

Identification of significant pressures and impacts upon receiving waters

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Abstract This study gives a review on the process of identification of significant pressures and impacts, which is an important part of river basin planning and in particular for implementing the EU Water Framework Directive (WFD) (2000/60/EC). The questions: what is a “significant pressure” in terms of the WFD? which sources and driving forces have to be regarded? which data can be used? which pressure on a water body is significant? and which implications and requirements result from the identification process? – should be considered. The European Commission requires reporting from all Member States about the status of the water bodies within a river basin district and about the risk of failing the environmental objectives by the end of 2004. Therefore, a number of prevailing projects across Europe aim to develop a guideline on a common understanding of the most effective approach towards the identification of significant anthropogenic pressures, and the analysis of potential impacts including the identification of appropriate tools and models. In such a guideline suitable and intelligent criteria have to be developed in order to enable a uniform assessment of the anthropogenic pressures within a river basin district.

Keywords EU Water Framework Directive; impacts; pressures; receiving waters; river basin management

Introduction

The EU Water Framework Directive aims to achieve a good surface water and groundwater status 15 years after the date of entry into force of this directive at the latest. Therefore one of the key, on-going processes in river basin planning is the integrated analysis of the impact of human activity on the status of surface water bodies and groundwater (Article 5) (see Figure 1). An important issue is the identification of significant anthropogenic pressures and the assessment of their impacts on water bodies (Annex II, WFD).

The WFD does not give specifications for criteria allowing the identification of significant pressures and impacts. For this reason a common understanding of the most effective approach to the identification of anthropogenic pressures on a river basin and the analysis of potential ecological impacts of these pressures has to be developed.

Basically, the WFD intends to protect an almost natural status of water bodies both for human uses and their ecological functions. These objectives require a shift of strategies from water quality issues towards an ecological orientated management, because the existing ecological deficits of running waters in many cases are no longer determined by point sources, but from a series of complex anthropogenic influences including diffuse pollution and morphological status. Therefore, ecological status refers not only to water quality, but in many cases to the catchment properties and the status of river beds and banks. These issues are considered within the WFD, because the ecological status is defined on biological, hydromorphological and physico-chemical elements (Annex V). Measures for water protection can be regarded as being efficient only if they aim towards a meaningful balance between improvements of the water quality and improvements of the morphological properties, since the ecological condition of a running water is a result of all anthropogenic impacts on the abiotic conditions and the communities (Figure 2).

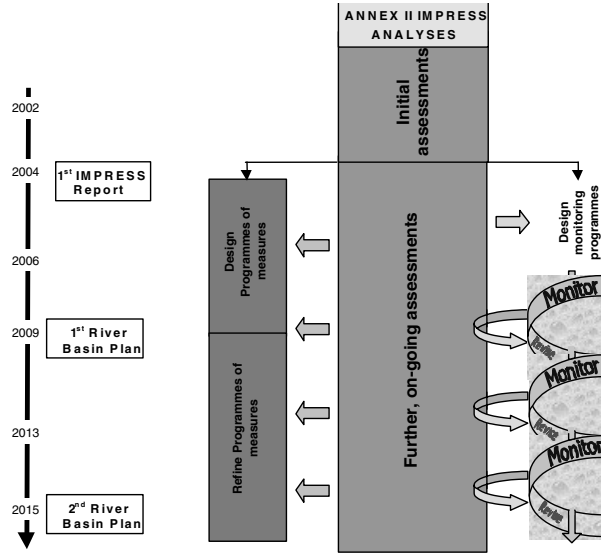


Figure 1 Pressures and impacts analyses are a key and on-going process within the planning cycle. The initial assessments should be refined after 2004 to the extent necessary for effective river basin management planning (from: CIS working group 2.1 “Analysis of pressures and impacts. Policy summary” 2002b)

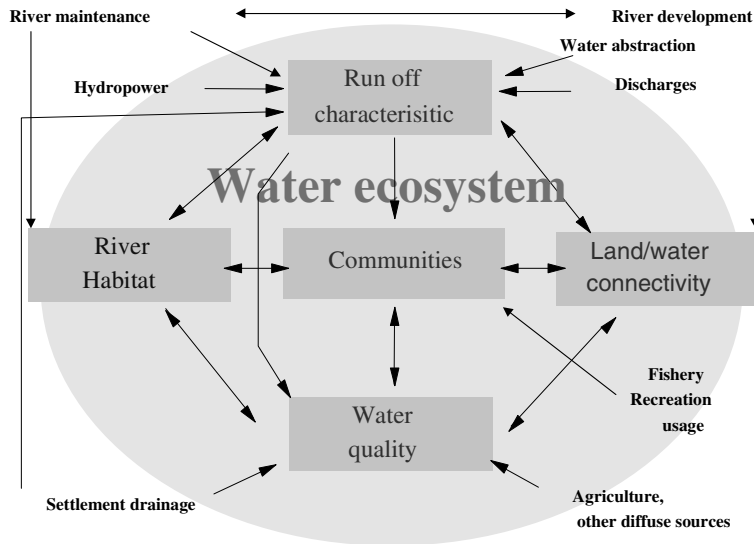


Figure 2 Compartments of running water ecosystems – interactions and anthropogenic influences (from: Borchardt and Mohaupt, 2002)

However, there are substantial differences between the individual river basins according to considerable differences in existing uses. Therefore, there is a need for screening procedures which support the identification of significant pressures in order to focus the analyses according to their ecological relevance in subsequent planning steps. Another point needing attention is the fact that the assessment of the impacts on a water body requires a defined area. The collected data and information have to be referred and aggregated to particular scales. Presently an observation area of approximately 500 km² to 2,500 km² is proposed, for specific conditions the area can be smaller.

Methods

General approach to the identification of significant pressures and their impacts

The following definitions are used in the general approach:

Pressures are:

- pollutions from point and diffuse sources
- alterations of the water regime (water abstraction, water flow regulation)
- uses which lead to morphological alterations of the water bodies.

Impacts are:

- modifications of the quality elements resulting from one or a number of pressures, which potentially leads to a failing of the environmental objectives set under Article 4

The identification of the pressures and the assessment of their impacts should be performed in subsequent steps (WFD Annex II, 1.4 and 1.5). The following provisions are given by the WFD:

1. Identification of pressures with potential impacts on the status of a water body = significant pressure (Annex II, 1.4). Collection of available emission data (referring to existing directives listed in Annex II, 1.4) and of data on the state of the water bodies from environmental monitoring.
2. Assessment of these impacts (Annex II, 1.5) ⇒ risk of failing the environmental quality objectives set under Article 4? For this step primarily the data on the state of the water bodies shall be used. For those water bodies identified as being at risk further analyses shall be carried out in order to optimise the design of both the monitoring programmes (Art. 8) and programmes of measures (Art. 11).

Against the background of the schedule (report to the Commission until end of 2004), the compilation and assessment of all anthropogenic pressures has to be carried out primarily on the basis of existing knowledge on the waters and available data from environmental monitoring. To determine the significant pressures from point and diffuse sources the references to other EU directives in Annex II 1.4, WFD, give hints for the substances to be included in the assessment. According to these directives the required information about the significant pressures may be existent in part. Because the WFD gives no criteria to assess whether a pressure is significant or not, they have to be derived separately. It is necessary to agree on uniform, intelligent criteria. In principle there are two basic complementary approaches, possibly working in parallel. On the one hand there are broad indicators and indices, which potentially indicate significant pressures within a catchment. Further available chemical and morphological data for catchment areas which do not exceed 2,500 km² can be used for a detailed assessment.

Criteria for the identification of significant pressures and an assessment of their impacts

To identify significant pressures and to assess their impacts, different working groups are developing methods and criteria. One example is the Strategy paper from the LAWA Working group on significant pressures and impacts (LAWA, 2002). In this paper some criteria for the identification of pressures and impacts are given. These criteria are also listed in the “Guidance for the analysis of pressures and impacts” of the CIS Working-group on pressures and impacts (CIS Working-group 2.1, 2002a). The LAWA criteria are summarized in the following table:

Results and discussion

The Member States are obliged to estimate significant anthropogenic pressures within a river basin district (WFD, Annex II, 1.4), to assess the impacts on the status of water bodies

Table 1 LAWA criteria for the identification of significant pressures

Pressures	Examples for quantitative expressions
Point sources	
Public sewage treatment plants	> 2000 PE (derived from Urban Wastewater Treatment Directive 91/271/EEC) Annual volume of water discharge Population (P) and population equivalents (PE) Substance loads according to Annex I of the German Wastewater Directive Annual loads of priority substances, substances of the quality objective directive, and river basin-specific substances, insofar as these substances are limited by water directives
Industrial direct discharge	Statement of systems according to IPPC Directive = pollutants according to EPER Annual loads of plants with obligation to report according to IPPC Directive: consideration of the particular size threshold for the annual load of 26 substances (cf. Table 1: Size thresholds; EPER) Annual loads of priority substances, substances of the quality objective directive, and river basin-specific substances, insofar as these substances are limited by water directives Food industry facilities >4,000 EP
Storm water/combined wastewater discharges	Discharge of wastewater from an urban area >10 km ² Urban areas can be estimated e.g. based on CORINE-landcover, multiplied with discharge coefficients
Discharges with heat load	Discharges with heat load > 10 MW
Salt discharges	Discharges > 1 kg/s chloride
Diffuse sources	
	Diffuse sources in general are surveyed during the inventory taking for groundwaters. Normally these data can be used also for the description of surface water bodies (this does not apply to erosion from surfaces with a gradient > 2%. If no results from description of groundwaters are available, the following values can be used for an estimation of diffuse pressures: – urban land > 15% – agriculture = 40% – sugar beets, potatoes and corn = 20% of agricultural land – special crop land (vineyards, fruits, vegetables, etc.) = 5% of agricultural land – livestock intensity: > 1.5 animal unit equivalents (AUE) per hectare – contaminated land = individual case
Water abstraction	
Water flow regulation	
Anthropogenic barriers	Parameter "anthropogenic barriers" (Stream habitat survey): ≥ 6
Backwater	Parameter "backwater" (Stream habitat survey): = 7 Diversion stretches > 1 km
Morphological alterations	
	Stream habitat survey and comparable data
Impacts	Examples for quantitative expressions
Saprobic status	> 30% of stream network > national biological quality level (here: biological quality level II)
Trophic status	> 30% of stream network > national quality level (here: trophic class > II, assessment based on concentrations of Nitrate-N > 6 mg/l and Phosphate-P > 0.2 mg/l; 50-percentile)
Chemical substances	Exceeding existing quality objectives or quality criteria of EU directive 76/464/EEC and knowledge about entries of priority substances
Warming	According to the EU Fish-Life Directive (78/659/EEC): – max. annual temperature: >21.5°C (salmonid water body) >28°C (cyprinid water body) – max. winter temperature: >10°C (salmonid water body) >10°C (cyprinid water body) – max. warming up: 1.5 K (salmonid water body) 3.0 K (cyprinid water body)
Salinisation	Median: Cl = 400 mg/l
Morphology	River habitat survey – overview method: – more than 30% of the river distances within the management unit are surveyed with structural quality classes 6 or 7 for the compartment "river bed" – impairment of river continuity (anthropogenic barriers, backwater) >30% of stream network

and, based on this, the susceptibility of the water bodies (WFD, Annex II, 1.5). A number of requirements will be needed to undertake the analysis of pressures and impacts: an understanding of the terms “Pressure” and “Impact”, methods for estimating pressures and impacts, information sources and tools for the analysis of data. Because of the short time schedule (first report at the end of 2004), and to modulate the effort, the estimation shall primarily be carried out on the basis of already existing data. The criteria given above to identify the pressures and impacts may not be considered as cut off criteria, but rather serve for the inventory. If the assessment of impacts indicates the potential failing of quality objectives in the first inventory, a more detailed characterisation of the water bodies including the anthropogenic pressures will be necessary. Thus, the process of linking the pressures and impacts is an iterative process (cf. Figure 1). The assessment of the impacts currently cannot take into account the status of a water body, because the reference conditions for surface water bodies are not completely known and still have to be evaluated. For this purpose a EU-funded research project (REFCOND, CIS Working-group 2.3, 2002) is currently developing guidelines for the identification of reference conditions.

Conclusions

The Water Framework Directive obligates all Member States to ensure a review of the impacts of human activities for each river basin district (Article 5). This review includes the identification of significant pressures. In the definitions of the WFD a significant pressure exists, if it can be reasonably assumed that this pressure can have an impact on the ecological status of a water body. The origins which have to be reviewed are discharges from point and diffuse sources, effects of modifying the natural water regime, alterations of the morphology and land use including fishery and forestry. For these groups criteria must be defined to allow estimations on the basis of available data. If water bodies are identified to be at risk of failing the environmental objectives set under Article 4, monitoring programmes (WFD, Article 8) and programmes of measures (WFD, Article 11) have to be established.

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