs. prevention. (+) Although municipalities have the mandate to finance investments in flood risk measures by collecting taxes/fees, (-) financing e.g. large scale defence measures may still be very difficult for low income municipalities. (-) For small municipalities with limited financial and human resources it may also be challenging to maintain and develop necessary competence;

- The design of the regulatory framework – (-) The legislative framework is typically not targeting floods and flood risk. Although the planning legislation requires flood risks to be considered, weak formulations leave room for discretion. (+) On the other hand, both planning and environmental legislation is designed for case-to-case assessment and thus leave room for flexibility. The assessment is based on balancing rules implying that floods and flood risk can be considered without legislative changes. (+) Legislation governing water operations is currently being reformed amongst other to fully comply with the EU Water Framework Directive. The suggestions from the investigation entails for example that existing water operations (built before the Environmental Code) will require a renewed permit. This may open up for a better consideration flood risks under existing operations and the implementation of new measures;
• **Non-purpose instruments/measures** – The domination of non-purpose measures particularly regarding flood defence and flood mitigation imply, on the one hand, (-) that floods are not the primary target for these measures and therefore may not be considered at all or at least not has prioritisation. On the other hand, (+) the regulation of rivers for the production of hydropower is imperative to control the flow of water. In the same way, the large-scale (and rather strict) protection of areas in the country has a mitigating effect on floods;

• **Emergency management** – (+) is strongly institutionalised and covers a broad range of societal risks such as military threats, pandemics, terrorist attacks, and nature catastrophes (which includes larger floods). (-) The legal responsibility of the individuals to protect themselves and their property conflicts, however, with the perception of the public (high societal expectations);

• **Public participation** – To consult with the public is an important part of both the Environmental Impact Assessment (EIA) and the Strategic Environmental Assessment (SEA) process, as well as for planning matters in general. Participation is motivated not least to enhance acceptance and increase the legitimacy of decision-making. (-) The interest and involvement of the Swedish citizens to participate and deliberate on matters regarding measures towards flood risks seem, however, to be limited;

• **The insurance system** – (+) Most households are insured and the insurance cover damages that result from a flow of water entering the property. (-/+) Insurance fees are not differentiated with respect to risk.

### 8.3 Opportunities and barriers to moving forward

Besides the strengths and weaknesses identified above, the potential for strengthening flood risk governance in Sweden is also affected by external elements. Such opportunities and barriers are presented in the table below.

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Barriers</th>
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</thead>
<tbody>
<tr>
<td>Climate change discourse (and policy); efforts to mitigate and adapt to climate change (on all levels): the increased awareness of the consequences of climate change can possibly trigger institutional change by altering peoples’ preferences (cf. North, 1990) and thus break the path dependence.</td>
<td>Institutional path dependence: while the expected increase in floods and other extreme weather events will call for change/adaptation in virtually all sectors, most social structures are characterized by a path dependence that will likely be a barrier to moving forward.</td>
</tr>
<tr>
<td>Floods Directive: opportunity to create a structure for managing flood risk and strengthen flood risk governance (maps, administration, legal framework, establishing concepts etc.).</td>
<td>Technological path dependence/lock-in effects: e.g. with respect to existing pipe solutions, dam structures etc. can be a barrier to more diversified solutions.</td>
</tr>
<tr>
<td>Floods – a local issue: the local nature of floods and flood risk makes it difficult to establish general/national support.</td>
<td>Floods – a local issue: the local nature of floods and flood risk makes it difficult to establish general/national support.</td>
</tr>
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</table>

### 8.4 Recommendations for strengthening flood risk governance in Sweden

In this chapter, attention has been drawn to potential strengths and limitations in the current governance arrangements for flood risk in Sweden. In the light hereof, this section presents ideas and recommendations on how to further enhance societal resilience to flooding.
The local level, *i.e.* the municipalities, accounts for the lion’s share of the implementation of concrete flood management measures in Sweden. Although there are pros and cons associated with the strong municipal self-government, we do not see a need to restrict the local self-government. The substantial variations across the country with respect to *e.g.* geological, hydrological and socio-economic factors imply that flexibility that allows flood risk measures to be adjusted local conditions is essential for efficient and legitimate flood risk governance.

Our analysis indicates that the Commission on Climate and Vulnerability (Official Reports of the Swedish Government 2007:60) was an important driver for change which contributed to the development of flood risk governance in Sweden, in particular during the years directly after the commission’s work was finalised. Our results, however, also show that flood risk governance in Sweden is highly fragmented and that the national level is perceived as being relatively passive; representatives from not least the local level claim that they would like to see clearer goals together with more support and guidance from the national level. A revised and updated national climate strategy where goals are clarified could potentially contribute to a more coherent and distinct flood risk management on the national level in the country (similar suggestions in this direction are put forward by Andersson *et al.* (2015)).

The analysis also point towards a need for increased public awareness with respect to the impacts of climate change in general and flooding in particular, as well as enhanced understanding of the individual responsibility in terms of flood measures. A large part of the instruments related to preparedness and recovery is based on individual responsibility and it is therefore necessary that people are aware of what they are facing both in terms of risks and opportunities. Increased awareness also entails opportunities for changed preferences which are imperative for institutional change and to rupture the path dependence.

Additionally, also the following recommendations can be made on the basis of the analysis:

- There is a need to *promote cooperation* between all levels of authority;
- Both *financial* and *knowledge* support provided from the national level to the municipalities (*i.e.* in particular for to municipalities with limited endowments) needs to be increased;
- Stronger incentives and possibilities to implement *e.g.* targeted mitigation measures need to be created, preferably through binding regulations, for example in the form of protection of areas for the detention of water, and mandatory open-pipe solutions.
- In relation to the previous point, measures that have a mitigating or protecting impact in relation to floods and flood risk, but that have not been established for this purpose, should thus be considered as actual flood mitigation or defence strategies. Wetlands could for example be established specifically for the management/mitigation of flood risk, and the many dams installed *e.g.* for the purpose of hydropower production can also be directed towards flood protection.
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Act (2007:1303) reforming the Planning and Building Act
Planning and Building Act (2010:900)
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Ordinance (2009:956) on Flood Risks
Ordinance (2012:546) with instruction for the National Board of Housing, Building and Planning
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Government Bill 1985/86:170 [Proposition] om räddningstjänstlag, m.m., 1986

Official Reports of the Swedish Government

Department series
### Annex I: List of Interviewees

#### Karlstad

<table>
<thead>
<tr>
<th>INTERVIEWEE</th>
<th>POSITION AND ORGANIZATION</th>
<th>DATE AND LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee 1</td>
<td>Municipality, city planning department</td>
<td>2014-02-12, Karlstad</td>
</tr>
<tr>
<td>Interviewee 2</td>
<td>County Administrative Board, risk and safety unit</td>
<td>2014-02-06, Karlstad</td>
</tr>
<tr>
<td>Interviewee 3</td>
<td>County Administrative Board, risk and safety unit</td>
<td>2014-02-06, Karlstad</td>
</tr>
<tr>
<td>Interviewee 4</td>
<td>County Administrative Board, County Administrative Board, risk and safety unit</td>
<td>2014-02-06, Karlstad</td>
</tr>
<tr>
<td>Interviewee 5</td>
<td>Municipality, Technical Services and Property Management Department</td>
<td>2014-02-11, Karlstad</td>
</tr>
<tr>
<td>Interviewee 6</td>
<td>Municipality, Technical Services and Property Management Department</td>
<td>2014-02-06, Karlstad</td>
</tr>
<tr>
<td>Interviewee 7</td>
<td>Rescue Services, Security Department</td>
<td>2014-05-27, Karlstad</td>
</tr>
<tr>
<td>Interviewee 8</td>
<td>Municipality, Technical Services and Property Management Department, Water and sewerage unit</td>
<td>2014-02-06, Karlstad</td>
</tr>
</tbody>
</table>

#### Gothenburg

<table>
<thead>
<tr>
<th>INTERVIEWEE</th>
<th>POSITION AND ORGANIZATION</th>
<th>DATE AND LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee 1</td>
<td>Municipality, Urban Planning Department</td>
<td>2014-08-26, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 2</td>
<td>Municipality, Water and Water Cycle Department</td>
<td>2014-10-13, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 3</td>
<td>Municipality, Parks and Nature Department</td>
<td>2014-10-16, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 4</td>
<td>Emergency Services for Metropolitan Gothenburg</td>
<td>2014-10-14, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 5</td>
<td>Municipality, Civil Protection and Preparedness</td>
<td>2014-10-15, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 6</td>
<td>County Administrative Board, Urban Development Unit</td>
<td>2014-08-26, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 7 and 8</td>
<td>County Administrative Board, Unit for Protection and Safety</td>
<td>2014-09-03, Gothenburg</td>
</tr>
<tr>
<td>Interviewee 9</td>
<td>County Administrative Board, Västerhavet Water Authority</td>
<td>2014-08-21, Gothenburg</td>
</tr>
</tbody>
</table>

#### National level

<table>
<thead>
<tr>
<th>INTERVIEWEE</th>
<th>POSITION AND ORGANIZATION</th>
<th>DATE AND LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee 1</td>
<td>National Board of Housing, Building and Planning (Official working with climate change adaption)</td>
<td>2015-06-15, Luleå (via telephone)</td>
</tr>
<tr>
<td><strong>Interviewee 2</strong></td>
<td>Swedish Civil Contingencies Agency (Official working with climate change adaption)</td>
<td>2015-06-16, Luleå (via telephone)</td>
</tr>
</tbody>
</table>