EUROPEAN
COMMISSION

Brussels, 26.2.2019
SWD(2019) 60 final

COMMISSION STAFF WORKING DOCUMENT

First Flood Risk Management Plans - Member State: Denmark

Accompanying the document

REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC)
Second River Basin Management Plans
First Flood Risk Management Plans

{COM(2019) 95 final} - {SWD(2019) 30 final} - {SWD(2019) 31 final} - {SWD(2019) 32 final} - {SWD(2019) 33 final} - {SWD(2019) 34 final} - {SWD(2019) 35 final} - {SWD(2019) 36 final} - {SWD(2019) 37 final} - {SWD(2019) 38 final} - {SWD(2019) 39 final} - {SWD(2019) 40 final} - {SWD(2019) 41 final} - {SWD(2019) 42 final} - {SWD(2019) 43 final} - {SWD(2019) 44 final} - {SWD(2019) 45 final} - {SWD(2019) 46 final} - {SWD(2019) 47 final} - {SWD(2019) 48 final} - {SWD(2019) 49 final} - {SWD(2019) 50 final} - {SWD(2019) 51 final} - {SWD(2019) 52 final} - {SWD(2019) 53 final} - {SWD(2019) 54 final} - {SWD(2019) 55 final} - {SWD(2019) 56 final} - {SWD(2019) 57 final} - {SWD(2019) 58 final} - {SWD(2019) 59 final} - {SWD(2019) 61 final} - {SWD(2019) 62 final} - {SWD(2019) 63 final} - {SWD(2019) 64 final} - {SWD(2019) 65 final} - {SWD(2019) 66 final} - {SWD(2019) 67 final} - {SWD(2019) 68 final} - {SWD(2019) 69 final} - {SWD(2019) 70 final} - {SWD(2019) 71 final} - {SWD(2019) 72 final} - {SWD(2019) 73 final} - {SWD(2019) 74 final} - {SWD(2019) 75 final} - {SWD(2019) 76 final} - {SWD(2019) 77 final} - {SWD(2019) 78 final} - {SWD(2019) 79 final} - {SWD(2019) 80 final} - {SWD(2019) 81 final} - {SWD(2019) 82 final} - {SWD(2019) 83 final} - {SWD(2019) 84 final}

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Acronyms

APSFR	Areas of Potential Significant Flood Risk
CBA	Cost-Benefit Analysis
EEA	European Environment Agency
FD	Floods Directive
FHRM	Flood Hazard and Risk Map
FRMP	Flood Risk Management Plan
NGO	Non-Governmental Organisation
NWRM	Natural Water Retention Measures
PFRA	Preliminary Flood Risk Assessments
PoM	Programme of Measures
RBD	River Basin District
RBMP	River Basin Management Plan
SEA	Strategic Environmental Assessment
UoM	Unit of Management
WFD	Water Framework Directive
WISE	Water Information System for Europe

Introduction

The Floods Directive (FD) (2007/60/EC) requires each Member State to assess its territory for significant risk from flooding, to map the flood extent, identify the potential adverse consequences of future floods for human health, the environment, cultural heritage and economic activity in these areas, and to take adequate and coordinated measures to reduce this flood risk. By the end of 2011, Member States were to prepare Preliminary Flood Risk Assessments (PFRAs) to identify the river basins and coastal areas at risk of flooding (Areas of Potential Significant Flood Risk – APSFRs). By the end of 2013, Flood Hazard & Risk Maps (FHRMs) were to be drawn up for such areas. On this basis, Member States were to prepare Flood Risk Management Plans (FRMPs) by the end of 2015.

This report assesses the FRMPs for Denmark[1]. Its structure follows a common assessment template used for all Member States. The report draws on two main sources:

- Member State reporting to the European Commission on the FRMPs[2] as per Articles 7 and 15 of the FD: this reporting provides an overview of the plans and details on their measures.
- Selected FRMPs: Denmark produced FRMPs for two of its Units of Management (UoMs) and 20 FRMPs for municipalities within these UoMs. The two overarching UoM-level FRMPs were assessed. In addition, the assessment reviewed five of the 20 municipal FRMPs: these five were chosen to cover different UoMs, different flood types and different approaches in terms of methods[3]. The following FRMPs were reviewed:
    - Holstebro (DK1)
    - Aabenraa (DK1)
    - Odense Fjord (DK1, prepared jointly by the municipalities of Odense, Kerteminde and Nordfyns)
    - Slagelse (DK2)
    - Hvidovre (DK2)

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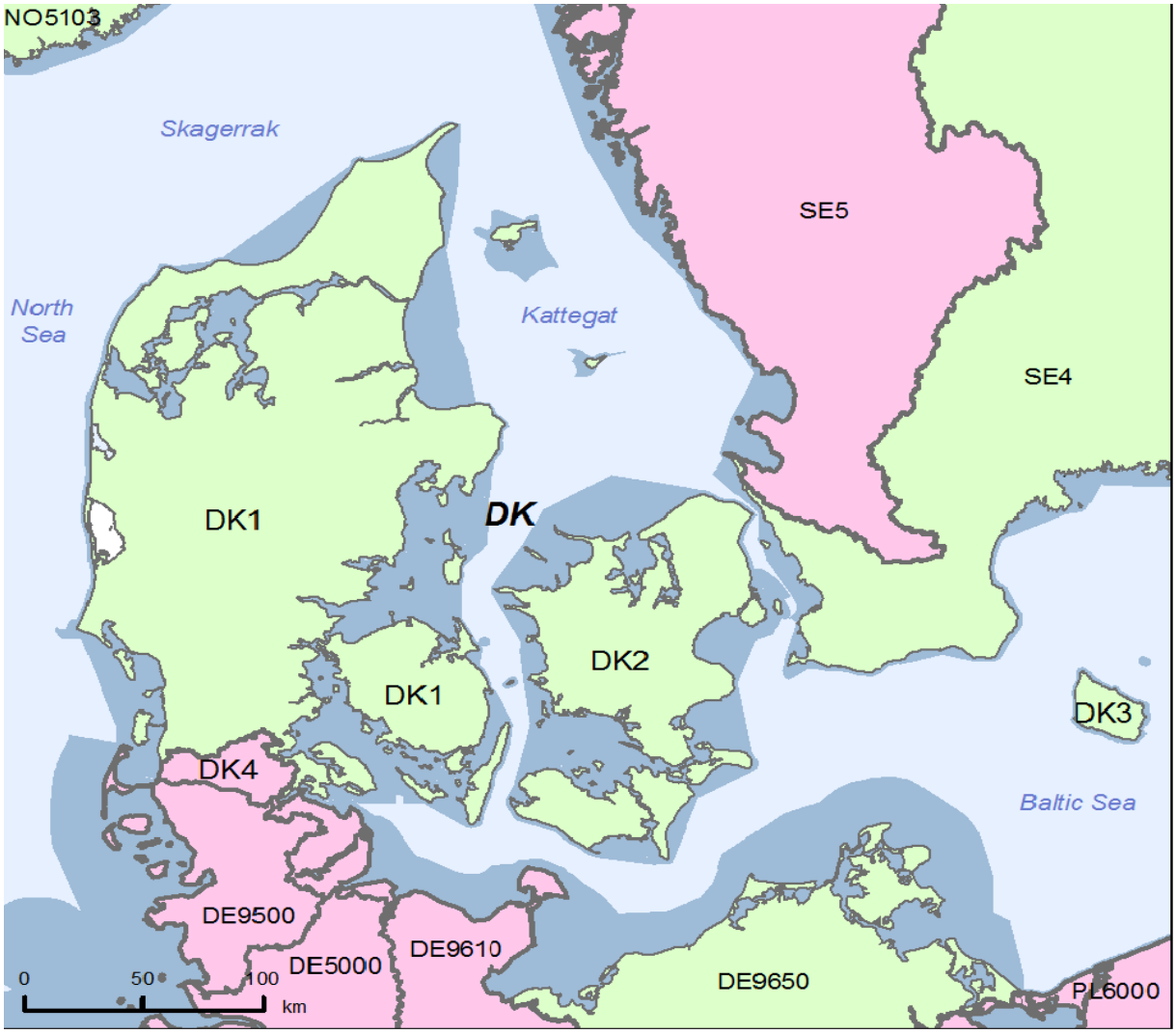
1 The present Member State assessment reports reflect the situation as reported by each Member State to the Commission in 2016 or 2017 and with reference to FRMPs prepared earlier. The situation in the Member States may have altered since then.

2 Referred to as "Reporting Sheets" throughout this report. Data must be reported in a clear and consistent way by all Member States. The format for reporting was jointly elaborated by the Member States and the Commission as part of a collaborative process called the "Common Implementation Strategy": http://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm
Whereas a key role of the Commission is to check compliance with EU legislation, the Commission also seeks information to allow it to determine whether existing policies are adequate. It also requires certain information to create a European-wide picture to inform the public.

3 In particular, municipal FRMPs differed with regard to the use of CBA and the integration of climate change information, as the UoM-level FRMPs revealed differences in these areas among the municipal-level FRMPs.

Overview

Figure 1 Map of Units of Management/River Basin Districts



International River Basin Districts (within European Union)
International River Basin Districts (outside European Union)
National River Basin Districts (within European Union)
Countries (outside European Union)
Coastal Waters

Source: WISE, Eurostat (country borders) as presented in the 2012 RBMP assessment reports

Denmark is divided into four UoMs, which correspond to the River Basin Districts (RBDs) under the Water Framework Directive (WFD). However, APSFRs were identified only in two of them (DK1, Jutland and Funen, and DK2, Seeland) and FRMPs were prepared only for those two UoMs.

In Denmark, the national government is responsible for the PFRA, APSFR and FHRM phases, whereas municipalities are responsible for the FRMP phase and thus were responsible for elaborating 'municipal' FRMPs. For Denmark it should be mentioned that all of the APSFRs identified are along the coast, except for one APSFR for fluvial flooding (Holstebro municipality in DK1). In DK1, Jutland and Funen, 10 municipalities contain APSFRs, either wholly or in part. Seven of these municipalities each prepared an FRMP, and three of these municipalities collaborated and developed a common FRMP (Odense Fjord): consequently, eight municipal-level FRMPs were developed in DK1. In DK2, Seeland, 12 municipalities are at risk of flooding; although two of those cooperated closely, each municipality developed its own plan, resulting in 12 municipal FRMPs in DK2.

The national competent authority (Ministry of Environment and Food of Denmark - MoEF) provided the municipalities with a guidance document for the development of their FRMPs[4]. Overall, the municipal FRMPs in both UoMs follow a similar approach, but there are some differences concerning, among others, the objectives they formulated, the measures they suggested and the public consultation processes. Moreover, some municipal FRMPs are of a more strategic nature (e.g. Slagelse in DK2), while others list measures, costs and benefits in detail (e.g. Odense Fjord in DK1).

In addition to the municipal plans, the Ministry of Environment and Food of Denmark prepared two overarching FRMPs – one for each UoM with APSFRs identified, DK1 and DK2. These plans contain a summary of the municipal FRMPs.

The municipal FRMPs were approved by the municipal councils. The two overarching FRMPs include a summary of the municipal FRMPs and were prepared to comply with the requirements of the Floods Directive. There was no approval of these overarching FRMPs at the national government level.

This assessment reviewed five municipal FRMPs as well as the two overarching UoM-level plans (for more details about the selection see section 1). The table below gives an overview of all UoMs in Denmark, including the UoM code, the name, and the number of APSFRs reported. It also shows if all documents required for each UoM were reported to European Environment Agency's (EEA) WISE[5] – the FRMP as a PDF and the reporting sheet as an XML. Denmark, however, only reported the two summary FRMPs at UoM level, not the detailed municipal level plans.

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4 http://www.klimatilpasning.dk/media/826542/vejledning_risikostyringsplaner.pdf

5 http://rod.eionet.europa.eu/obligations/603/deliveries?id=603&tab=deliveries&d-4014547-p=1&d-4014547-o=2&d-4014547-s=3

Table 1 Overview of UoMs in Denmark

	Name	Number of APSFRs	XML reported	PDF Reported
DK1	JUTLAND AND FUNEN	7	Yes	Yes
DK2	SEELAND	3	Yes	Yes
DK3	BORNHOLM	-	No	No
DK4	VIDAA KRUSAA	-	No	No
TOTAL		10		

The FRMPs can be accessed as follows:

- The two UoM-level FRMPs can be downloaded from the webpage: http://kysterne.kyst.dk/risikostyringsplaner.html;
- The municipal FRMPs can be downloaded through links available in the UoM-level FRMPs.

Overview of the assessment

The table below gives an overview of the evidence found during the assessment of the FRMPs. The following categorisation was used for the column concerning evidence:

- **Evidence to the contrary**: An explicit statement was found stating that the criterion was not met;
- **No evidence**: No information found to indicate that the criterion was met;
- **Some evidence**: Reference to the criterion is brief and vague, without a clear indication of the approach used for the criterion. Depending on the comment in the adjacent column, "some evidence" could also be construed as "weak evidence";
- **Strong evidence**: Clear information provided, describing an approach followed in the FRMP to address the criterion.

Table 2 Overview of the evidence found during the assessment of the FRMPs

Criterion	Evidence	Comments
FRM objectives have been established	Strong evidence	All but one of the 20 municipal FRMPs have formulated objectives: these include reducing the likelihood of flooding, reducing damages to existing assets and avoiding damages to new assets. The exception, the Holstebro municipal FRMP, does not contain a separate chapter on objectives, though it describes local risks and relevant measures to reduce the risks.
FRM objectives relate to...		
...the reduction of potential adverse consequences	Strong evidence	Reduction or avoidance of damages is listed as an objective in all 20 municipal FRMPs, except that of Holstebro.
...to the reduction of the likelihood of flooding	Some evidence	This is listed as an objective in most municipal FRMPs.
...to non-structural initiatives	Some evidence	Several municipalities indicate non-structural initiatives in their objectives, such as spatial planning to address flood risks or actions to raise the risk-awareness of citizens.
FRM objectives consider relevant potential adverse consequences to...		
...human health	Some evidence	While some municipal FRMPs state explicitly

Criterion	Evidence	Comments
		in their objectives that they aim to protect all or some of the objectives human health, cultural heritage, the environment and/or economic activities, others do not explicitly do so (though they refer to these elements in the discussion of the suggested measures).
...economic activity	Some evidence	See above
...environment	Some evidence	See above
...cultural heritage	Some evidence	See above
Measures have been...		
...identified	Some evidence	Denmark has reported 28 measures across the two UoMs with APSFRs. The majority, but not all municipal FRMPs, have identified measures.
...prioritised	Some evidence	Denmark has indicated priorities for all 28 measures reported. The majority, but not all municipal FRMPs, have prioritised measures.
Relevant aspects of Article 7 have been taken into account such as...		
...costs & benefits	Some evidence	Costs and benefits are only calculated in one municipality. Overall, there is little evidence on the use of cost-benefit analysis (CBA).
...flood extent	Strong evidence	The flood extent is mapped in the flood risk and hazard maps.
...flood conveyance	No evidence	Flood conveyance routes are not mapped in the flood risk and hazard maps and not mentioned in the FRMPs.
...water retention	Some evidence	Most Danish municipalities are at risk of seawater flooding and have therefore not included NWRMs. One municipality assessed[6] that is at risk of fluvial flooding, mentions in its FRMP that the possibility for water retention measures upstream will be investigated.
...environmental objectives	No evidence	The RBMPs for the implementation of the

[6] Denmark subsequently clarified that there are five APSFRs and five municipalities at risk from sea and fluvial flooding: Randers, Vejle, Aabenraa, Odense and Køge.

Criterion	Evidence	Comments
of the WFD		WFD are mentioned as other relevant plans in conjunction with the FRMPs. But the FRMPs do not state that the WFD's objectives have been considered.
...spatial planning/land use	Some evidence	The overarching UoM-level FRMPs for both DK1 and DK2 include spatial planning measures. But such measures are considered in only some of the five municipal FRMPs assessed.
...nature conservation	Some evidence	The five municipal FRMPs assessed indicate that Natura 2000 areas were taken into account in the planning of measures. However, further details are not provided.
...navigation/port infrastructure	Strong evidence	Navigation and port infrastructure are considered in the FRMPs of municipalities whose territory contains such infrastructure.
...likely impact of climate change	Strong evidence	Climate change has been incorporated in the flood hazard and risk maps elaborated for the whole of Denmark. Most of the municipal FRMPs make a reference to the municipal climate change adaptation and mitigation plans, however, the coordination between the two types of plans is not clearly described.
Coordination with other countries ensured in the RBD/UoM	Some evidence	Denmark has only one UoM shared with another Member State, Vidaa Krusaa (DK4): no APSFRs were identified in DK4, and Denmark did not prepare an FRMP for its national UoM. However, Germany has shared information on work in its corresponding UoMs.
Coordination ensured with WFD	Some evidence	The RBMPs for the implementation of the WFD are mentioned as relevant plans in conjunction with the FRMPs. But further details were not found on how far the implementation of both Directives is coordinated.
Active involvement of interested parties	Some evidence	All municipalities had a process whereby the public was informed, involving public meetings as well as the participation of

Criterion	Evidence	Comments
		stakeholders in advisory groups. Most of the FRMPs assessed, however, do not specify how the input given by the public was further used in the elaboration of the FRMPs.

Good practices

The assessment identified the following good practices in the Danish FRMPs assessed.

Table 3 Good practices in the Danish FRMPs

Topic area	Good practices identified
Planning/implementing of measures and their prioritization for the achievement of objectives.	While many municipal FRMPs do not provide information how implementation will be monitored, one municipality (Norddjurs) plans to have a public log where the public can follow the implementation of the measures. The measures in some (but not all) of the municipal FRMPs assessed are specific, also in terms of location, and measurable. For example, the FRMP for Odense Fjord describes for each measure, the goal of the measure, how it will be implemented, its criteria for success and its cost.
Consideration of climate change in the FRMPs assessed.	All municipalities in Denmark have developed climate change mitigation and adaptation plans; almost all municipal FRMPs make a direct reference to those plans and state that the implications of climate change on flooding are considered.
Public participation.	There was a broad involvement of stakeholders in the FRMP process via working groups.
Flood risk governance.	Neighbouring municipalities coordinated their FRMPs and three municipalities developed a joint FRMP. The development of FRMPs at municipal level gave local actors a leading role in planning. There was good cooperation between the national government and the municipalities that prepared FRMPs: the national government provided the FHRMs used by municipalities for their FRMPs and prepared a guidance document for the development of the FRMPs.

Areas for further development

The assessment identified the following areas for further development in the Danish FRMPs assessed.

Table 4 Areas for further development in the Danish FRMPs

Topic area	Areas for further development identified
Integration of previously reported information in the FRMPs.	Pluvial flooding was not considered relevant in the PFRA (conducted at national level) and is therefore not addressed in four of the five municipal FRMPs assessed[7]. While the FHRMs were prepared at national level as well, at least one municipality developed in addition its own risk maps (Aabenraa in DK1): it found different conclusions (higher damage risks) compared to the national maps for the same area.
Setting of objectives for the management of flood risk.	The formulation of objectives varies among municipalities, and one municipal FRMP does not contain objectives.
Planning/implementation of measures and their prioritization for the achievement of objectives.	The prioritisation was carried out in different ways in different municipal FRMPs and the process remains unclear for many. Only one of the five FRMPs assessed provides information concerning the costs of the measures and their funding sources. The FRMPs assessed do not provide information about coordination with Denmark's RBMPs.
Consideration of climate change in the FRMPs assessed.	Although the FRMPs refer to municipal climate change mitigation and adaptation plans, they do not explain how those plans impacted the final selection of flood risk management objectives and measures. There is no apparent coordination between the FRMPs and the national climate change adaptation strategy.
Use of CBA in the FRMPs assessed.	Only two municipal FRMPs refer to CBA, and they do not indicate clearly if or how this was used in prioritisation. Where they present costs, these appear to only cover investment costs. It appears that only in one municipal FRMP was a kind of preliminary CBA used.
Public participation.	The FRMPs do not indicate how public and stakeholder input was taken into account in the plans.
Flood risk governance.	Each municipal FRMP is different, in particular as municipalities are in different stages (with some having produced detailed plans and others, less detailed and more strategic ones), even though there is a national guidance document on how to compile FRMPs. Moreover, despite national guidance, the process of development appears to have been different across the municipal FRMPs, and details are for the most part not provided.

[7] Denmark subsequently clarified that pluvial flood risk had been assessed by Danish municipalities when preparing their individual municipal climate adaptation plans in 2013. Following amendments to the Danish Planning Act, from now on all new municipal climate plans must contain guidelines for areas that may be exposed to significant flooding or erosion and requirements for setting up preventive measures to safeguard against flooding or erosion when planning urban development, special technical facilities, or in case of altered land use, etc.

Topic area	Areas for further development identified
	Only one group of municipalities sharing APSFRs prepared a common FRMP; in other cases, municipalities sharing APSFRs prepared separate plans, potentially hindering coordination on shared flood risks. The FRMPs do not provide information about the coordination with the WFD or other Community Acts and what measures are taken also under those acts. There is no information if SEAs were carried out.

Recommendations

Based on the reported information and the FRMP assessed, the following recommendations are made to enhance flood risk management (not listed in any particular order):

- The FRMPs should provide more information on the process for their development[8], including how the PFRA and FHRMs were used in the preparation of the FRMPs.
- The FRMPs should provide more details about the costs of the measures and the funding sources for the measures.
- Further information should be provided on the prioritisation of measures, including the criteria used[9]. Cost benefit analysis should be considered for measures in the FRMPs that lend themselves to it[10].
- Information should be provided in all FRMPs about the mechanisms to be used to monitor the implementation of their measures[11].

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[8] Denmark subsequently informed the Commission that in relation to the revision of the MoEF publication "Guidelines for the Preparation of Flood Risk Management Plans", and in the course of the preliminary meetings for revision of FRMPs, the MoEF will point out to the municipalities that information on the planning process and monitoring should be included in there.

[9] Denmark subsequently informed that in connection with the revision of the "Guidelines for the Preparation of Flood Risk Management Plans", the MoEF will emphasise that more detailed information on this matter should be included in the revised version of the 2020/21 FRMPs.

[10] Denmark recalls that a cost-benefit-analysis is not mandatory under the FD. It is a question of subsidiarity, if the Member States consider CBA at the level of the FRMP as a relevant aspect. In Denmark's case, the municipalities decide themselves whether they apply cost-benefit-analyses. Most municipalities consider costs and benefits as part of the planning process for individual measures and that cost-benefit analyses may be found in other municipal plans and/or documents, serving as the basis for decisions to implement specific measures. It is expected during the update of the FRMP for 2020/21, that more municipalities will have applied cost-benefit-analyses. Denmark also informed the Commission that during the revision of the "Guidelines for the Preparation of Flood Risk Management Plans", the MoEF will consider whether adding a more detailed section on cost assessment and funding options might be useful to the municipalities. Additionally, in the autumn of 2018 the MoEF will publish a guide to the sharing of costs between stakeholders in coastal protection projects implemented under section 1a of the Danish Coastal Protection Act.

[11] Denmark informed subsequently that in connection with the revision of the "Guidelines for the Preparation of Flood Risk Management Plans" the MoEF will explore with the municipalities how best to include additional information on monitoring in the revised FRMPs for 2020/21.

- On Governance: (1) Ensuring that municipal and national considerations are synchronised would avoid potential differences between national and local conclusions. It would also be useful to evaluate whether the separate municipal plans have left any gaps in flood risk management (2) The five municipal FRMPs assessed are quite different in nature[12]. Some FRMPs are more strategic, with comparatively few details on implementation, while others describe measures in detail. The merits of a more uniform approach should be considered. (3) Stronger collaboration would ensure effective coordination between municipalities in addressing common flood risks such as seawater flooding, which might be aggravated by climate change[13].
- FRMPs should provide greater detail on the consideration of climate change, including in the selection and prioritisation of measures[14]. Coordination between the FRMPs and the national climate change adaptation strategy should be ensured or elaborated upon in the FRMPs.
- The FRMPs should provide information about coordination with the WFD or other relevant Community Acts[15].
- The FRMPs should provide detail how inputs received through public consultation and active involvement of stakeholders affected the development of the plans[16].
- Considerations should be given for SEAs to be carried out for the FRMPs[17].

[12] Denmark noted that municipalities have a high degree of freedom when preparing FRMPs. As part of the preparation for the revision of the FRMPs for 2020/21, the MoEF will raise the topic with the municipalities, i.e. whether a certain standardisation of risk management plans would facilitate the revision and provide a basis for comparisons and thus improve utilisation of plans across municipalities.

[13] Denmark subsequently informed that the MoEF will discuss with the municipalities on the advantages of preparing joint municipal FRMPs, where this would add value.

[14] Denmark recalls that consideration of climate change is not mandatory under the FD for the first cycle FRMPs.

[15] Denmark stated subsequently that prior to the revision of the "Guidelines for the Preparation of Flood Risk Management Plans" and in the meetings planned in connection to the municipalities' revision of their FRMPs in 2020/21, the MoEF will remind them that the content of the FRMPs must be coordinated with the Water Planning Action Program for the relevant river basin district - and that this should be stated explicitly in the revised FRMPs. Furthermore, a special coordination group has been set up under the auspices of the Ministry for the purpose of ensuring sharing of knowledge and for coordination of efforts under the WFD, the FD and other relevant Directives.

[16] Denmark recalls that it is not mandatory according to Article 7 of the FD to explain in the FRMP how feedback from stakeholders was considered in the elaboration of the Plans.

[17] Denmark informed subsequently that the MoEF will remind the municipalities, in connection to the revision of their FRMPs for 2020/21, that where relevant the content of the FRMPs should be subject to an environmental impact assessment.

1. Scope of the assessment and sources of information for the assessment

1.1 Reporting of the FRMPs

Denmark reported two FRMPs – one for each of its two UoMs containing APSFRs (DK1 and DK2). These two plans state that each municipality having a share of an APSFR had developed their own flood risk management plan, expect for one APSFR, where three municipalities developed one FRMP: in total, 20 municipal FRMPs were prepared. Although not reported, these plans can be found through links in the annexes of the UoM-level FRMPs. For DK1, eight municipal FRMPs were prepared by 10 municipalities (three neighbouring municipalities prepared one common plan). For DK2, 12 municipal FRMPs were prepared by 12 municipalities.

Denmark did not make use of Article 13.3 of the Floods Directive, which allowed Member States to make use of previous flood risk management plans for the first cycle (provided their content is equivalent to the requirements set out in the Directive).

1.2 Assessment of the FRMPs

The Ministry of Environment and Food of Denmark (the national competent authority) provided the municipalities with a guidance document on how to develop the FRMPs[18]. Overall, the municipal FRMPs in both UoMs follow a similar approach, but there are differences. Some municipal FRMPs are of a more strategic nature (e.g. Slagelse in DK2), while others provide greater detail on measures, costs and benefits (e.g. Odense Fjord in DK1).

The two overarching FRMPs each present a summary of information from the municipal FRMPs within their territory. The assessment covers both these overarching FRMPs, which do not contain detailed information, and five municipal FRMPs: Holstebro (DK1), Aabenraa (DK1), Odense Fjord (DK1, developed jointly by the municipalities of Odense, Kerteminde and Nordfyns), Slagelse (DK2), and Hvidovre (DK2). The selection captured key differences among the municipal FRMPs concerning: the UoM (DK1 or DK2); the flood type (fluvial and seawater floods); if a form of CBA was undertaken or not; if the plan has a more strategic or more detailed approach; and if the plan explained how the municipal climate change plan and the FRMP were integrated. The table below provides an overview of these issues for the five municipal FRMPs chosen:

[18] http://www.klimatilpasning.dk/media/826542/vejledning_risikostyringsplaner.pdf

Table 5 Danish municipal FRMPs covered in the assessment

UoM	Municipality	Flood type	CBA	Detailed/ strategic plan	Climate Change plans & FRMPs
DK1	Holstebro	Fluvial	No	Strategic	Not explained in detail
DK1	Abenraa	Seawater & Fluvial	Yes	Detailed	Explained in detail
DK1	Odense, Nordfyn & Kerteminde	Seawater & Fluvial	Yes	Detailed	Explained in detail
DK2	Slagelse	Seawater	No	Strategic	Some explanation
DK2	Hvidovre	Seawater	No	Detailed	Explained in detail

The FRMPs can be found online as follows:

- The two UoM-level FRMPs can be downloaded from the webpage: http://kysterne.kyst.dk/risikostyringsplaner.html;
- The municipal FRMPs can be downloaded through links available in the UoM-level FRMPs. The five municipal FRMPs assessed in this report can be accessed via the following links:
  - Aabenraa: https://www.aabenraa.dk/borger/natur-og-miljoe/vand/klimatilpasning/risikostyringsplan
  - Holstebro: https://www.holstebro.dk/borger/natur-og-miljoe/klimatilpasning/risikostyringsplan
  - Odense Fjord (Odense, Nordfyn & Kerteminde): https://www.kerteminde.dk/borger/miljoe-og-natur/klimatilpasning/risikostyringsplan-oversvoemmelse-fra-odense-fjord
  - Hvidovre: https://www.hvidovre.dk/Politik/hoeringer-og-afgoerelser/2015/11/risikostyringsplan
  - Slagelse: https://www.slagelse.dk/media/7548560/Risikostyringsplan-For-Oversvoemmelse-I-Udpegede-Omraader-I-Korsoer-A4.pdf

2. Integration of previously reported information

2.1 Conclusions drawn from the preliminary flood risk assessment

The conclusions of the PRFA are presented in the FRMPs as a textual description and a summary map showing the APSFRs (areas of potentially significant flood risk). In the PFRA, seven areas in DK1 (Jutland and Funen) and three areas in DK2 (Seeland) were identified as APSFRs. These areas are described textually in the FRMPs, marked in an overview map of Denmark, as well as presented in detailed maps. There are no APSFRs which are shared with other Member States[19].

Links to maps of the APSFRs have been provided in all of the FRMPs assessed. All links lead to a national GIS system[20], but are zoomed in to the relevant APSFR[21]. All assessed municipal FRMPs contain maps showing the area at risk from flooding[22].

Flood conveyance routes are not explicitly addressed in the FRMPs for DK1 and DK2. They are not addressed in the assessed municipal FRMPs either[23].

2.1.1 Coordination with neighbouring Member States on shared RBDs/UoMs

The Vidå-Kruså UoM (DK4) is the only UoM shared with another Member State, Germany. There were no flood risk areas identified in DK4 from the Danish side. The German side is made up of two UoMs, the Eider (DE 9500) and the Schlei Trave (DE9610): both contain APSFRs. In the coordination between the two Member States, Germany shared draft assessments, maps and plans with Denmark[24].

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[19] FRMPs for DK1 and DK2, all assessed municipal FRMPs.

[20] http://miljoegis.mim.dk/spatialmap?&profile=oversvoem2

[21] Specific areas can be selected through the dropdown menu: http://miljoegis.mim.dk/spatialmap?profile=oversvoem2&sessionid=%7BA1F7067C-8B28-4C4B-9F2E-2923C6931D03%7D
Information on areas at risk can also be found on Denmark's climate change adaptation web page: http://www.klimatilpasning.dk/vaerktoejer/oversvoemmelseskort.aspx

[22] FRMP DK1: page 11&12; FRMP DK2: page 10&12; Municipal FRMPs

[23] FRMP for DK1 and DK2; municipal FRMPs and the maps provided by the national web-GIS system (see footnotes 5 and 6 above).

[24] Reporting sheets, section on "summary of coordination".

2.1.2 Information how the PFRA was used in the development of the FHR maps

The UoM-level FRMPs state that the FHRMs confirmed the findings of the PFRA and no additional risk areas were identified. For the APSFRs identified in the PFRA, FHRMs were developed[25].

2.2 Presentation of Flood Hazard and Risk Maps (FHRMs) in the FRMPs

FHRMs have been provided in all FRMPs assessed, these maps cover fluvial and seawater floods. The UoM-level FRMPs for DK1 and DK2 are overarching documents that present FHRMs as examples and only show maps for 100-year floods (with 2012 as the reference year i.e. based on driving natural forces such as wind, precipitation and natural conditions such as land uplift for 2012). The links provided in the UoM-level plans for each APSFR lead to more detailed maps showing other flood probabilities, also taking into account future climate change impacts. Similarly, the municipal FRMPs assessed provide examples of FHRMs and links to more detailed FHRMs.

Neither in the FRMPs assessed, nor in the national web-GIS, are there maps for groundwater floods or floods from artificial water bearing structures (according to the PFRA assessment, the latter are not relevant for Denmark; information was not found, however, to indicate if groundwater floods could be relevant[26]). Pluvial flooding was not assessed at the PFRA stage. Nevertheless, there are pluvial flood risk maps available in one municipal FRMP assessed, for the municipality of Aabenraa in DK1: The FRMP of Aabenraa also provides a local map showing the combined effect of flooding from seawater, fluvial and pluvial sources[27].

All links to the FHRMs provided in both the UoM-level and the municipal FRMPs lead to the national GIS system and pinpoint the relevant APSFR[28].

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[25] FRMPs of DK1 and DK2, maps of the national Web-Gis system (miljøgis).

[26] European Commission, Assessment of Flood Hazard and Flood Risk Maps Member State Report: DK – Denmark, 2015. Available at: http://ec.europa.eu/environment/water/flood_risk/pdf/fhrm_reports/DK%20FHRM%20Report.pdf

[27] FRMPs for DK1 and DK2; Municipal flood risk management plan Abenraa, page 11 & 12: https://www.aabenraa.dk/media/2787544/risikostyringsplan-for-oversvoemmelser.pdf, Other municipal FRMPs.

[28] All APSFRs can be found here, specific areas can be selected through the dropdown menu, while different aspects covered by FHRMs can be selected from the menu on the left-hand side: http://miljoegis.mim.dk/spatialmap?profile=oversvoem2&sessionid=%7BA1F7067C-8B28-4C4B-9F2E-2923C6931D03%7D

2.2.1 Maps for shared flood risk areas

As no APSFRs were identified in the only transboundary UoM of Denmark (DK4), there was no need to prepare maps for shared flood risk areas.

2.2.2 Conclusions drawn from the flood hazard and flood risk maps

FHRMs have been used to develop the FRMPs assessed as follows:

- FHRMs were used to set priorities for flood risk management (e.g. locations, economic activities, assets);
- Specific objectives on flood risk reduction were defined based on the FHRMs.

The FHRMs are provided by the Danish government, but the elaboration of FRMPs is the responsibility of the municipalities with areas at flood risk. The guidance document for FRMPs of the Ministry of Environment and Food of Denmark called on municipalities to use the FHRMs in the preparation of their plans. Municipalities were free to decide which maps, provided by the ministry, they use for their FRMPs and how they use them. The UoM-level FRMPs for DK1 and DK2 indicate that maps were used in some municipalities to set priorities (e.g. protect the areas with the highest risk for losses first) and to set flood risk reduction targets (e.g. any buildings in risk areas have to have certain installations above a certain water level)[29].

The national guidance document also states that the FHRMs can be supplemented with local information: in at least one case, the municipality of Aabenraa, local flood risk maps were prepared in addition to the national FHRMs; in this case, the local flood risk maps found greater flood risks than the national FHRM.

2.3 Changes to the APSFRs or other Flood Risk Areas

The FRMP assessment looked for information on changes in the identification of APSFRs since December 2011, or in the FHRMs since December 2013, indicated in the FRMP. The municipal FRMPs do not mention any changes APSFRs or FHRMs (and this preliminary work undertaken at national level); however, as noted above, one municipal FRMP prepared local flood risk maps in addition to the national FHRMs.

[29] FRMPs for DK 1 and DK 2. Municipal FRMPs.

2.4 Areas for further development in the earlier assessment of the flood hazard and risk maps

The FHRM assessment had identified the following areas for further development for Denmark[30]:

- According to Art.6(2), APSFRs shared with other Member States shall be subject to prior exchange of information between the countries concerned. The information Denmark shared with Germany concerning their shared basin was not clear.
- It appears that flood extent was not shown in relation to probabilities.
- It appears that water depth was not to shown in relation to probabilities.
- Population at risk from floods was shown just for coastal medium probability flooding. It was not clear whether any population is at risk considering other flood sources.
- APSFRs associated with pluvial flooding had not been identified or subsequently mapped, even though relatively recent events had shown that they could cause significant damage in Denmark. No information regarding flood sources (pluvial, groundwater, and sewage) was reported by the authorities.
- No potential adverse consequences on the environment were shown in the maps.

None of these areas for further development are explicitly addressed within the FRMPs assessed or in Denmark's reporting, in the time period between publication of the FHRMs and the assessment of the FRMPs. Nonetheless, the following information has been found in the current FHRMs:

- While Denmark's FRMPs state that there are regular coordination meetings between Denmark and Germany and information on catchments is exchanged between the two Member States, the specific nature of these exchanges is not indicated. As noted above, Denmark has not identified any shared flood risk areas.
- Flood extent is shown for the 20-year, 100-year and 1000-year floods (high, medium and low probability scenarios). The 20-year flood extent is shown for the years 2012 and 2050 (this future scenario includes consideration of climate change impacts), the 100-year flood extent is shown for the years 2012, 2050 and 2100 (the two future scenarios consider climate change), and the 1000-year flood extend is shown only for the year 2012.

[30] These areas for further development were identified based on the FHRM assessment: European Commission, Assessment of Flood Hazard and Flood Risk Maps – Member State Report: DK – Denmark, February 2015. Available at: http://ec.europa.eu/environment/water/flood_risk/pdf/fhrm_reports/DK%20FHRM%20Report.pdf

- Water depth is shown in relation to probabilities (20, 100 and 1000-year flood events).
- Population at risk from flooding is also shown for inland flooding.
- Pluvial flooding was not considered to be relevant for Denmark (at the national level) in the first cycle[31]. Risk of pluvial flooding was considered by some municipalities (i.e. in parts of the UoMs) in the form of an "overall preparedness for pluvial flooding and flooding from the sea".[32]
- The maps show protected areas (including areas protected under the Ramsar Convention and Natura 2000 sites) which are affected by flooding[33].

2.5 Good practices and areas for further development in the FRMPs regarding integration of previously reported information

The following **areas for further development** were identified:

- There appears to be potential for improved coordination between national and local levels: While the FHRMs were also prepared at national level, at least one municipality (Aabenraa in DK1), developed in addition its own municipal risk maps: it found greater flood risks (higher damage risks) compared to the national maps for the same area.

3. Setting of Objectives

3.1 Focus of objectives

In Denmark each municipality affected by flooding elaborated an FRMP. For one APSFR, three municipalities elaborated one common FRMP. The FRMPs for DK1 and DK2 sum up the objectives set in each municipality's FRMP. These objectives differ from municipality to municipality:

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[31] Denmark subsequently clarified that pluvial flood risk had been assessed by Danish municipalities when preparing their individual municipal climate adaptation plans in 2013. Following amendments to the Danish Planning Act, from now on all new municipal climate plans must contain guidelines for areas that may be exposed to significant flooding or erosion and requirements for setting up preventive measures to safeguard against flooding or erosion when planning urban development, special technical facilities, or in case of altered land use, etc.

[32] Denmark's online GIS system includes "Blue Spots" that indicate roads that could be affected by heavy rainfall. See for example: http://en.klimatilpasning.dk/media/297917/the_blue_spot_concept_report_181.pdf The mapping of Blue Spots on the national GIS does seem to equate to the preparation of pluvial hazard maps.

[33] National web-GIS (all APSFRs): http://miljoegis.mim.dk/spatialmap?profile=oversvoem2&sessionid=%7BA1F7067C-8B28-4C4B-9F2E-2923C6931D03%7D and Abenraa municipality FRMP, p.11: https://www.aabenraa.dk/media/2787544/risikostyringsplan-for-oversvoemmelser.pdf

- An objective which all but one of the 20 municipal FRMPs have in common is to reduce the adverse consequences of flooding.
- One of the five municipal FRMPs assessed did not identify any objectives (Holstebro in DK1. No explanation for this was found).
- Some municipalities aim to reduce the likelihood of flood risk (e.g. Køge in DK2).
- Some municipalities set objectives to reduce damages caused by flooding (e.g. Aabenraa, Fredericia in DK1).
- Several municipalities call for non-structural actions in their objectives, such as spatial planning (e.g. Aabenraa, Fredericia, Norddjurs in DK1) or improved cooperation with neighbouring municipalities.
- Some municipalities specify in their objectives the flood risk level they use to plan their protection measures for (e.g. Aabenraa, Solrød), whereas others have not yet defined the level of protection and thus only set preliminary objectives (e.g. Copenhagen in DK2).

Consequently, from the FRMPs assessed, it can be concluded that[34]:

- Nearly all municipal FRMPs have objectives that aim to reduce the adverse consequences of floods;
- Some municipal FRMPs have objectives aiming to reduce the likelihood of flooding[35],
- Some municipal FRMPs have objectives referring to non-structural measures[36].

3.2 Specific and measurable objectives

In Denmark, the objectives are neither fully specific nor measurable. Four of the five FRMPs assessed provide information at which location and how they will be achieved, though there is a large variation among them concerning the level of detail. Some municipalities specify their objectives and targets for pinpointed location such as a street or a facility, explaining where and what kind of measures should be implemented to achieve the objectives (e.g. Aabenraa, Norddjurs, Greve), while others remain more general (e.g. Copenhagen, Dragør). As noted above, one of the five FRMPs assessed, Holstebro, does not contain objectives.

Across the five municipal FRMPs assessed, there are no quantitative targets specified.

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[34] These categories are included in Art. 7 of the Floods Directive.

[35] The assessment adopts the generally accepted definition of risk as a product of consequence times likelihood, thereby also in alignment with Art. 7(2) of the FD.

[36] Non-structural measures include measures such as flood forecasting and raising awareness of flooding as well as land use planning, economic instruments and insurance.

It is not mentioned when the objectives will be achieved. in the either FRMPs for DK1 and DK2, or in any of the municipal FRMPs assessed.

3.3 Objectives to reduce adverse consequences from floods

Among the five municipal FRMPs assessed, some state explicitly in the formulation of their objectives that they aim to reduce adverse consequences of floods on human health, cultural heritage, the environment or economic activities (e.g. Vejle, Aabenraa); others do not explicitly state this in the objectives themselves, but mention this in the justification of the suggested measures instead; e.g. the FRMP for Greve suggests to make the local wastewater treatment plant flood-safe to avoid disease, the FRMP for Solrød calls for an assessment of the negative consequences of flooding on nature areas to identify relevant measures.

3.4 Objectives to address the reduction of the likelihood of flooding

As noted above, some FRMPs include objectives to reduce the likelihood of flooding. In their objectives, some FRMPs call for improving infrastructure, such as sea dykes, to reduce the likelihood of flooding; some FRMPs identify the level of protection to achieve (e.g. Solrød defined a protection against 2.80 metre sea level rise for its infrastructure, which means protection against a 1000-year return interval event for some areas).

3.5 Process for setting the objectives

Each Danish municipality at risk from flooding developed its own FRMP, but several municipal FRMPs assessed state that they had coordinated with neighbouring municipalities (or that such coordination is planned). In one case, three municipalities developed a joint FRMP (Nordfyns, Odense, Kerteminde). Hence, there is, to a certain extent, local coordination; however, the FRMPs assessed do not refer to national coordination in the preparation of the FRMPs or the identification of their objectives.

As noted in section 2, together with flood maps on the current flood risk, flood maps taking into consideration climate change were also developed by the national government. However, each municipality decided which maps to use for their flood risk management planning.

The municipal FRMPs mention that climate change was considered: Danish municipalities had previously prepared climate adaptation plans that were taken into account in their FRMPs (see section 5 for further details).

The FRMPs assessed do not describe whether stakeholders were consulted for setting the objectives of the FRMPs.

3.6 Good practices and areas for further development regarding setting objectives

The following **good practice** was identified:

- Neighbouring municipalities coordinated their FRMPs and three municipalities developed a joint FRMP.

The following **area for further development** was identified:

- Each municipal FRMP is different, even though there is a national guidance document on how to compile FRMPs. This might impede cooperation between municipalities.

4. Planned measures for the achievement of objectives

Denmark reported 28 measures in total, 15 in DK1 and 13 in DK2[37]. Denmark reported only aggregated[38] measures, and no individual measures (the FRMPs and reporting sheets do not, however, provide a definition for aggregated measures).

Measures are reported for each aspect[39], with preparedness measures making up half of the total (14 of 28 measures, or 50 %), followed by protection measures (8 of 28, or 29 %), prevention measures (five of 28, or 18 %) and recovery and review measures (one, or 4 %). No "other" measures are reported.

For DK1, Denmark reported two prevention measures (for measure types M21[40] and M23[41]), six protection measures (measure types M31[42], M32[43], M35[44]) and seven preparedness measures (types M41[45], M42[46], M43[47]). For DK2, three prevention measures (types M21 and

[37] The information reported to WISE was the starting point for the assessment in this section. The majority of the statistics presented are based on processing of information reported to WISE. Assuming that the Member States accurately transferred the information contained in their FRMPs to the reporting sheets (the sheets are the same for all Member States and are not customisable) and barring any undetected errors in the transfer of this information to WISE arising from the use of interfacing electronic tools, these statistics should reflect the content of the FRMPs.

[38] The Reporting Guidance mentions "Measures can be reported as individual measures (recommended for major projects) or aggregated measures,…" and also notes that measures may be comprised of "many individual projects". European Commission, Guidance for Reporting under the FD (2007/60/EC), 2013, pp. 54-58.

[39] See Annex B for the list of all measure aspects and measure types.

[40] Measures to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation.

[41] Measures to adapt receptors to reduce the adverse consequences in the event of a flood actions on buildings, public networks, etc.

[42] Natural flood management / runoff and catchment management, Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water

[43] Water flow regulation, Measures involving physical interventions to regulate flows, such as the construction, modification or removal of water retaining structures (e.g. dams or other on-line storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime.

[44] Other measures to enhance protection against flooding, which may include flood defence asset maintenance programmes or policies.

[45] Flood Forecasting and Warning, Measures to establish or enhance a flood forecasting or warning system.

[46] Emergency Event Response Planning / Contingency planning, Measures to establish or enhance flood event institutional emergency response planning.

[47] Public Awareness and Preparedness, Measures to establish or enhance the public awareness or preparedness for flood events.

M23), two protection measures (M31 and M35), seven preparedness measures (M41, M42, M43) and one recovery & review measure (M51[48]) are reported.

Please see Tables A2 and A3 and Figures A1 and A2 in Annex A for supplementary tables and charts on measures reported at the UoM-level.

4.1 Cost of measures

Table 6 Overall budget for the measures in the assessed FRMPs

Municipal FRMP	Estimated overall budget of planned measures (2015-2021) in DKK
Odense Fjord (DK1)	45-53 m
Other four FRMPs assessed	n/a

Source: FRMPs

No information concerning the budget of the measures was provided in the reporting sheets and/or in the UoM-level FRMPs for DK1 and DK2.

Among the five municipal FRMPs assessed, only the FRMP for Odense Fjord (developed jointly by the municipalities of Odense, Kerteminde and Nordfyns) provides an estimate of the cost of implementation of all measures: between DKK 45 and 53 m (approximately EUR 6 – 7 m)[49]. The FRMP for Odense Fjord further details that DKK 10 m will be used for common projects, the remaining money for projects in each municipality; for sluices and dykes the costs in Odense will be between DKK 27.1 and 30.6 m; in Kerteminde around DKK 6 m; and in Nordfyns between DKK 1.75-6.75 m. A screening of the measures showed that in the FRMP for Odense Fjord, mainly construction costs or costs for equipment are considered, and not administrative costs to plan or establish measures or operational costs[50].

The FRMP for DK1 mentions that seven municipalities made some prioritisation of measures based on schedules or budgets, suggesting that other municipal FRMPs in this UoM prepared budgets. In the FRMP for DK2, it is not mentioned if any municipal FRMPs provide a budget.

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[48] Recovery and Review (Planning for the recovery and review phase is in principle part of preparedness), Individual and societal recovery, Clean-up and restoration activities (buildings, infrastructure, etc), Health and mental health supporting actions, incl. managing stress Disaster financial assistance (grants, tax), incl. disaster legal assistance, disaster unemployment assistance, Temporary or permanent relocation, Other.

[49] For some measures, the cost is given as a range.

[50] FRMP DK1 and DK2, assessed municipal FRMPs.

4.2 Funding of measures

Among the five municipal FRMPs assessed, information about the funding sources of the measures is provided only in the FRMP for Odense Fjord (DK1). The costs of infrastructure projects (i.e. for constructing or reinforcing dykes) will be shared between those which are protected by the infrastructure, such as landowners. Measures like monitoring stations, actions for emergency services and dynamic mapping of storm floods will be shared between the municipalities[51].

Table 7 Funding of measures

	Odense Fjord (DK1)
Distribution of costs among those groups affected by flooding	✓
Use of public budget (national level)	
Use of public budget (regional level)	
Use of public budget (local level)	✓
Private investment	
EU funds (generic)	
EU Structural funds	
EU Solidarity Fund	
EU Cohesion funds	
EU CAP funds	
International funds	

Source: FRMPs

4.3 Measurable and specific (including location) measures

Some but not all of the FRMPs assessed include a clear and explicit description of the measures with regard to:

- What they are trying to achieve;
- Where they are to be achieved;
- How they are to be achieved; and
- By when they are expected to be achieved.

Both UoM-level FRMPs (DK1 and DK2) note differences in approach among municipal FRMPs. In DK1, three out of ten affected municipalities elaborated more high-level plans without many details, while other municipalities prepared detailed plans specifying the

[51] FRMP for Odense Fjord (municipalities Odense, Kerteminde and Nordfyns).

measures to be implemented, where and until when (e.g. DK1_Odense Fjord). The variation can be seen across the three FRMPs assessed for this UoM:

- In Holstebro's (DK1) municipal FRMP, the measures are not very specific: they include, for example, establishing flood-prevention provisions in local spatial plans and ensuring the free flow of water in the river to reduce flooding. Who will carry out the measure, when, where and what it will cost are not described.
- In the FRMP of Abenraa (DK1) the description of measures is a mix of general descriptions, such as focusing urban development in areas not at risk from flooding, with concretely described measures such as the construction of a sluice or pumping equipment in a specific location.
- In the FRMP for Odense Fjord (DK1, municipalities of Odense, Kerteminde & Nordfyns), the measures are described in detail and include, as noted above, a budget estimate as well as measurable success criteria, which are related to the completion of the measure.

In DK2, many of the plans do not contain measurable and specific measures. For example, the UoM-level FRMP provides the following information:

- three out of 12 affected municipalities prepared high-level plans that do not contain detailed information on measures,
- the municipality of Copenhagen has not yet defined concrete measures (as a decision on the local flood risk safety level has not yet been taken),
- another municipality has only suggested measures and leaves the decision on which measures to implement up to land-owners.

The same is also seen in the two FRMPs assessed in this UoM:

- In Slagelse (DK2), the measures to be taken by the municipality are described on a more strategic level: examples include – further dialogue with landowners and identification of possible measures in a given location. In contrast, measures to be taken by the power supply company are very concrete such as moving of electricity feeder pillars to higher levels to reduce flood risks.

- In Hvidovre (DK2), it is described at which location measures should be implemented and what the aim of those measures is, but the municipality is still in the phase of defining what concrete measures have to be used to reach the specified aims[52].

In Denmark, primary FRMPs are developed at municipal level. Consequently, the location of the measures is at the APSFR level, the municipal level or even below, at the level of an APSFR in each municipality[53]:

Table 8 Location of measures

	All five municipal FRMPs assessed
International	
National	
RBD/UoM	
Sub-basin	
APSFR or other specific risk area	✓
Water body level	
Municipal level or municipal part of an APSFR	✓

Source: Reporting sheet and FRMPs

4.4 Measures and objectives

Some of the municipal FRMPs assessed indicate by how much the measures will contribute to the achievement of objectives. However, none of the plans assessed specifies whether the objectives will be achieved when all measures are completed.

In DK1, all municipalities have specified measures in the areas of prevention, protection and preparedness and those will contribute to achieving the defined objectives – with the exception of one municipality, Holstebro, whose FRMP has not defined objectives, but only measures.

In DK2, not all municipalities have defined measures in their municipal FRMPs. The UoM-level FRMP reveals that most municipalities have defined their objectives for flooding from the sea or from a river in terms of the water level up to which there should be protection against flooding. The suggested infrastructure measures are targeted towards this, but it remains unclear how much each measure or combination of measures will contribute to this target.

[52] FRMP DK1 and DK2, municipal FRMP Odense Fjord and the other assessed municipal FRMPs.
[53] FRMP DK1 and DK2, municipal FRMP Odense Fjord and the other assessed municipal FRMPs.

For objectives that refer to non-structural initiatives, such as better cooperation between neighbouring municipalities, it is not clearly stated in the FRMPs assessed what measures will be taken.

Overall, it remains unclear from the provided information to which degree the defined objectives in each municipality will be achieved and when[54].

4.5 Geographic coverage/scale of measures

In its reporting sheets, Denmark indicated that the location of all measures was at the UoM level. Based on information in the FRMPs assessed, however, almost all measures are implemented on the municipal level. In addition, in some cases, neighbouring municipalities cooperate on measures across their territories. There is one municipality (Holstebro), which is at risk from river flooding and it plans to assess measures upstream from the municipality to avoid flooding, i.e. beyond the municipal territory. The issuance of emergency warnings is one exception: this is a national task undertaken by the Danish Meteorological Institute.

In its reporting sheets, Denmark indicated that the geographic coverage of the effects of all measures is the specific APSFR. Based on the FRMPs, most measures are expected to have a local effect, as most measures are implemented at municipal level and address seawater flooding. One exception are measures indicated in the FRMP prepared by the municipality of Holstebro, which is at risk from river flooding: some measures would have an impact outside municipal borders.

4.6 Prioritisation of measures

In its reporting sheets, Denmark provided information about the prioritisation of the 28 measures it reported. In DK1, three measures have critical priority, two very high, five high and five moderate priority. In DK2, two measures have critical, two very high, six high and three moderate priority. No measures were reported as low priority.

Across both UoMs, all prevention measures have a high priority, and of the eight protection measures, four have a critical, two a very high and two a moderate priority. For the 14 preparedness measures, two have very high, six high and six moderate priority. The single recovery and review measure has critical priority (see Tables A4 and A5 in Annex A for more details)[55].

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[54] FRMP DK1 and DK2, assessed municipal FRMPs.
[55] Reporting sheets.

The UoM-level FRMPs do not provide detailed information how prioritisation of measures was made at this level, though the FRMP for DK1 mentions that seven municipalities made a prioritisation of measures based on schedules or budgets and two municipalities used CBA.

The five municipal-level FRMPs assessed provide further information, though prioritisation was carried out in different ways in the different municipalities. Some municipalities did not yet prioritise measures (e.g. Holstebro, DK1), some did not state their criteria for prioritization. Some based their prioritization on assessments of the impacts of flooding (i.e. highest priority in areas where the highest risks are expected) or the relevance of the measure for the climate change mitigation and adaptation plans (e.g. Aabenraa, DK1), while others specified which geographic areas are prioritised for measures, though do not explain why.

The municipal FRMPs assessed give no indication that CBA was used for prioritisation (see section 6 for further information)[56].

The FRMPs assessed do not provide any information about the timeline of the measures.

4.7 Authorities responsible for implementation of measures

For all the measures reported by Denmark, municipalities are indicated as the authorities with the responsibility for implementation.

In the five municipal FRMPs assessed, specific stakeholders are identified as relevant for the implementation of measures: for example, fire brigades and police for emergency response; drinking water and energy providers for the protection of their infrastructure and services; private landowners affected by flooding for the co-financing of dykes.

4.8 Progress of implementation of measures

According to the information reported by Denmark, all 28 measures are under ongoing progress or construction. The majority of the measures (22,79 %) are classified as 'progress ongoing' while only two prevention and four protection measures are classified as 'ongoing construction' (see Tables A6 and A7 in Annex A for more details)[57].

4.9 Measures taken under other Community Acts

Member States have been asked to report on other Community Acts under which each measure has been implemented (such as the Strategic Environmental Assessment and

[56] FRMP DK1 and DK2, assessed municipal FRMPs.
[57] Reporting sheets.

Environmental Impact Assessment Directives, the Water Framework Directive or the Seveso Directive). According to the information reported by Denmark, no measures have been taken under other Community Acts.

Several municipal FRMPs mention that the measures specified in their FRMPs take into account the municipal climate change adaptation plans and the measures specified herein. Some municipalities (e.g. FRMP for Odense Fjord) also mention the river basin management plans for the implementation of the WFD and municipal stormwater management plans tackling pluvial flooding.

4.10 Specific groups of measures

With regard to **spatial planning/land use measures**, Denmark has reported a measure in the category M21[58], which covers land use measures, in both DK1 and DK2.

The municipal FRMPs assessed specify spatial planning/land use measures. Examples include:

- allowing urban development only outside of flood risk areas (Køge FRMP, DK2),
- incorporating flood-related prevention measures in local spatial plans (Holstebro FRMP, DK1),
- elaborating a holistic plan for city neighbourhoods near the coast (Fredericia FRMP, DK1),
- elaborating guidance documents to avoid the construction of any new building in flood-risk areas (Slagelse FRMP, DK2), and
- preparing an overall flood-risk plan addressing seawater flooding and flooding due to heavy rain (Solrød, DK2).

The FRMPs assessed do not indicate if the framework for controlling building and development in floodplains has evolved since 2000[59].

Natural water retention measures (NWRMs) have been mentioned in one of the five municipal FRMPs assessed. The FRMP for the municipality of Holstebro (in DK1) is at risk of river flooding and its FRMP considers the use of natural retention measures upstream, but it does not describe specific measures to be implemented.

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[58] Prevention, Avoidance, Measure to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation.

[59] Reporting sheets; municipal FRMPs.

Measures that specifically consider nature conservation. In DK2, in some municipal FRMPs, Natura 2000 plans and other nature plans are mentioned among plans which have to be considered for the implementation of flood measures; however, these references were not found for the municipal FRMPs in DK1[60].

Some of the FRMPs assessed state that they shall take into consideration **navigation and port infrastructure**. Ports are often identified as areas of flood risk and measures are planned to protect these areas, often in cooperation with stakeholders related to port activities: this is seen, for example, in the municipal FRMPs of Aabenraa and Odense Fjord[61].

No reference has been found in the five FRMPs assessed to **dredging** to increase river channel capacity and its ability to convey water for flood alleviation purposes. Moreover, among the municipal FRMPs assessed, this would be only relevant for the municipality of Holstebro (DK1), which is at risk of river flooding. Its FRMP includes a prevention measure for continued river flow and good maintenance of the river bed, but it is unclear if this would also involve dredging[62].

4.11 Recovery from and resilience to flooding

The role of insurance policies is discussed in two of the municipal FRMPs assessed: the plans for Odense Fjord and Holstebro briefly discuss when the damages would be eligible for compensation via the "Stormrådet" (Danish Storm Council[63]), a kind of national insurance mechanism. However, there are no further details concerning the types of insurance available for flood risks in Denmark.

4.12 Monitoring progress in implementing the FRMP

According to the UoM-level FRMPs, monitoring of progress falls under the responsibility of the municipality and is handled differently in the municipalities.

In DK1, most of the municipal FRMPs provide some information about monitoring. Municipalities mention project groups for progress monitoring, yearly and half-yearly progress-reporting, internal monitoring routines and public access to progress reports[64]. One

60 FRMP DK1 and DK2, municipal FRMPs.
61 FRMP DK1 and DK2, municipal FRMPs.
62 FRMP DK1, municipal FRMPs.
63 https://www.danishstormcouncil.dk/artikler/danishstormcouncil/about-the-danish-storm-council/what-is-the-danish-storm-council/
64 FRMPs DK1 and DK2, municipal FRMPs.

municipality (Norddjurs) plans a public log where the public can follow the implementation of measures.

In DK2, information about monitoring progress is provided only for three of the 12 municipalities. In these municipalities, progress will be monitored "in combination with a revision of the flood risk management plan", "following the municipal routines" or through yearly public reporting (e.g. Greve municipality).

However, there is no information if a baseline has been established against which progress will be monitored and assessed, in either DK1 or DK2.

4.13 Coordination with the Water Framework Directive

The table below shows, based on information available, how the development of the FRMPs has been coordinated with the development of the second RBMPs of the WFD.

Table 9 Coordination of the development of the FRMPs with the development of the second River Basin Management Plans of the WFD

	All FRMPs assessed
Integration of FRMPs and RBMPs into joint documents	
Joint consultation of draft FRMPs and RBMPs	
Coordination between authorities responsible for developing FRMPs and RBMPs	
Coordination with the environmental objectives in Art. 4 of the WFD	
The objectives of the Floods Directive were considered in the preparation of the RBMPs [a]	
Planning of win-win and no-regret measures in FRMPs	✓
The RBMP PoM includes win-win measures in terms of achieving the objectives of the WFD and Floods Directive, drought management and NWRMs [a]	✓
Permitting or consenting of flood risk activities (e.g. dredging, flood defence maintenance or construction) requires prior consideration of WFD objectives and RBMPs	
Natural water retention and green infrastructure measures have been included	✓
Consistent and compliant application of WFD Article 4(7) and designation of heavily modified water bodies with measures taken under the FD e.g. flood defence infrastructure	
The design of new and existing structural measures, such as flood defences, storage dams and tidal barriers, have been adapted to take into account WFD Environmental Objectives [a]	✓

The use of sustainable drainage systems, such as the construction of wetland and porous pavements, have been considered to reduce urban flooding and also to contribute to the achievement of WFD Environmental Objectives	

Notes: [a] based on reporting under the WFD

Some of the municipal FRMPs assessed list the river basin management plans and related local plans[65], which specify measures to be taken to implement the WFD, among the other plans relevant for the implementation of the Floods Directive (e.g. in the municipal FRMP for Odense Fjord). Therefore, it appears that at least in some municipalities, work under the RBMPs was considered in the preparation of the FRMPs[66]. However, based on the available information, it is not possible to determine how the development of the FRMPs was coordinated with the WFD.

4.14 Good practices and areas for further development with regard to measures

The following **good practices** were identified:

- While many municipal FRMPs do not provide details on monitoring of implementation, some do and one municipality (Norddjurs) plans to have a public log where the public can follow the implementation of measures.
- The measures in some but not all of the municipal FRMPs assessed are specific, also in terms of location, and measurable. For example, the FRMP for Odense Fjord describes for each measure, its goal, how it will be implemented, its success criteria and its cost.

The following **areas for further development** were identified:

- The prioritisation process remains unclear for all the FRMPs assessed.
- Based on the information available in the FRMPs assessed, it was not possible to determine how the FRMPs were coordinated with the RBMPs.
- Only one of the five FRMPs assessed provides information concerning the costs of the measures and their funding sources.

[65] *Vandplaner* and *vandhandleplaner*, respectively.
[66] FRMPs DK1 and DK2, municipal FRMPs.

5. Consideration of climate change

The Ministry of Environment and Food of Denmark has developed flood maps for scenarios with low, medium and high probability, with and without climate change scenarios, for use in the development of the FRMPs. In addition, all municipal FMRPs except from Hedensted in DK1 cite the municipal climate change mitigation and adaptation plans as relevant planning documents for implementing the Floods Directive. Most municipal FRMPs also mention that they will consider climate change in the implementation of their measures. However, neither the UoM-level FRMPs nor the five municipal FRMPs assessed make reference to the national climate change adaptation strategy[67], in relation to the flood risk management measures[68].

The timeframes for the climate change scenarios considered in the national flood risk maps are 2050 and 2100, with 2012 as the basis year[69]. However, neither the FRMPs nor Denmark's reporting sheets provide information if a shift in the occurrence of extreme events and changes in numerical recurrence times or changes in the main sources of flooding will take place under the long term climate change scenarios.

5.1 Specific measures to address expected effects of climate change

Several municipal FRMPs mention that the risk of flooding in the context of future climate change, is considered in municipal spatial planning. All Danish municipalities have climate change mitigation and adaptation plans, and in one of the assessed municipal FRMPs (DK2_Slagelse) it is stated that by elaborating the climate change mitigation and adaptation plan the municipality became aware of potential flood problems in one part of its territory. Another municipality (DK1_Holstebro) states that in spatial planning and building applications, climate change must be considered[70]. In the municipal FRMP of Abenraa (DK1), it is stated that some measures were designated high priority for implementation as they were derived from the municipal climate change mitigation and adaptation plan.

The UoM-level FRMPs list several examples where climate change is considered in municipalities when planning flood defence measures, including structural measures (e.g. DK1: Holstebro, Abenraa; DK2: Copenhagen, Brøndby, Vallensbæk, Ishøy, Slagelse).

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67 Available at: http://en.klimatilpasning.dk/media/5322/klimatilpasningsstrategi_uk_web.pdf Danish strategy for adaptation to a changing climate.

68 FRMP DK1 and DK2, municipal FRMPs.

69 State GIS-system (miljøgis): http://miljoegis.mim.dk/spatialmap?profile=oversvoem2&sessionid=%7B8F7FC331-4D6F-44DE-92DC-D44930E762BA%7D

70 FRMP for DK1 and DK2, municipal FRMPs.

Further details are not provided, and the documents do not indicate whether any of these are "no regret measures"[71].

5.2 Good practices and areas for further development concerning climate change

The following **good practice** was identified:

- All municipalities in Denmark have developed climate change mitigation and adaptation plans; almost all municipal FRMPs make a direct reference to those plans and state that the implications of climate change on flooding are considered. In the municipal FRMP of Abenraa (DK1), some measures were designated high priority for implementation as they were derived from the municipal climate change mitigation and adaptation plan.

The following **area for further development** was identified:

- Most FRMPs did not provide details how the climate change mitigation and adaptation plans impacted the final selection of flood risk management objectives and measures.
- No apparent coordination between the FRMPs and the national climate change adaptation strategy.

[71] FRMP DK 1 and DK2, municipal FRMPs.

6. Cost-benefit analysis

The UoM-level FRMP for DK1 states that two municipalities used CBA for the prioritisation of measures. The UoM-level FRMP for DK2 does not mention any application of CBA.

A screening of all the municipal FRMPs for DK1 revealed that the municipal FRMP for Aabenraa included calculations of damages and the FRMP for Odense Fjord (prepared jointly by the municipalities of Odense, Kerteminde and Nordfyns) provides maps showing potential damage from flooding. However, these two FRMPs state that this information was not used for the prioritisation of measures.

In the municipal FRMP for Odense Fjord, costs were calculated for all proposed measures. In the municipal FRMP for Aabenraa, costs for a levee and some technical infrastructure (pumps and sluices) were calculated. In both cases, only investment costs appear to have been considered.

There is some information to indicate that multiple benefits were considered. Some municipal FRMPs both in DK1 and DK2 mention that measures should be selected if they have recreation benefits in addition to flood risk reduction effects (e.g. DK1: Aabenraa, DK2: Køge, Brøndby, Ishøj), but there is no information available to indicate if they considered such benefits when prioritizing their measures[72].

6.1 Good practices and areas for further development

The following **area for further development** was identified:

- Only two municipal FRMPs refer to CBA, and they do not indicate clearly if or how this was used in prioritisation. Where they present costs, these appear to only cover investment costs.

[72] FRMP for DK1 and DK2, municipal FRMPs.

7. Governance including administrative arrangements, public information and consultation

7.1 Competent authorities

The FRMPs assessed and the information provided in the reported sheets do not indicate changes to the Competent Authorities and the Units of Management identified for the Floods Directive. No updates have been reported to the European Commission regarding this matter since 2010.

7.2 Public information and consultation

The table below shows how the public and interested parties were **informed**, based on information in the UoM-level FRMPs concerning the draft FRMPs (information how the consultation was actually carried out and which stakeholders participated is presented in the rest of the section):

Table 10 Methods used to inform the public and interested parties of the FRMPs

	DK1 and DK2
Media (papers, TV, radio)	
Internet	✓
Digitial social networking	
Printed material	
Direct mailing	
Invitations to stakeholders	✓
Local Authorities	
Meetings	✓

Source: FRMPs

The municipalities were responsible for public information and consultation for their FRMPs, and the specific mechanisms employed vary among municipalities. The UoM-level FRMPs are essentially summaries of the municipal-level plans, and no public information and consultation was carried out for these higher-level documents.

The table below shows how the actual **consultation** was carried out:

Table 11 Methods used for the actual consultation

	DK1 and DK2
Via Internet	✓
Via digital social networking	

	DK1 and DK2
Direct invitation	✓
Exhibitions	
Workshops, seminars or conferences	✓
Telephone surveys	
Direct involvement in drafting FRMP	✓

Source: FRMPs

The UoM-level FRMPs state that the municipalities provided the plans online, had a public consultation phase (mostly six months) and organised at least one public meeting. Some municipalities (e.g. DK1: Hedensted, Norddjurs, Randers; DK2: all except Hvidovre and Copenhagen) established working groups which brought together stakeholders such as neighbouring municipalities, landowners affected by flood risks or measures, and companies such as water service companies, to work on special aspects of the FRMP (e.g. DK1: Hedensted and Vejle; DK2: Vallensbæk, Brondby, Slagelse).

The five municipal FRMPs assessed do not describe how the feedback from the consultation was received, i.e. if in written or oral form or both, and how the feedback was taken further in the elaboration of the plans[73].

The table below shows how the **documents** for the consultation were provided:

Table 12 Methods used to provide the documents for the consultation

	DK1 and DK2
Downloadable	✓
Direct mailing (e-mail)	
Direct mailing (post)	
Paper copies distributed at exhibitions	
Paper copies available in municipal buildings (town hall, library etc.)	

Source: FRMPs

All municipalities provided the documents online, but the FRMPs assessed do not mention if other ways were used to distribute them[74].

[73] FRMP for DK1 and DK2.
[74] FRMPs DK1 and DK2, municipal FRMPs.

7.3 Active involvement of Stakeholders

The table below shows the groups of **stakeholders** that have been actively involved in the development of the FRMPs, based on information in the UoM-level FRMPs:

Table 13 Groups of stakeholders actively involved in the development of the FRMPs

	DK1	DK2
Civil Protection Authorities such as Government Departments responsible	✓	✓
Flood Warning / Defence Authorities		
Drainage Authorities	✓	
Emergency services	✓	✓
Water supply and sanitation	✓	✓
Agriculture / farmers		
Energy / hydropower	✓	✓
Navigation / ports	✓	✓
Fisheries / aquaculture		
Private business (Industry, Commerce, Services)	✓	✓
NGO's including nature protection, social issues (e.g. children, housing)		
Consumer Groups		
Local / Regional authorities	✓	✓
Academia / Research Institutions		
Affected landowners	✓	✓

Source: FRMPs

In addition, landowners and neighbouring municipalities were actively involved in both UoMs, the Danish railroad company was involved in the FRMPs for DK1 and the Copenhagen Airport in the FRMPs for DK2.

The involvement of stakeholder groups varies from municipality to municipality, depending which stakeholders were considered as relevant and which were interested. Most of the municipalities involved a range of actors from public agencies and the private sector in the consultation process. It remains unclear if NGOs or consumer groups were involved, most plans talk about "interest groups" which were involved[75]. Moreover, the municipal FRMPs do not specify how exactly different stakeholders were involved in the process, so it remains unclear if all were actively involved.

The table below shows the **mechanisms** used to ensure the active involvement of stakeholders, based on information in the UoM-level FRMPs:

[75] FRMPs DK1 and DK2, chapter 7 and 8.

Table 14 Mechanisms used to ensure the active involvement of stakeholders

	DK1 and DK2
Regular exhibitions	
Establishment of advisory groups	✓
Involvement in drafting	✓
Workshops and technical meetings	
Formation of alliances	
Information days	

Source: FRMPs

The mechanisms to involve stakeholders varied from municipality to municipality. As noted above, some municipalities established working groups with stakeholders. The UoM-level FRMPs state that relevant actors were involved in the drafting of the FRMPs, but it remains unclear how this was done in detail and if this can be considered as an "active involvement". In the FRMPs the following terms were used to describe the involvement of stakeholders: asked stakeholders for input (Holstebro), created a working group with stakeholders from the local area (Herdensted), developed the plan in cooperation with (some listed) stakeholders (Solrød, Ishøj, Vallensbæk, Brondby)[76].

7.4 Effects of consultation

It is not described in detail how the received feedback from the stakeholder meetings was further considered in the process of developing the municipal FRMPs. According to the UoM-level FRMPs, for at least one municipality in DK1 as well as one municipality in DK2, public consultation did not result in any changes in the FRMPs[77].

7.5 Strategic Environmental Assessment

Neither the UoM-level FRMPs nor the municipal FRMPs assessed indicate if an SEA was carried out for the plans.

7.6 Good practices and areas for further development regarding Governance

The following **good practice** was identified:

- Danish municipalities involved a broad range of stakeholders in the FRMP consultation process via working groups.

[76] FRMPs DK1 and DK2, chapter 7 and 8.
[77] FRMPs DK1 and DK2, chapter 7 and 8.

The following **areas for further development** were identified:

- It is unclear how the input of the stakeholders was used in the development of the FRMPs.
- There is no information if SEAs were carried out.

Annex A: Supplementary tables and charts on measures

This Annex gives an overview of the data on measures provided by Denmark in the reporting sheets. These tables and charts were used for the preparation of section 4 on measures. It should be noted that the reporting sheets of Denmark provide information at UoM level, while the assessment in the previous sections considered also the FRMPs developed at municipal level.

Background & method

This document was produced as part of the assessment of the Flood Risk Management Plans (FRMPs). The tables and charts below are a summary of the data reported on measures by the Member States and were used by the Member State assessor to complete the questions on the Flood measures. The data are extracted from the XMLs (reporting sheets) reported by Member States for each FRMP, and are split into the following sections:

- **Measures overview** – Tabulates the number of measures for each UoM;
- **Measure details: cost** – Cost & Cost explanation;
- **Measures details: name & location** – Location & geographic coverage;
- **Measure details: authorities** – Name of responsible authority & level of responsibility;
- **Measure details: objectives** – Objectives, Category of priority & Timetable;
- **Measure details: progress** – Progress of implementation & Progress description;
- **Measure details: other** – Other Community Acts.

On the basis of the reporting guidance (which in turn is based on the Floods Directive)[78], not all fields are mandatory, and, as such, not all Member States reported information for all fields.

Some of the fields in the XMLs could be filled in using standardised answers – for example, progress is measured via the categories set out in the Reporting Guidance. This means that producing comprehensive tables and charts required little effort. For many fields, however, a free data format was used. For some Member States, this resulted in thousands of different answers, or answers given in the national language.

In such situations, tables and charts were developed using the following steps:

[78] http://icm.eionet.europa.eu/schemas/dir200760ec/resources

- A first filter is applied to identify how many different answers were given. If a high number of different answers are given, Member States assessors were asked to refer to the raw data when conducting the assessment, and this Annex does not reflect these observations.
- If a manageable number of answers are given, obvious categories are identified, and raw data sorted.
- Measures missing information may be assigned categories based on other fields (for example, if the level of Responsibility Authority is missing, the information may be obvious from the field "name of Responsible Authority").
- Measures where obvious categories cannot be defined based on other available information (as in the example above on the name of the Responsible Authority), are categorised as "no information".

Types of measures used in reporting

The following table[79] is used in the reporting on the types of measures. Each type of measures is coded as an M-number. Measures are grouped in an 'aspect'.

Table A1 Types of measures used in reporting

NO ACTION M11: No Action	**PREPAREDNESS** M41: Flood Forecasting & Warning M42: Emergency response planning M43: Public Awareness M44: Other preparedness
PREVENTION M21: Avoidance M22: Removal or relocation M23: Reduction M24: Other prevention	**RECOVERY & REVIEW** M51: Clean-up, restoration & personal recovery M52: Environmental recovery M53: Other recovery
PROTECTION M31: Natural flood management M32: Flow regulation M33: Coastal and floodplain works M34: Surface Water Management M35: other protection	**OTHER MEASURES** M61: Other measures

[79] Guidance for Reporting under the Floods Directive (2007/60/EC): https://circabc.europa.eu/w/browse/a3c92123-1013-47ff-b832-16e1caaafc9a

List of Annex A tables & figures

Measures overview

Table A2 Number of measures reported in the reporting sheets

Number of individual measures	0
Number of individual measures including measures which have been allocated to more than one measure type	0
Number of aggregated measures	28
Number of aggregated measures including measures which have been allocated to more than one measure type	28
Total number of measures	28
Total number of measures including measures which have been allocated to more than one measure type	28
Range of number of measures between UoMs including measures which have been allocated to more than one measure type (Min-Max)	13-15
Average number of measures across UoMs including measures which have been allocated to more than one measure type	14

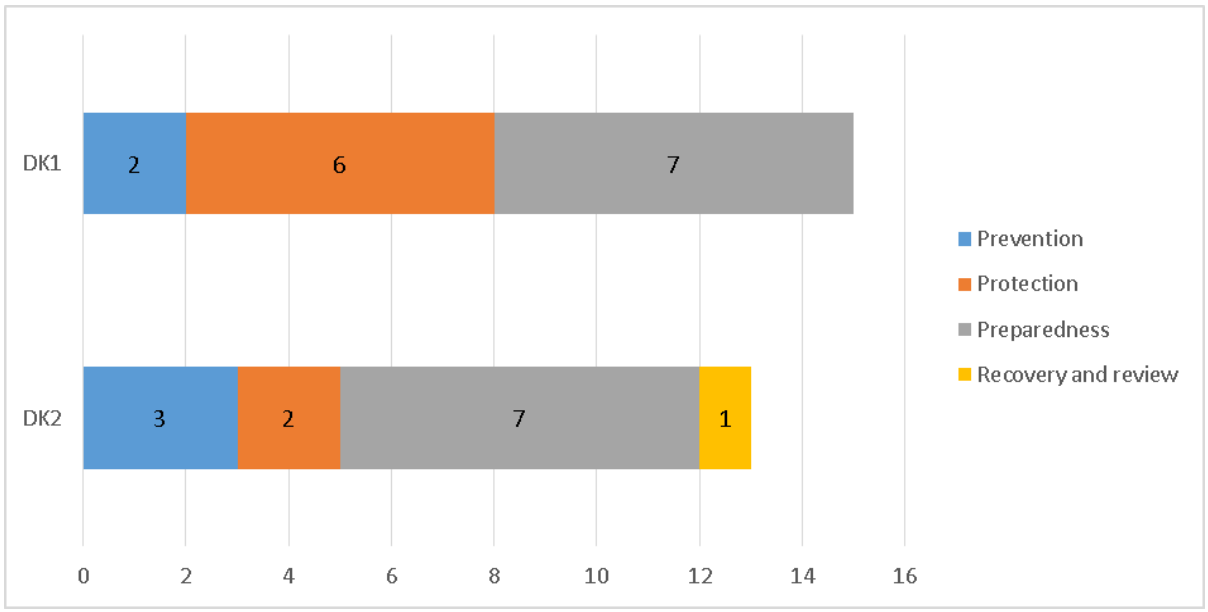
Table A3 Total number of measures (aggregated and individual) per measure type and UoM, including duplicates

	Prevention		**Total**	**Protection**			**Total**	**Preparedness**			**Total**	**Recovery & review**	**Total**	**Other**	**Grand Total**
	M21	**M23**		**M31**	**M32**	**M35**		**M41**	**M42**	**M43**		**M51**			
DK1	1	1	2	3	1	2	6	2	3	2	7				15
DK2	1	2	3	1		1	2	2	3	2	7	1	1		13
Grand Total	**2**	**3**	**5**	**4**	**1**	**3**	**8**	**4**	**6**	**4**	**14**	**1**	**1**	**0**	**28**
Average per UoM	**1**	**2**	**3**	**2**	**1**	**2**	**4**	**2**	**3**	**2**	**7**	**1**	**1**	**0**	**14**

Note: All measures are aggregated as Denmark did not report any individual measures.

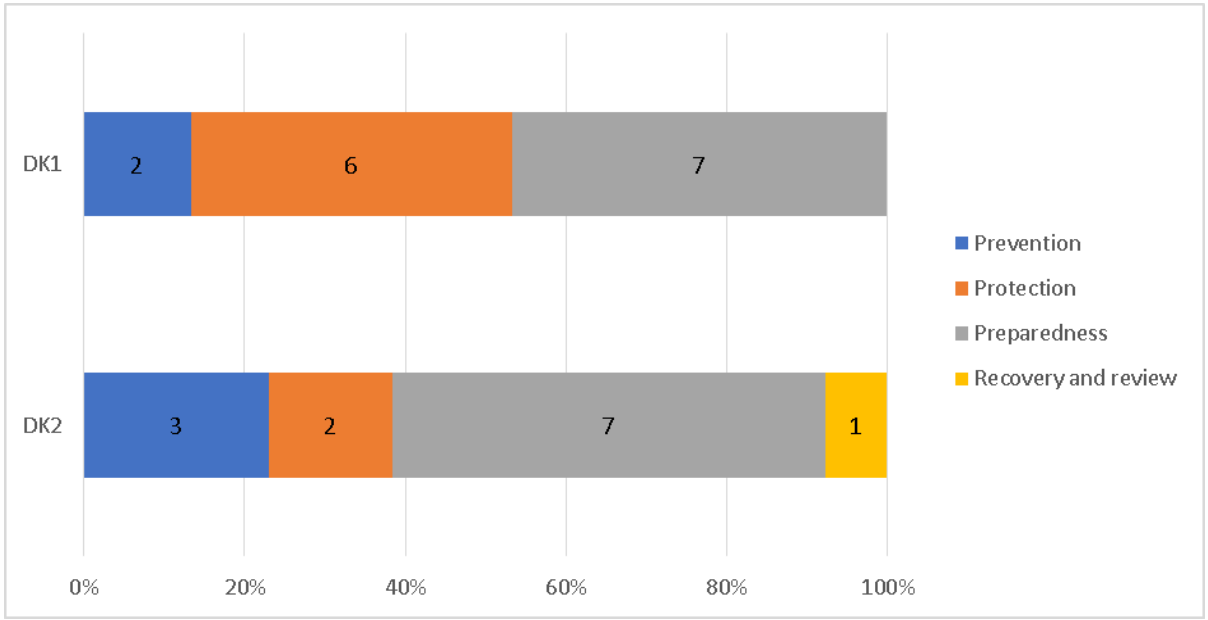
The information in Table A3 is visualised in Figures A1 and A2 below:

Figure A1 Number of total measures (individual and aggregate) by measure aspect



Note: All measures are aggregated as Denmark did not report any individual measures

Figure A2 Share of total measures (aggregated and individual) by measure aspect



Note: All measures are aggregated as Denmark did not report any individual measures.

Measure details: cost

Member States were requested to report information on:

- Cost (optional field);
- Cost explanation (optional field).

Information about costs was not provided in the reporting sheets.

Measure details: name & location

Member States were requested to report information on the following:

- Location of implementation of measures (mandatory field);
- Geographic coverage of the impact of measures (optional field).

Location of measures

Information about the location was provided for all measures in the reporting sheets, the location is indicated as the respective River Basin District (RBD) i.e. UoM.

Geographic coverage

Information about the geographic coverage of the impact was provided for all measures in the reporting sheets, the geographic coverage is indicated as the different APSFRs. However, as this was an open question, a large number of different responses were provided and it was not possible to aggregate the information.

Measure details: objectives

Member States were requested to report information on:

- Objectives linked to measures (optional field, complementary to the summary provided in the textual part of the XML);
- Category of priority (Conditional, reporting on either 'category of priority' or 'timetable' is required);
- Timetable (Conditional, reporting on either 'category of priority' or 'timetable' is required).

Objectives

The Guidance Document indicates that for each measure, an "Explanation of how the measure contributes to the objectives" can be provided (this is an optional field).

Information was provided about the objectives of all measures in the reporting sheets of Denmark, however as this was an open question a large number of different responses were provided and aggregation was not possible.

Category of priority

Denmark provided information for the priority of all measures. The following categories are used in the reporting sheet:

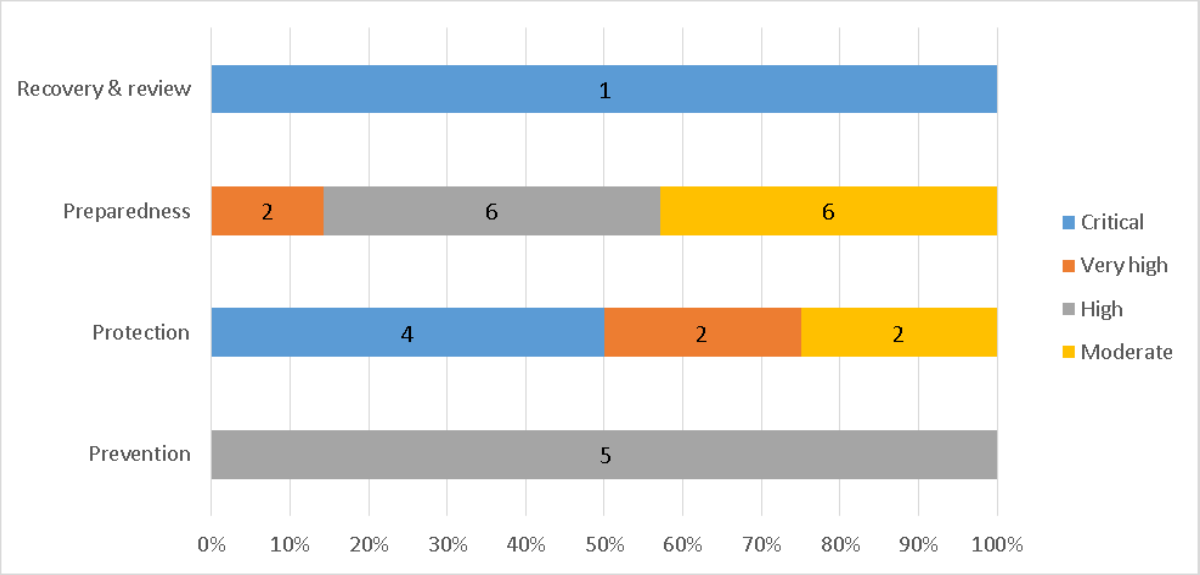
- Critical;
- Very high;
- High;
- Moderate;
- Low.

Table A4 Category of priority by measure aspect

	Critical	Very high	High	Moderate	Grand Total
Prevention			5		5
Protection	4	2		2	8
Preparedness		2	6	6	14
Recovery & review	1				1
Grand Total	**5**	**4**	**11**	**8**	**28**

Note: Denmark did not report any measures of low priority.

Figure A3 Visualisation of Table A4: Category of priority by measure aspect



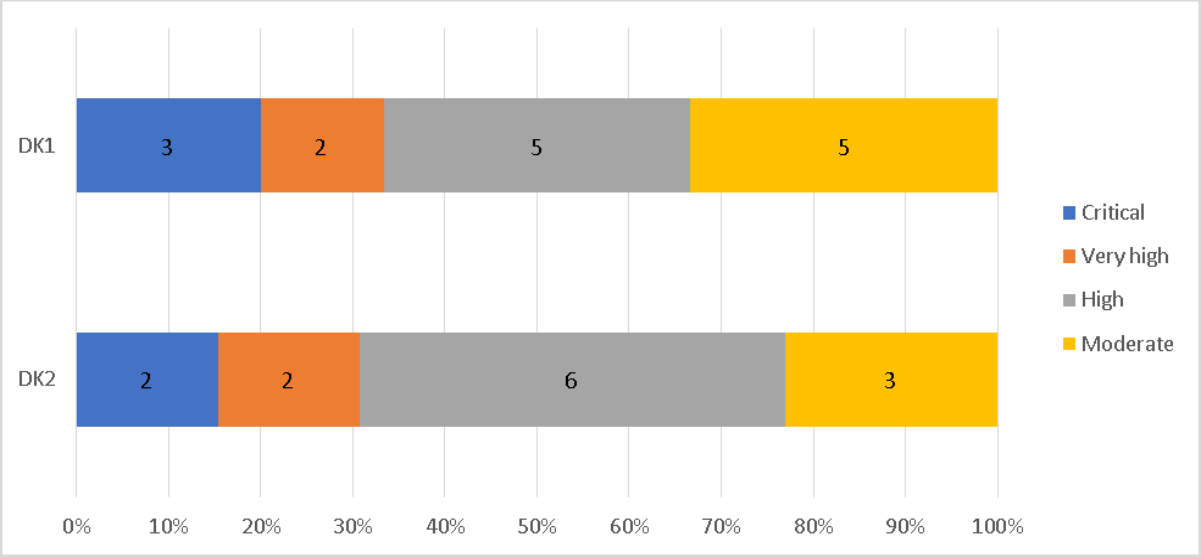
Note: Denmark did not report any measures of low priority.

Table A5 Category of priority by UoM

	Critical	Very high	High	Moderate	Grand Total
DK1	3	2	5	5	15
DK2	2	2	6	3	13
Grand Total	**5**	**4**	**11**	**8**	**28**
Average per UoM	**3**	**2**	**6**	**4**	**14**

Note: Denmark did not report any measures of low priority.

Figure A4 Visualisation of Table A5: Category of priority by UoM



Note: Denmark did not report any measures of low priority.

Timetable

Information about the timetable of the measures was not provided in the reporting sheets.

Measure details: authorities

Member States were requested to report information on:

- Name of the responsible authority (optional if 'level of responsibility' is reported);
- Level of responsibility (optional if 'name of the responsible authority' is reported).

Information about the responsible authorities was provided for all measures in the reporting sheets – these are different municipal authorities. The level of responsibility for all measures is municipal.

Measure details: progress

Member States were requested to report information on:

- Progress of implementation of measures (mandatory field) – this is a closed question whose responses are analysed below;
- Progress description of the implementation of measures (optional field) – this is an open text question for which not all Member States reported and whose answers are not analysed here.

Denmark reported information about the progress of implementation of the measures. The progress of implementation was reported as[80]:

- COM (completed);
- OGC (ongoing construction);
- POG (progress ongoing);
- NS (not started).

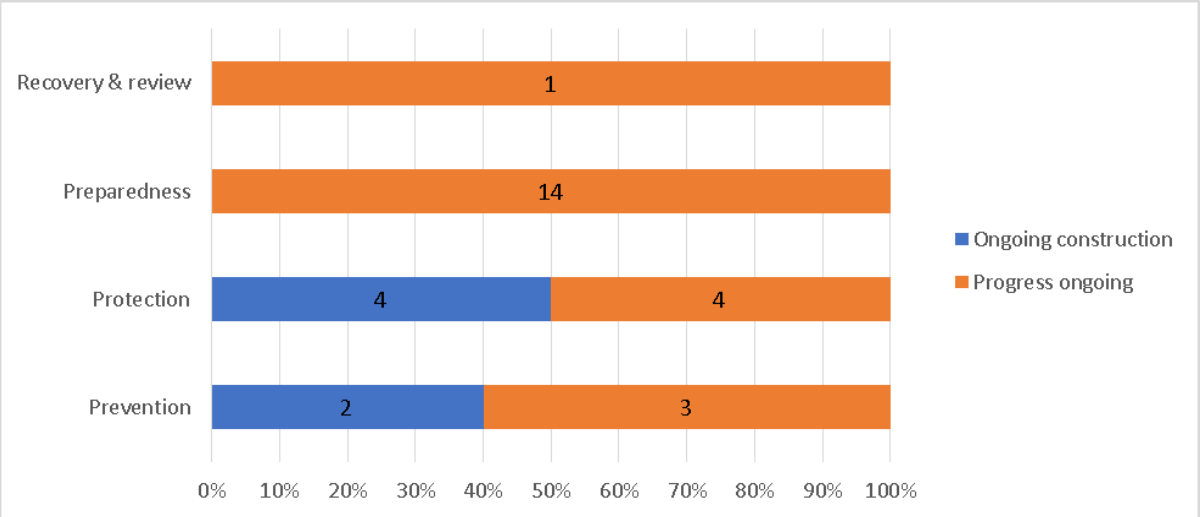
A full definition of these terms can be found at the end of this section.

Table A6 Progress of implementation by measure aspect

	Ongoing construction	Progress ongoing	Grand Total
Prevention	2	3	5
Protection	4	4	8
Preparedness		14	14
Recovery & review		1	1
Grand Total	**6**	**22**	**28**

Note: Denmark did not report any measures that are 'completed' or 'not started'.

Figure A5 Visualisation of Table A6: Progress of implementation by measure aspect



Note: Denmark did not report any measures that are 'completed' or 'not started'.

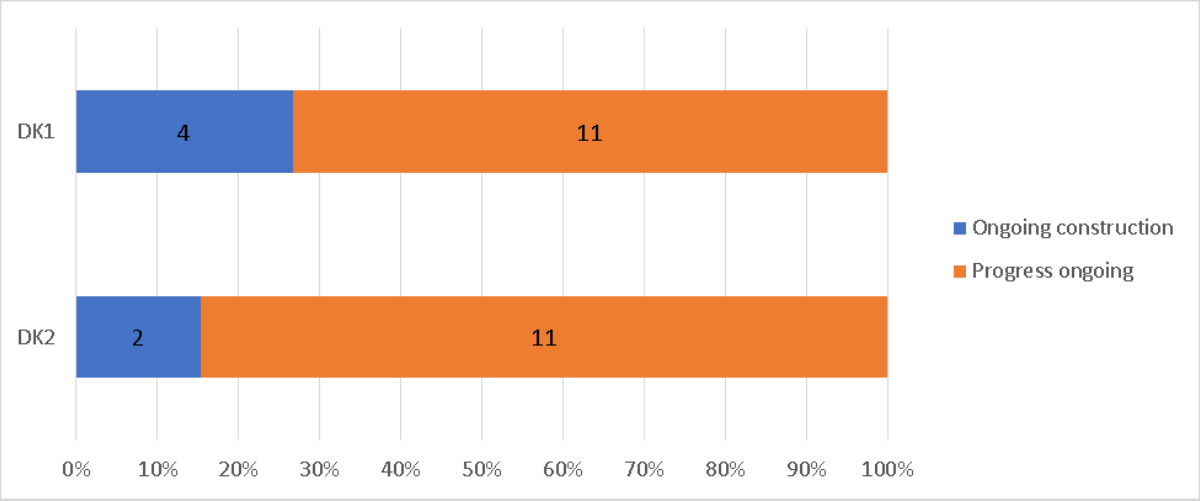
[80] Guidance for Reporting under the Floods Directive (2007/60/EC): https://circabc.europa.eu/w/browse/a3c92123-1013-47ff-b832-16e1caaafc9a

Table A7 Progress of implementation by UoM

	Ongoing construction	Progress ongoing	Grand Total
DK1	4	11	15
DK2	2	11	13
Grand Total	**6**	**22**	**28**
Average per UoM	**3**	**11**	**14**

Note: Denmark did not report any measures that are 'completed' or 'not started'.

Figure A6 Visualisation of Table A7: Progress of implementation by UoM



Note: Denmark did not report any measures that are 'completed' or 'not started'.

The categories describing the progress of measures are defined in the EU Reporting Guidance Document on the Floods Directive:

For **measures involving construction or building works** (e.g. a waste water treatment plant, a fish pass, a river restoration project, etc.):

- Not started (NS) means the technical and/or administrative procedures necessary for starting the construction or building works have not started.
- Progress on-going (POG) means that administrative procedures necessary for starting the construction or building works have started but are not finalised. The simple inclusion in the RBMPs is not considered planning in this context.
- On-going construction (OGC) means the construction or building works have started but are not finalized.
- Completed (COM) means the works have been finalised and the facilities are operational (maybe only in testing period in case e.g. a waste water treatment plant).

For measures involving **advisory services** (e.g. training for farmers):

- Not started (NS) means the advisory services are not yet operational and have not provided any advisory session yet.

- Progress on-going (POG) means the advisory services are operational and are being used. This is expected to be the situation for all multi- annual long/mid-term advisory services that are expected to be operational during the whole or most of RBMP cycle.
- On-going construction (OGC): Not applicable
- Completed (COM) means an advisory service that has been implemented and has been finalised, i.e. is no longer operational. This is expected only for advisory services that are relatively short term or one-off, and which duration is time limited in relation to the whole RBMP cycle.

For measures involving **research, investigation or studies**:

- Not started (NS) means the research, investigation or study has not started, i.e. contract has not been signed or there has not been any progress.
- Progress on-going (POG) means the research, investigation or study has been contracted or started and is being developed at the moment.
- On-going construction (OGC): Not applicable
- Completed (COM) means the research, investigation or study has been finalised and has been delivered, i.e. the results or deliverables are available (report, model, etc.).

For **measures involving administrative acts** (e.g. licenses, permits, regulations, instructions, etc.):

- Not started (NS) means the administrative file has not been opened and there has not been any administrative action as regards the measure.
- Progress on-going (POG) means an administrative file has been opened and at least a first administrative action has been taken (e.g. requirement to an operator to provide information to renew the licensing, request of a permit by an operator, internal consultation of draft regulations, etc.). If the measure involves more than one file, the opening of one would mean already "ongoing".
- On-going construction (OGC): Not applicable
- Completed (COM) means the administrative act has been concluded (e.g. the license or permit has been issued; the regulation has been adopted, etc.). If the measure involves more than one administrative act, "completed" is achieved only when all of them have been concluded.

Measure details: other

Member States were requested to provide information on:

- Other Community Acts associated to the measures reported (optional field);
- Any other information reported (optional field).

Information about these fields was not provided in the reporting sheets.

Annex B: Definitions of measure types

Table B1 Types of flood risk management measures[81]

No Action	
M11	No Action, No measure is proposed to reduce the flood risk in the APSFR or other defined area,
Prevention	
M21	Prevention, Avoidance, Measure to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation
M22	Prevention, Removal or relocation, Measure to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and/or of lower hazard
M23	Prevention, Reduction, Measure to adapt receptors to reduce the adverse consequences in the event of a flood actions on buildings, public networks, etc...
M24	Prevention, Other prevention, Other measure to enhance flood risk prevention (may include, flood risk modelling and assessment, flood vulnerability assessment, maintenance programmes or policies etc...)
Protection	
M31	Protection Natural flood management / runoff and catchment management, Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water.
M32	Protection, Water flow regulation, Measures involving physical interventions to regulate flows, such as the construction, modification or removal of water retaining structures (e.g., dams or other on-line storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime.
M33	Protection, Channel, Coastal and Floodplain Works, Measures involving physical interventions in freshwater channels, mountain streams, estuaries, coastal waters and flood-prone areas of land, such as the construction, modification or removal of structures or the alteration of channels, sediment dynamics management, dykes, etc.
M34	Protection, Surface Water Management, Measures involving physical interventions to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or though sustainable drainage systems (SuDS).
M35	Protection, Other Protection, Other measure to enhance protection against flooding, which may include flood defence asset maintenance programmes or policies
Preparedness	
M41	Preparedness, Flood Forecasting and Warning, Measure to establish or enhance a flood forecasting or warning system
M42	Preparedness, Emergency Event Response Planning / Contingency planning, Measure to establish or enhance flood event institutional emergency response planning
M43	Preparedness, Public Awareness and Preparedness, Measure to establish or enhance the public awareness or preparedness for flood events

[81] Guidance for Reporting under the Floods Directive (2007/60/EC): https://circabc.europa.eu/w/browse/a3c92123-1013-47ff-b832-16e1caaafc9a

M44	Preparedness, Other preparedness, Other measure to establish or enhance preparedness for flood events to reduce adverse consequences
Recovery & Review	
M51	Recovery and Review (Planning for the recovery and review phase is in principle part of preparedness), Individual and societal recovery, Clean-up and restoration activities (buildings, infrastructure, etc), Health and mental health supporting actions, incl. managing stress Disaster financial assistance (grants, tax), incl. disaster legal assistance, disaster unemployment assistance, Temporary or permanent relocation, Other
M52	Recovery and Review, Environmental recovery, Clean-up and restoration activities (with several sub-topics as mould protection, well-water safety and securing hazardous materials containers)
M53	Recovery and Review, Other, Other recovery and review Lessons learnt from flood events Insurance policies
Other	
M61	Other

Catalogue of Natural Water Retention Measures (NWRM)

NWRM cover a wide range of actions and land use types. Many different measures can act as NWRM, by encouraging the retention of water within a catchment and, through that, enhancing the natural functioning of the catchment. The catalogue developed in the NWRM project represents a comprehensive but non prescriptive wide range of measures, and other measures, or similar measures called by a different name, that could also be classified as NWRM.

To ease access to measures, the catalogue of measures hereunder is sorted by the primary land use in which it was implemented: Agriculture; Forest; Hydromorphology; Urban. Most of the measures however can be applied to more than one land use type.

Table B2 List of NWRMs

Agriculture	Forest	Hydro Morphology	Urban
A01 Meadows and pastures	F01 Forest riparian buffers	N01 Basins and ponds	U01 Green Roofs
A02 Buffer strips and hedges	F02 Maintenance of forest cover in headwater areas	N02 Wetland restoration and management	U02 Rainwater Harvesting
A03 Crop rotation	F03 Afforestation of reservoir catchments	N03 Floodplain restoration and management	U03 Permeable surfaces
A04 Strip cropping along contours	F04 Targeted planting for 'catching' precipitation	N04 Re-meandering	U04 Swales
A05 Intercropping	F05 Land use conversion	N05 Stream bed re-naturalization	U05 Channels and rills
A06 No till agriculture	F06 Continuous cover	N06 Restoration and	U06 Filter Strips

Agriculture	Forest	Hydro Morphology	Urban
	forestry	reconnection of seasonal streams	
A07 Low till agriculture	F07 'Water sensitive' driving	N07 Reconnection of oxbow lakes and similar features	U07 Soakaways
A08 Green cover	F08 Appropriate design of roads and stream crossings	N08 Riverbed material renaturalisation	U08 Infiltration Trenches
A09 Early sowing	F09 Sediment capture ponds	N09 Removal of dams and other longitudinal barriers	U09 Rain Gardens
A10 Traditional terracing	F10 Coarse woody debris	N10 Natural bank stabilisation	U10 Detention Basins
A11 Controlled traffic farming	F11 Urban forest parks	N11 Elimination of riverbank protection	U11 Retention Ponds
A12 Reduced stocking density	F12 Trees in Urban areas	N12 Lake restoration	U12 Infiltration basins
A13 Mulching	F13 Peak flow control structures	N13 Restoration of natural infiltration to groundwater	
	F14 Overland flow areas in peatland forests	N14 Re-naturalisation of polder areas	

Source: www.nwrm.eu