

# Integrated River Basin Management and Flood Risk Management Planning in Germany

W. Wendler<sup>a</sup>

<sup>a</sup>Leibniz Institute of Ecological and Regional Development (IOER)  
Weberplatz 1, 01217 Dresden, email: w.wendler@ioer.de

## Abstract

European water legislation demands from all Member States the establishment of river basin management plans (Art. 13 WFD) and flood risk management plans (Art. 7 FD). Coordination between both management strategies is intended (Art. 9 FD), but widely left to the Member States.

The analysis of intersections between river basin and flood risk management planning reveals numerous linkages and overlaps in the field of “naturogenic” and anthropogenic driving sources. The planning cycles offer both potential synergistic effects and conflicts concerning data requirements, objectives and the planning of measures. Hence, approaches for usage of synergetic effects and/or handling of conflicts between river basin and flood risk management planning are needed. Propositions for adjustment of both management approaches are made in this paper.

**Keywords:** European water policy, WFD, Floods Directive, river basin management, flood risk management, spatial planning, sectoral integration

## 1 Introduction: Planning instruments of European Water Policy

By adopting the Water Framework Directive (WFD, [1]) and releasing a proposal for a ‘European Directive on the assessment and management of floods’ (Floods Directive, FD, [2]) the European Commission is creating a common legislative framework for water policy in all Member States. Both directives use the instrument of plans as a strategy to achieve their objectives.

River basin management planning (RBMP, Art. 13 para. 7 WFD) aims at achieving a good ecological status of all water bodies by 2015. The flood risk management plans (FRMP, Art. 7 FD) are supposed to ensure appropriate levels of flood protection. Coordination between the two planning instruments on river basin level is intended (Art. 9 FD). The questions to be answered are at which planning steps of river basin and flood risk management coordination is required, and how it can be achieved.

## 2 Approach

Firstly, natural processes in river basins were analysed in order to reveal where relevant processes for RBMP and FRMP are redundant or linked. Using the DPSIR model (cf. [3], [4]) and the SPRC model (cf. [5], [6]) as theoretical background, starting points for RBM and FRM were ascertained and overlaps identified.

Secondly, river basin and flood risk management plans were screened for objectives, measures and planning procedures possessing possible synergies and conflicts. As no river basin and flood risk management plans fulfilling WFD and FD requirements are adopted yet, the directives, correspondent German law, model projects, older planning instruments, recommendations of research projects and public authorities were examined instead. Objectives and management targets were deduced from the theoretical background and directives regulation. In the following, the potential effects of measures and instruments regarding the achievement of management targets were assessed.

Once having identified the planning steps that exhibit possible synergies or conflicts, potential methods for adjustment are proposed.

### **3 Results: Requirements of coordination between river basin management and flood risk management**

#### **3.1 Overlap of natural processes of relevance for river basin and flood risk management**

The instruments and objectives of the Water Framework Directive (WFD) and Floods Directive (FD) are concurring management approaches in the river basin. On the one hand, ecocentric river basin management (RBM) aims at reducing emission and immission of pollutants as well as at the protection and improvement of the state of aquatic ecosystems and their floodplain. On the other hand, the anthropocentric oriented flood risk management (FRM) tries to avoid flooding and to protect the society from floods.

However, both management approaches are compulsorily based on the same process factors, like landscape and water household processes and human influence (cf. [7]: 342). Examples for coupled components and processes are climate variability including climate change, characteristics of the river basin district (e. g. topography, soils, vegetation ...), and processes in the channel like run-off generation, groundwater recharge, transport of particulate matter and sedimentation, hydraulic discharge or exchange with the floodplain and wetlands. The anthropogenic intervention in the natural system (e. g. use of land or water) influences both the ecological and chemical status of water bodies and the flood risk.

#### **3.2 Synergies and conflict potential of river basin and flood risk management**

##### **3.2.1 Objectives, targets, indicators**

The objectives of WFD are characterised in Art. 4, Art. 9, Art. 10 WFD, while the FD commits the definition of "appropriate objectives" for flood risk management of the areas at risk widely to the Member States (Art. 7 para. 2 FD). Based on the directives and the theoretical background, management targets have been deduced from the more or less abstract objectives.

Synergies of targets appear particularly in relation to "improvement of ecological structure", "reduction of input from diffuse sources" or "limitation of anthropogenic changes of ground water" (RBM), and "creation of room for overflowing", "retention of water" and "adaptation of land use in the flood plain" (FRM). Conflict potential especially arises from targets involving hydromorphological structure in cases where enhancing flood protection implies the degradation of river morphology, physico-chemical characteristics and thus the biological quality of rivers.

Monitoring of ecological and chemical state partially uses the same indicators as the assessment of flood risk management strategies, e. g. discharge, number of pollutants in the flooding area, water quality during a flood event, groundwater level.

##### **3.2.2 Instruments and measures**

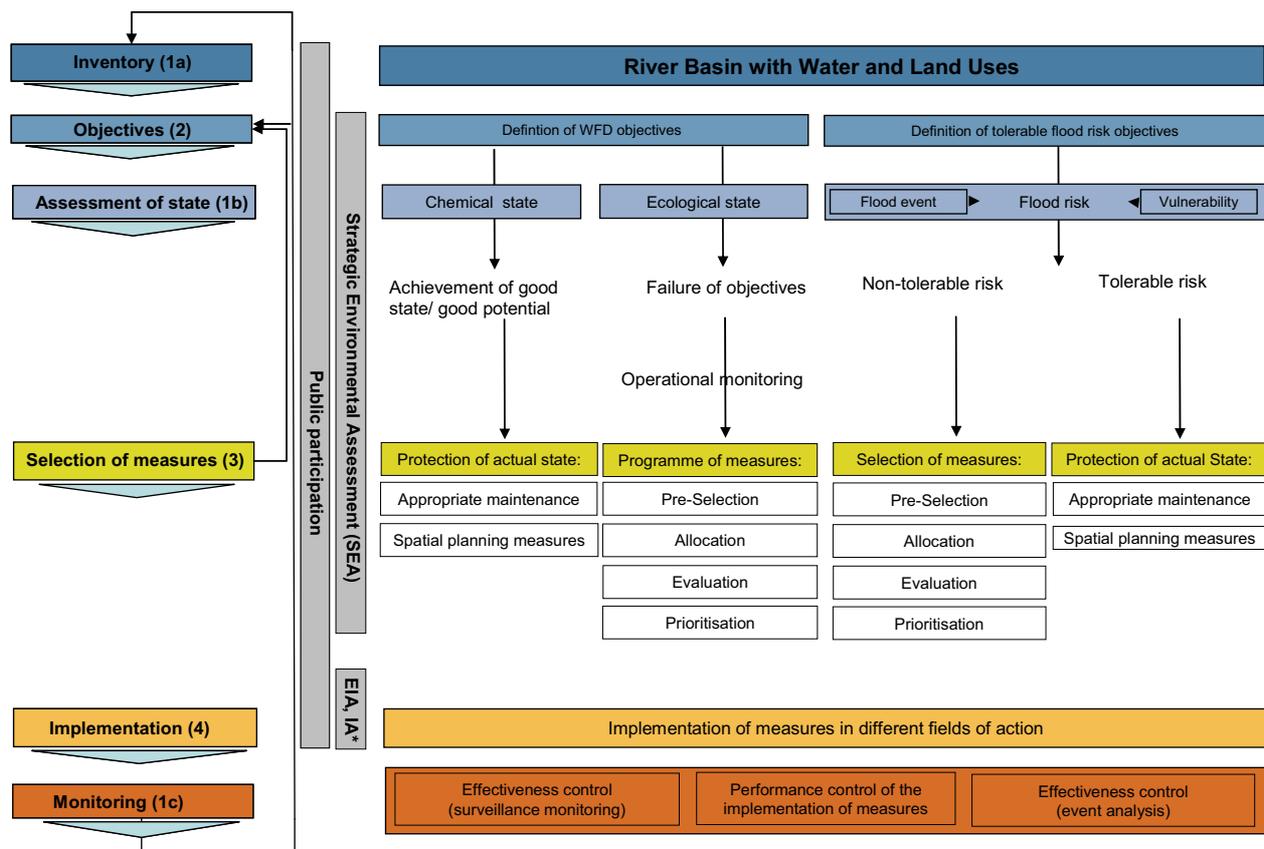
Possible interventions of river basin and flood risk management are numerous and are not restricted to water management but involve different fields of action. In the catchment river basin or flood risk management, actions are settled in the fields of agriculture, forestry, water supply, water distribution, and waste water management. They show predominantly synergic positive effects because they aim at the detention either of water or pollution which are coupled processes (cf. section 3.1).

Spatial and environmental planning instruments can be powerful tools for support and adjustment (see below) of both river basin and flood risk management measures in the catchment and along river stretches. By means of "mitigation measure banks" or (inter)communal "compensation area pools" connected passages along rivers may be saved for optimal ecological development as well as overtopping flood events. Several "non-structural" flood risk measures (cf. [8]) in the channel or floodplain may be used either for river basin or flood risk management. Often they are also in line with the objectives of nature protection.

Numerous conflicts become evident concerning construction measures and their maintenance. Longitudinal structures, lateral structures connected to quantitative and qualitative sediment management and regulated polder often oppose to the achievement of good ecological status. But their removal or the rehabilitation of water bodies may cause an augmenting flood risk for areas with high vulnerability. That's one reason why some pressures or impacts of the ecological state of water bodies will stay inevitable and/ or irreversible. Therefore, compensatory measures will play an important role in the implementation of the WFD.

#### **3.3 Planning steps with necessity for reconciliation**

The analysis of synergy and conflict potentials between river basin and flood risk management plans reveals thematic overlaps as well as the necessity for coordination in almost all planning steps (cf. figure 1).



**Figure 1.** Demand for adjustment in different steps of river basin and flood risk management planning. **1a-c** Inventory, Monitoring of state of water bodies (WFD) and of flood risk assessment (FD) share data requirements. **2-3** Objectives and Selection of measures show strong synergies and conflict potentials that need to be adjusted (cf. Section 3.2). **4** Implementation of measures demands for adjustment of responsibilities, funding and priority setting. **Abbreviations:** **EIA** – Environmental Impact Assessment, **IA** – other impact assessments (e. g. impact regulation according to Sections 18 et seq. Nature Conservation Act, appropriate evaluation according to Art. 6 para. 3 Habitats Directive)

### 3.4 Approaches for the reconciliation of river basin and flood risk management

In every planning step showing a demand for reconciliation, agreements for the cooperation of river basin and flood risk management and procedures for reconciliation need to be developed. In table 1 instruments for the identification of potential synergies or conflicts are proposed.

**Table 1.** Instruments for the identification of possible synergies and conflicts of river basin and flood risk management

Planning step	Instruments for the identification of potential synergies and conflicts
A Definition of objectives	Identification of conflicts between RBM and FRM targets is integrated in <ul style="list-style-type: none"> <li>- the review of environmental impacts of human activity and economic analysis of water use (Art. 5 WFD),</li> <li>- the definition of environmental objectives and verification of exemptions (Art. 4 WFD)</li> </ul>
B Selection of measures	Pre-selection of potential measures: <ul style="list-style-type: none"> <li>- A catalogue of all relevant measures for river basin and flood risk management and their positive and negative effects on targets of RBM, FRM and other management sectors (e. g. agriculture, nature protection, urban development ...) would be a useful tool</li> </ul> Allocation and evaluation of measures: <ul style="list-style-type: none"> <li>- The summary of measures in the FRMP (see annex A Floods Directive Number 4) include flood related measures taken under the Directives of Environmental Impact Assessment (EIA),</li> </ul>

	<p>Seveso II, Strategic Environmental Assessment (SEA) and WFD. Thus, it is compulsory to demonstrate and use synergies.</p> <ul style="list-style-type: none"> <li>- The analysis of cost-effective combination of measures should not only include the cost and effectiveness of the actions for RBM but as well the benefits and costs for FRM and other management targets. Thus, synergies and conflicts can be identified. Due to the effort, a traditional “quantitative” cost-benefit-analysis (CBA) is rarely applicable in practice. Instead the costs and benefits can be assessed by qualitative methods.</li> <li>- The Strategic Environmental Assessment (SEA) of WFD programmes of measures and of flood risk management plans includes the assessment of synergies and conflicts between FRM and WFD measures and targets</li> <li>- Instruments of spatial planning (regional plans, urban development schemes) can visualise overlapping zones e. g. priority areas/ areas of reservation for groundwater protection, flood retention, nature and landscape protection and thus help identify synergy potential and conflicts</li> <li>- A plan of conflicting zones and synergistic measures can be developed. Therefore instruments of landscape planning can be used if applicable.</li> </ul>
C Implementation of measures	<p>Detailed planning of the implementation of measures is the last step where positive and negative effects of a measure on RBM, FRM and other environmental objectives are assessed. Therefore existing procedures can be used including</p> <ul style="list-style-type: none"> <li>- the authorisation of measures according to the German Water Act,</li> <li>- the Environmental Impact Assessment (EIA),</li> <li>- the German impact regulation according to Sect. 18 et seq. German Nature Conservation Act,</li> <li>- the appropriate evaluation according to Art. 6 para. 3 Habitats Directive,</li> <li>- the German spatial impact assessment for spatially significant projects such as large reservoirs, dams and flood polders or transport projects</li> </ul>
All planning steps	<p>The different responsible authorities need to identify common data requirements within the scope of inventory, surveillance or monitoring.</p> <p>All important stakeholders can be assembled in a river (sub-)basin commission which can be used to identify synergies and conflicts as well as to adjust different management targets</p>

Concerning conflicts between FRM and RBM objectives the WFD grants less stringent environmental objectives (Art. 4 para. 3 a iv, Art. 4 para. 7, Annex II para. 2.4 WFD) due to flood risk management.

As for the (pre-)selection of measures, authorities should clearly outline priority criteria. One criterion for the selection of measures could be that the actions accord to RBM targets and FRM targets and / or avoid conflicts between them. Those actions preferred should be promoted by regulatory instruments (laws or decrees), economic instruments (funds, pricing) and sectoral planning instruments.

The planning of measures needs to use and adapt existing water planning instruments and other sectoral plans e. g. agricultural or forestry development schemes, urban development schemes, management plans of protected areas as well as plans of sewage systems. For instance, local communities need to be incited to use community pre-emption or (inter)communal “compensation area pools“ in favour of the development of green corridors along rivers. Where executed, the SEA can be used for adjustment, the mitigation of conflicts and the support of positive synergistic effects. Also the integration of external costs and benefits into calculation of prices for hydropower, navigation, flood protection or their contribution to mitigation of impacts should be envisaged (cf. [9]).

The mentioned authorisation procedures for the implementation of measures (cf. table 1 line C) do generally integrate the denomination of avoidance, mitigation or compensatory measures. In this context a maintenance concept for quantitative and qualitative sediment management can be useful for adjustment of the interests of RBM, FRM, nature protection, navigation and mining.

Synergies referring to inventory, surveillance, or monitoring data can be capitalised on if the responsible authorities agree about standards for data acquisition, collection and recording. Where possible the same indicators should be applied. For instance, RBM indicators can serve as indicators for the achievement of the FRM target “limitation / reduction of ecological vulnerability of channel and flood plain”.

## OUTLOOK

The author is developing a theoretical framework for an integrated river basin management plan in Germany. Within this work methods for reconciliation of river basin and flood risk management should systematically be reviewed. Finally, the concept will be discussed with concerned authorities.

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