

## SEA of River Basin Management Plans: Incorporating Climate Change

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### Abstract:

In 2000 the European Parliament and the European Council passed the Water Framework Directive (WFD) to be implemented in the Member States, among these Denmark. The consequence of the directive is that the authorities shall prepare river basin management plans (RBMPs), which according to European and Danish legislation are subject to a strategic environmental assessment (SEA). A seemingly important environmental factor for the water sector is the repercussions of climate change, however, the prospect of the Danish authorities including climate change in their considerations are not good. This paper reviews the connections between climate change and water, in order to gain an overview of the consequences of climate change for the water environment and SEA of RBMPs. Based on this, the paper includes comments on the status for the inclusion of climate change in the preparation of the RBMPs and SEAs in Denmark.

*Key-words:* Strategic Environmental Assessment, River Basin Management Plans, Climate change

### 1. Introduction

In 2000 the EU issued the WFD, which sets up a framework for river basin management planning in Member States. The directive dictates preparation of RBMPs, containing environmental goals for the quality of all surface and groundwater within the water district, and a programme of water management activities in order to reach these goals. (Directive 2000/60/EC 2000) The directive is implemented in Danish legislation, and the seven national environmental centres are obliged to prepare the RBMPs for the four Danish river basins (LBK nr 316 2004; Danish Ministry of Environment n.d., 5). As a Danish addition to the provisions of the directives, the 98 Danish municipalities will prepare action plans, containing specific directions for the implementation of the RBMPs within their geographical area (Danish Ministry of the Environment, n.d. 10). SEA in accordance with the EU directive from 2001 and resulting in the Danish *Law on Environmental Assessment of Plans and Programmes* from 2001, applies to both the state RBMPs and the municipal action plans. This will be elaborated on in Section 2. This paper takes its point of departure in the SEA of RBMPs.

SEA includes a broad concept of environment, however, in this paper focus is on climate change and how this should be considered in SEA of RBMPs. In Denmark it has been decided that climate change will not be taken into consideration in the first generation of RBMPs. This decision has been taken centrally, in the Danish Ministry of the Environment, and in relation to a question posed in parliament it is stated that “*the present technical basis for such assessments is not sufficient*” (Danish Ministry of Environment 2007). The state environmental centres are performing the SEA of RBMPs, but this work has not yet begun, and it has not been decided how climate change will be handled in SEA of the RBMPs, or in the action plans and the subsequent SEA. From telephone interviews with the national environmental centres, it appears that some of the environmental centres have received input concerning climate change from the public. Because of among others this issue, four of the seven interviewees from the state environmental centres believe that climate change will in some form be included in the SEA of the RBMPs.

Internationally there are examples of practical guidance on how to include climate change in EA and SEA, for instance by Levett-Therivel Sustainability Consultants (2007) and The Federal-Provincial-Territorial Committee (2003). The purpose of this paper, is to reflect further over the implications of including climate change in SEA of the RBMPs and action plans in the Danish context.

### *Structure and Approach*

In Section 2 of this paper, the connections between the SEA Directive (SEAD) and the WFD are briefly described as part of the introduction. Following this, in Section 3, a model of the impacts of climate change on the water environment is set up. On basis of this, in Section 4, reflections over incorporation of climate change into SEA of RBMPs are presented, followed by conclusions in Section 5. Regarding approaches, the above introduction utilises seven telephone interviews with the Danish state environmental centres. The interviews were carried out in January 2008, and the interviewees were either responsible for the SEA or working on the RBMP. Further a literature study is used for the model in Section 3.

## **2. SEA and the Water Framework Directive**

As stated above, plans and programmes prepared for water management, including RBMPs, are covered by the SEAD. In the WFD it is also stated by the Commission that the SEAD needs to be taken into account during implementation (Directive 2000/60/EC).

The procedural links, explored by Carter and Howe (2006), between the WFD and the SEAD show common requirements including the collection of baseline data, assessment, mitigation, monitoring and consultation and public participation. A further link can also be found regarding reporting processes. That both directives share a common goal of sustainable development and have overlapping procedures, are reasons for a growing consensus that an integrated approach when applying SEA to RBMPs is beneficial (Deasly and Preston, 2007; Carter and Howe, 2006). Integration as a strategy is also in line with the SEAD, which aims to avoid duplication (Art. 4(1), 5(2) and 5(3)).

RBMP is a type of plan likely to have significant effects on the environment – hereunder also on the climate, which is the environmental parameter in focus in this paper. Screening and scoping within SEA, though, is not only based upon an assessment of how the RBMP may affect the environment. How the environment affects the plan is also a matter which determines whether a plan is subject to SEA or not, and what should be within the scope of assessment. According to the SEAD (Annex 2), one of the “*criteria for determining the likely significance of effects referred to in Article 3(5)*” is “*environmental problems relevant to the plan or programme*”. Covered by this criterion is climate change and how climate change influences the RBMP. Since the RBMPs are focused on the water environment, connections between climate change and the water environment is relevant, and is explored in the following section.

## **3. Connections between Climate Change and the Water Environment**

It is stressed, among others by UNEP (2007, 120), that climate change has a potential to influence the water environment: “*Climate change is expected to exacerbate pressure, directly or indirectly, on all aquatic ecosystems.*”

In Figure 1 a simple causal model of probable negative effects of climate change on the water environment in Denmark is drawn up. The model shows the temperature rise and other climate change, implications of this for water, consequences for the water environment, and effects on the environmental baseline represented by the environmental factors included in the European SEAD.

The model is based on a literature study of predictions of climate change including Sonnenborg et al. (2006), Danish Ministry of Finance et al. (2007), Muller (2007) and Footitt and McKenzie (2007). The effects on the environmental baseline are not based on the literature study, and should be regarded as illustrative examples rather than an exhaustive survey.

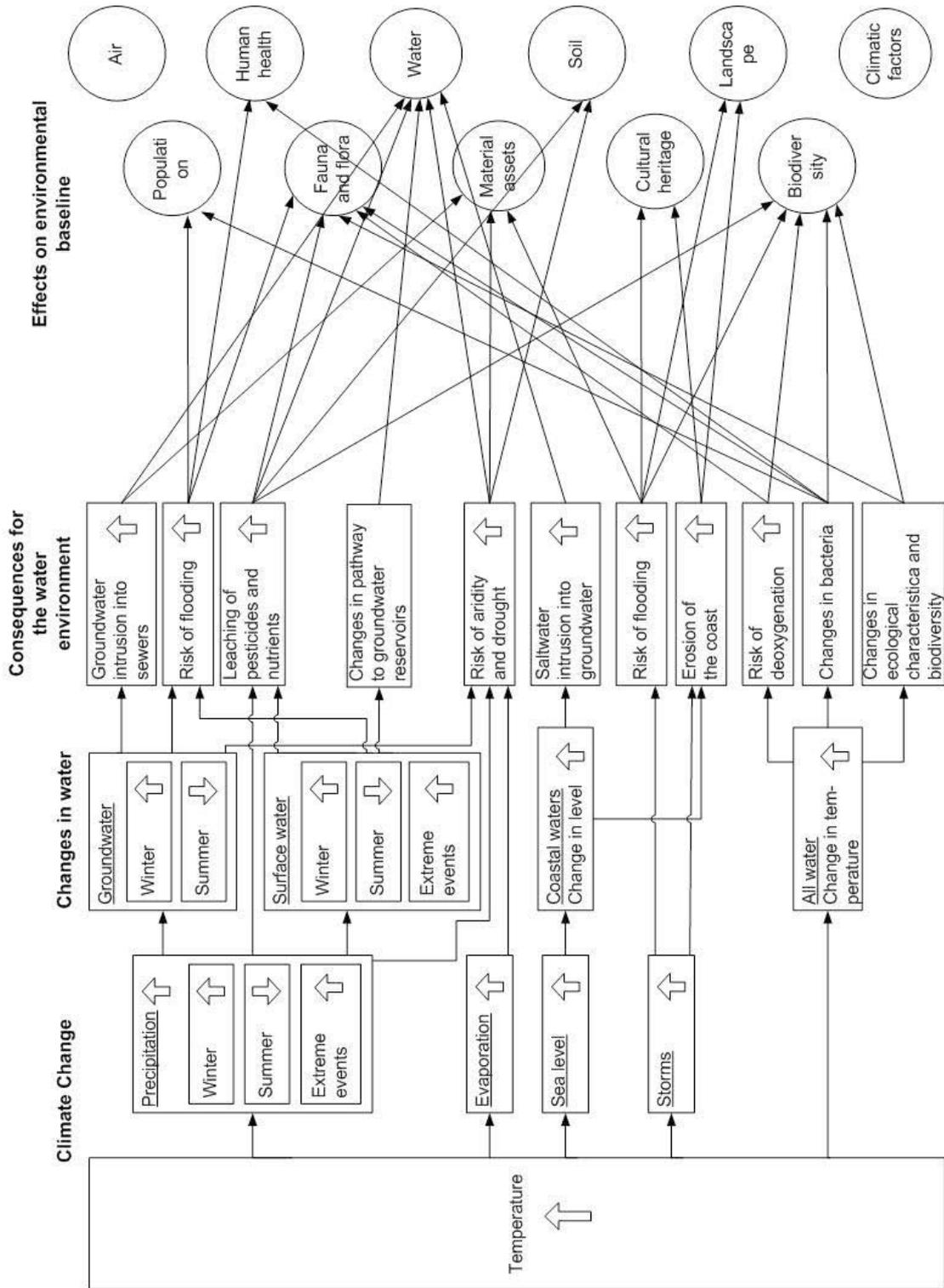


Figure 1 Model of the effects of climate change on the water environment

It should be noted that the model has a number of limitations, as stated in Table 1.

Model limitations	
It does not include reasons for temperature rise	It does not include human interference
It does not depict geographical variations	It does not represent a course of time
It does not show complexity of multiple stresses	It does not include feedback mechanisms

Table 1 Limitations of the model

The model shows that climate change can have a number of consequences for the water environment, and in turn a number of effects on issues such as population or biodiversity, which are part of the baseline for SEA. As stated in Section 2, any effects of climate change on the water environment is relevant to consider in SEA of the RBMPs, and when coupling this with the information in Figure 1 it appears that climate change is an important factor in SEA of RBMPs. In Section 4 an overview how to include climate change in SEA of RBMPs is given.

#### 4. Implications for SEA

Through its influence on the water environment as illustrated by Figure 1, climate change has implications for performing SEA of RBMPs. Three ways in which climate change should be considered, are shown in Figure 2.

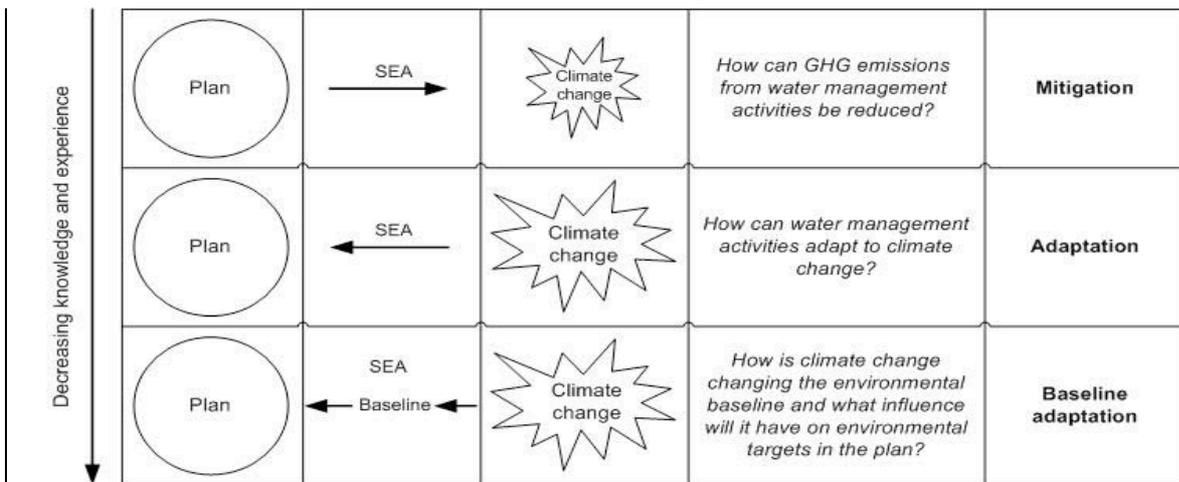


Figure 2 Climate change in SEA of RBMPs

Starting with the first line in Figure 2, SEA includes the effects of the plan on climate change. This means that SEA of RBMPs should include any contribution of the proposed water management activities to GHG emissions and climate change. Thus SEA of RBMPs includes mitigation.

Regarding the second line in Figure 2, SEA also includes assessing the impacts of climate change on the plan. As stated in Section 3, climate change can have multiple effects on the water environment, and because water is the issue dealt with in the RBMPs, it is clearly relevant to incorporate into SEA considerations of how climate change will affect the issues dealt with in the RBMPs. On the basis of this, adaptation measures (like e.g. natural retention of flood water and coastal protection infrastructure) can be integrated into the plan of water management activities, and thus society's resilience to climate change can be improved.

Finally, regarding the third line in Figure 2, when performing SEA, the impacts of climate change on the baseline of the assessment, and thus on the SEA as a whole, should be considered. As shown in Figure 1, climate change results in effects on almost all of the environmental factors in the baseline. Examples of how climate change changes the baseline, or the ecological status, and make this dynamic and uncertain, are e.g. changes in the water temperature and dissolved oxygen, changes in the aquatic fauna and flora, and changes in river flows (Wilbye et al., 2006; Footitt and McKenzie, 2007). This in turn influences the setting and achievement of the environmental targets of the plan. Thus setting the baseline in SEA for RBMPs is a complex task, and adaptation of the baseline to a changing and dynamic environment is necessary.

The arrow to the far left in Figure 2 illustrates that there is most knowledge and experience in dealing with mitigation of greenhouse gases, while there is less knowledge and experience with adaptation, and least with baseline adaptation.

## 5. Conclusion

In this paper the up-coming SEA of RBMPs is discussed. It is shown that climate change can have a range of impacts on the water environment ultimately influencing the environmental parameters in the baseline for SEA. This makes climate change a relevant part of SEA of RBMPs with their focus on the water environment. In this paper, three issues regarding climate change in SEA of RBMPs are pointed out: mitigation of climate change, adaptation to climate change and adaptation of the baseline (ecological status).

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