



## Observations on Sediment Management in River Basin Management Plans

A key component of the Water Framework Directive is the development of River Basin Management Plans (RBMP) which set out the necessary actions within each river basin to achieve set environmental quality objectives. The plans will be reviewed on a six yearly basis.

Drafts of the first version of RBMPs that have become available recently have been screened by members of the SedNet steering group or affiliated colleagues. The specific sections in this document do not necessarily reflect SedNet's views, nor does this compilation claim completeness. The SedNet steering group would like to stimulate the debate and highlight implications for management, research and policy.

On 6 and 7 October this year SedNet will organize another Round Table Discussion on Sediment Management in River Basin Management Plans. The outcome of this discussion will be presented in the SedNet conference, taking place in Hamburg from 7-9 October. The final conference program will soon be available for download from the SedNet website.

### The Danube River

The Danube River Basin is the "most international" river basin in the world covering territories of 19 countries. The 14 Danube countries with territories greater than 2.000 km<sup>2</sup> within the basin are joined under the framework of the International Commission for the Protection of the Danube River. With an area of 807,827 km<sup>2</sup> the Danube River Basin District is the largest one under the jurisdiction of the EU WFD.

The Danube Basin Analysis (WFD Article 5 report) published in 2005 enabled the identification of four Significant Water Management Issues (SWMI), which can directly or indirectly affect the status of both surface water and groundwater:

- Pollution by organic substances
- Pollution by nutrients
- Pollution by hazardous substances
- Hydromorphological alterations

Because the identified SWMIs cover the issues relevant for sediment management only partially it was decided to insert into the first river basin management plan in the Danube River Basin District an overview of pressures and impacts concerning the sediment quality and quantity including a summary of the preliminary recommendations as well as the necessary actions to be taken before the programme of measures can be set.

The Danube river basin management plan is still under preparation, more details on sediment issues will be available after an official adoption of the plan for public consultation in May 2009.

International Commission for the Protection of the Danube River ([www.icpdr.org](http://www.icpdr.org))

## The River Rhine

The River Rhine is the second largest river of Central Europe, both in terms of length (1,320 km) and catchment area (approx. 200,000 km<sup>2</sup>) and runs between the Alps and the North Sea. The Rhine basin goes through the seven EU member states (Italy, Austria, France, Germany, Luxemburg, Belgium, The Netherlands) and two non EU member states (Liechtenstein, Switzerland). The Rhine is one of the most intensively used rivers on earth. The most important uses are shipping, water power, industry, municipalities, agriculture, drinking water, high water protection and recreation. About half of the Rhine basin is used for agricultural purposes, more than one third contains woods and nature area and about 10% is urbanised area.

The Rhine states which are members in the International Commission for the Protection of the Rhine (ICPR) presented a coordinated management plan as is required by the Water Framework Directive (WFD). This plan consists of two parts. Part A is being compiled under the umbrella of the ICPR ([www.iksr.org](http://www.iksr.org)). It is based on the national planning efforts (Parts B), that is coordinated by the different member states (e.g. for The Netherlands at [www.kaderrichtlijnwater.nl](http://www.kaderrichtlijnwater.nl)) and in the case of Germany by the different federal states (e.g. for Rheinland-Pfalz [www.wrrl.rlp.de](http://www.wrrl.rlp.de)). The management plans and the respective action programmes were published as drafts on 22 December 2008 and are open to the public for comments until the end of June 2009.

Mandated by the ICPR, the ICPR expert group "SEDI" since 2005 elaborates a comprehensive strategy for sediment management in the Rhine basin. Main objectives are a Sediment Management Plan for contaminated sediments addressed to competent authorities for implementation in measure programs according to WFD and the "improvement of sediment quality in order to relocate dredged material without harm" (Art. 3 of the ICPR Rhine Convention). The group consists of experts from the countries Switzerland, Germany, France and The Netherlands. Water management authorities, waterways and shipping directorates, environment ministries and scientific institutes are involved.

In the first Rhine management plan (Part A) both qualitative and quantitative aspects of the sediment regime are taken into account. Important statements of the first plan are:

- With regard to priority substances, sediments can be a sink for contaminants which at the long term can cause problems with regard to reaching the good chemical status.
- HCB, just like PCB, is one of the contaminants which negatively influences the sediment quality. All measures in this respect have been taken and direct emissions of HCB are not known. Contamination of the water body takes place indirectly from contaminated sediments. Highly contaminated sediments will be remediated.
- Due to anthropogenic measures of the river system (construction of dikes and barrages) the sediment distribution in the Rhine has drastically changed. Next to these hydromorphological changes, large-scale contaminant emissions in the last decades have led to the deposition of large quantities of contaminated sediments in the river. To this day the sediment quality has been negatively influenced by this, because due to high floods or dredging activities historic contaminated sediments were redistributed in the Rhine basin and its tributaries.
- Also measures to improve sediment dynamics are summed up. The measures mentioned are the improvement of barrages, the adjustment of groins and the restoration of sediment transport in appropriate areas to retain and maintain the eroding functioning of the river.

- Last but not least the Sediment Management Plan for the Rhine is mentioned in the Rhine management plan, which will be finalized in the course of 2009.

For the River Rhine the member states decided not to include the measures which are recommended in the Sediment Management Plan in the first Programme of Measures of the WFD management plan (Plan A). It is up to the member states to include sediment quality measures in their Plan B. A good example of this is the Dutch approach, where measures from the national remediation programme are included in the plan, which adds up to the removal of a total of 5.3 million m<sup>3</sup> contaminated sediments.

## The River Elbe

The Elbe is the third largest river of Central Europe, both in terms of length (1,091 km) and catchment area (148,268 km<sup>2</sup>). The German part of the basin encompasses two thirds of the entire area, one third lies in the Czech Republic, and less than 1% in either Austria or Poland. The Elbe stands out among Central European rivers for its natural resources, e.g. its wetland and floodplain-forest habitats. At the same time the Elbe basin is a European region with dense population, highly developed industry, intensive agriculture, and a very long industrial history and tradition in mining.

The states belonging to the international river-basin district of the Elbe presented a common management plan consisting of two parts. Part A is being compiled under the umbrella of the International Commission for the Protection of the River Elbe ([www.ikse-mkol.org](http://www.ikse-mkol.org)). It is based on the national planning efforts (Parts B), that is coordinated in the case of Germany by the River Basin Community Elbe ([www.fgg-elbe.de](http://www.fgg-elbe.de)). The management plans and the respective action programmes were published as drafts on 22 December 2008 and are open to the public for comments until the end of June 2009. A series of national and international symposia will be held to acquaint the public with their major contents and to give explanations and justifications.

The first Elbe management plan highlights sediments as an essential and integrated part of the river and the influences they exert on the near-shore riparian structures. Qualitative and quantitative aspects of the sediment regime are taken into account with view both to the assessment of the ecological status and to the deriving of supra-regional management objectives. First measures for improving the sediment budget and the quality of sediments have been planned. Important statements of the first plan are:

- Measures for an improved bedload balance and sediment management are envisaged to reduce hydromorphological stress. The express objective for the future is to establish and implement principles of bedload and sediment management at the level of the whole river basin. Such a comprehensive approach has never been taken before.
- Significant contaminant loads belong to the most important supra-regional issues in water-resources management. The management plan underlines that contaminated sediments are one of the major reasons of this dissatisfying situation. Accordingly, one of the objectives is to establish a management concept for particle-bound contaminants at river-basin scale still in the first management period.
- Sediment quality was crucial for the definition of supra-regional environmental objectives regarding the contaminant issue. Generally, the objectives were formulated under consideration of the following standards:
  - Environmental quality standards of the EU WFD (water phase).
  - Environmental quality standards of specific pollutants; on some of these contaminants sediment-quality standards exist (e.g. As, Cu, Cr, Zn, PCBs).

- Guidelines for the protection of the marine environment (OSPAR); quality standards therein refer to sediment.
- Quality requirements with regard to relevant uses of the water body such as fishery, farming in floodplains. Here, for a number of pollutants (e.g. Hg, Cd, HCB, dioxins) sediment-quality standards found consideration through model analyses and exposure scenarios.

International Commission for the Protection of the Elbe River ([www.ikse-mkol.org](http://www.ikse-mkol.org))

## The Scheldt River

The Scheldt River is a small transboundary river system in North-Western Europe. The source is in the North of France and it continues through Walloon, Flanders (two of the regions in Belgium) and the Netherlands. A distinction is made in Belgium for the two regions, because water policy and management differs between the two regions. The Scheldt is 350 km long and covers a catchment area of about 21,000 km<sup>2</sup> which is inhabited by 10,000,000 persons (477 persons/km<sup>2</sup>). The Scheldt is known as one of the most polluted systems within Western Europe, but quality is improving mainly due to an increase of sewage treatment in Belgium in the last two decades. Extensive monitoring programs have been established especially in the Flemish and Dutch areas. Monitoring networks for sediment quality and bioaccumulation are only available for Flanders. Each region developed its own RBMP and the International Commission for the Scheldt (ICS, [www.isc-cie.com](http://www.isc-cie.com)) worked out an overall management plan for the coordination of water management with regard to the most crucial water management issues.

The overall RBMP of the ICS recognizes 7 important water management issues. Measures with regard to sediments are considered for two of these issues. Monitoring of sediments in the coastal area is suggested in function of the restoration of water quality of the transboundary surface water, while the quality should be further investigated to reduce pollution with basin specific compounds like PCBs. In the RBMP for the Scheldt estuary, managed by the Dutch government, sediments are almost completely neglected. Sediments are only recognized as a diffuse source of phosphorus, nitrogen and arsenic for groundwater. No measures are further suggested for this. Also in the RBMP of Walloon and France sediments are neglected.

In Flanders sediments are considered as a major obstacle in reaching a good ecological status, but at the same time sediments are a problem for nautical and hydraulic functions of the water systems. Therefore monitoring and management of sediments are fully integrated in the RBMP for the Flemish part of the Scheldt, taking into account that the natural sediment balance, including sedimentation and erosion processes, should be protected or even developed. Monitoring of sediments should focus both on quality of the sediment as on erosion and transport processes.

The program of measures in the RBMP of Flanders is divided into nine groups of which one is focusing integral on sediment related issues. The objectives that are kept in mind with the suggested program of measures are:

- Reducing land erosion and sediment transport to surface water
- Reducing transport and settlement of sediments to protect nautical and hydraulic functions
- Priorisation of sediment management options based on ecological, geomorphological and hydraulic criteria

- Guarantee dredging activities for nautical and hydraulic functions in such a way that maintenance is kept to a minimum
- Sustainable remediation of polluted sediments

The costs for the basic program of measures related to sediments as suggested in the proposed RBMP are estimated at an investment cost of 6.2 million Euro and an operational cost of 217 million Euro per year. This is  $\pm 30\%$  of the costs of the total program of measures. When additional measures are incorporated the estimated operational costs for the sediment related measures are 350-441 million Euro per year, exclusive costs for temporary storing or disposal capacity.

The program of measures for sediment related problems developed in Flanders considers sediments from source to sink, but there is a need to expand this plan to the whole catchment.

## The River Meuse

The River Meuse rises in France (in Pouilly-en-Bassigny) at an altitude of 384 m above sea level and flows with a length of 905 km through Belgium and the Netherlands to the North Sea. Its basin of 34,548 km<sup>2</sup> covers parts of France, Luxembourg, Germany, Belgium (most of the Walloon Region and part of Flanders) and The Netherlands. The most important tributary river basins of the Meuse river basin district are those of the rivers Chiers, Semois, Lesse, Sambre, Ourthe, Roer, Swalm, Niers, Dommel and Mark. Several of these rivers are transboundary. The number of inhabitants in this basin is close to 9 million. The average discharge of the river Meuse is 250 m<sup>3</sup>/s, but, being a 'rain river', the discharge fluctuates greatly over the year. The Meuse is used as water source for Brussels, Antwerp, Rotterdam and other towns. Other important functions are the use of water for agriculture and shipping.

Conventions on the protection of the Meuse led in 1998 to the establishment of the International Commission on the Protection of the Meuse (ICPM, [www.meuse-maas.be](http://www.meuse-maas.be)). The members of the ICPM are France, the Walloon, Flemish, and Brussels Capital regions of Belgium, the Netherlands, Luxembourg and Germany. For the coordination of the river basin management within the WFD, in 2002 a treaty was accepted by the member states.

The Meuse River Basin Management Plan (RBMP) consists of an overall management plan and separate plans for the French, Wallonian, Flemish and Netherlands parts of the Meuse. The overall RBMP contains a description of the river, the management objectives, measures and the organization of the work. Problems in the basin include urban wastewater from the Belgian part of the basin, much of which is still not treated, and accidental pollution. Moreover, water shortages can occur in summer, which has given rise to water allocation problems between Belgium and The Netherlands. Finally, flooding is a problem. An extensive program of measures will be carried out between 2010 and 2015, in order to improve the chemical and ecological status of the river Meuse. In the overall Meuse RBMP sediment management is not mentioned directly. However, the management of sluices, barrages, hydropower facilities and shipping are mentioned as important management tasks, and therefore indirectly sediment quantity issues certainly need to be addressed. Sediment contamination is mentioned in the RBMPs of Wallonia and The Netherlands. In The Netherlands dredging of contaminated sediments are included in the program of measures. In about 25 locations in the river basin, a total area of about 12 km<sup>2</sup> will be selected for removing about 325,000 m<sup>3</sup> contaminated sediments.

## **The River Po**

The River Po is the largest Italian river, both in terms of length (about 620 km) and catchment area (approx. 71,000 km<sup>2</sup>). The watershed includes most part of northern Italy, with a population of about 16 million inhabitants. The area is heavily industrialized, but also agriculture and animal farming are intensively carried out.

The Po River flows into the Northern Adriatic, where it represents the main freshwater input and therefore significantly influences water and ecosystem quality, due to the semi-enclosed morphology of the basin.

The Po River Basin is recognized by the Italian law as a District, according to Directive 2000/60/EC definition. The development of the RBMP in the Po River is being coordinated by the Po River Basin Authority ([www.adbpo.it](http://www.adbpo.it)), established in 1989.

The RBMP is still under preparation and the public consultation phase started on 30 March 2009, with the publication of the consultation timetable and work programme.

The river and its tributaries suffer from a diffused deepening of their beds, associated to narrowing and deactivation of secondary branches. This in turn causes the impossibility of withdrawing water for irrigation, because of the lowering of minimum flow water levels, and the need of reshaping several navigation locks.

Sediment management is therefore focused on hydromorphology, rather than on contamination.

The River Basin Authority approved since year 2006 Plans to manage alluvial sediments along the Po riverbed, that are now being integrated and transferred into the RBMP.

Strategic guidelines are the following:

- safeguarding of natural fluvial forms and processes;
- restoration of erosion processes, solid transport and sediment deposition through the abandonment or the adjustment of presently ineffective or useless manufacts;
- restoration of natural forms, through the reactivation of lateral branches.

Most probably, the sediment issue in lakes and in transitional/coastal area will be taken into account in the first release of the Plan (2009-2015) only as far as the assessment is concerned, but this is still under consideration.

## **Sediment issues in UK River Basin Plans**

Sediment issues in the UK have not been specifically prioritised in the first round of draft River Basin Plans, which are currently out for consultation. Issues surrounding soil erosion and the subsequent impact on game fish spawning habitats (in Chalk streams in lowland England particularly) have been recognised and are partly addressed in some Plans through existing agricultural advisory programmes, but there is little understanding of other sediment related issues. Particularly lacking is the role of sediments in pollutant flux through either catchments or in the water column. Significant criticism of the draft plans was expressed by NGOs and other stakeholders at a recent conference in London (The Water Framework Directive; River Basin Management Plans: Responding to the Consultation - Stakeholder Views, CIWEM, 11 February 2009). Some generic concerns expressed relevant to sediments were:

- There is a lack of ambition in the Plans with only 19% of rivers (by length) compliant with good status expected by 2015.

- There is a lack of clarity as to “how” the outcomes will be achieved, especially the huge leap to >60% compliance by 2027. Most people felt that the measures to achieve compliance in 2027 need to be in place now and the current Plans are largely a statement of the status quo.
- Neither the local nor general publics have been engaged in the process. Stakeholder involvement has been at a very high level, so much work (by NGOs and others) at the local (water body) scale has not been recognised in the Plans.
- In particular Local Authorities have not been engaged. They fail to see “what’s in it for them” with no extra funding and no clear vision expressed to engage them. How the Plans will integrate with spatial planning is not clear. One barrier to communication with planners and others is that the “non-use” benefits of improving land and water systems have not been taken into account sufficiently well.
- The Plans express the need to be 95% certain of there being a problem before a measure can be put in place. This level of certainty is simply not possible given the lack of data or understanding of the processes in many places and therefore an excuse for inaction. This is particularly relevant for sediments and other key issues not addressed because of concerns over costs masquerading as uncertainties about the evidence or the science. A quotation from a delegate: “The standards and the characterisation have been sold to us as ‘best science’ but are actually ‘best affordable science.’ For example, we were told initially that there is no evidence that over-supply of fine sediment has a deleterious effect on aquatic ecology. No impartial freshwater ecologist would make this statement and clearly budgetary constraints or ignorance influenced this position.” (Dr Dylan Bright, West Country Rivers Trust Director, UK)
- The lack of data and information published in the Plans makes it difficult to assess the issues identified in relation to each other. Concerns were expressed over whether the right pressures have been identified and if they have whether the measures were adequate.
- The Plans do not identify clear goals, particularly for the physical restoration of river and estuary habitats. A call was made for Plans to establish a “catchment restoration programme” with adequate funds for targeted pilot studies.

## The River Ebro

The River Ebro is the second largest basin in the Iberian Peninsula (approx. 85,000 km<sup>2</sup>) and one of the largest in the Mediterranean basin. The watershed includes most part of north-eastern Spain, with a population of about 3 million inhabitants. Agriculture is the most important land use, with irrigation covering hundreds of thousands of hectares along the catchment. Extensive afforestation has taken place along the second half of the 20th century, especially in mid-mountain areas both in the Pyrenean and the Iberian ranges, reducing water and sediment to drainage networks and lowlands. Together with changes in land use, dams and gravel mining are seen as the key factors for the substantial decline of the river’s sediment load to the lowlands and the delta. The Ebro River Basin is managed by the Ebro Water Authorities ([www.chebro.es](http://www.chebro.es)), established in 1926. This organisation is the responsible for the elaboration of the RBMP that is in preparation and of which part is already under public consultation. According to available documentation, measures on sediments will be indeed part of the RBMP, but mostly related to sediment as polluted waste. Despite well documented sedimentary disequilibriums in the catchment, sediment quantity issues (e.g. reservoir siltation, sediment deficit and effects on river-coastal systems) are not yet fully acknowledged in the RBMP

preliminary reports, and solid transport and sedimentation is only subsidiary mentioned in relation to flood mitigation.

## **Situation in Greece**

The Directive 2000/60 has been transposed into Greek Legislation by law 3199/2003 and Presidential Decree PD 51/2007. Law 3199/2003 mainly regulates the administrative structure for the implementation of the directive and PD 51/2007 transposes the important articles of the Directive 2000/60. Greece is divided into 14 water districts, each one including several river basins with similar hydrological and hydro-geological characteristics. In compliance with article 3 of the water directive, 45 river basins have been identified and 76 water bodies have been recognized. Seven of the river basins are transnational. Currently a study is underway by the Hellenic Center for Marine Research for the monitoring and establishment of ecological status in surface and coastal waters, in compliance with article 8 of the directive. This study is expected to be ready in April 2009. Sediment quality is considered indirectly in terms of the analysis required for the identification/characterization of the ecological status. Preliminary plans for the management of water resources have been prepared for all 14 water districts and they were open to public consultation in September 2008. However the emphasis on these plans was mainly on water quantity issues and less on water quality and in this respect they do not constitute "true" RBMPs. Sediment quality or sediment transport issues were not considered in these plans. Two pilot RBMP studies have recently been completed for the rivers Nestos and Strymonas. Both are transboundary rivers with catchments in Bulgaria and Greece. The studies are not yet open to consultation. Sediment quality is again considered indirectly.

## **Conclusions**

These few pages on WFD compliant River Basin Management and sediment management show a great variety. The river basins are different in size and challenges, and the solutions are as diverse as the recognition of sediments in the plans is. Also we trust that readers will appreciate that these texts have been written by different authors.

It seems to be clear that sediments need to be mentioned in the plans – which is not new to the SedNet community. In most plans they are recognized in one way or the other. But it would be too early to draw more conclusions now, not knowing the different backgrounds, drivers and reasons in depth. Therefore, at the same time, it can be questioned whether the role of sediments in these river basin management plans has been sufficiently addressed, and whether this could limit the effectiveness of the programs of measures.

In its October 2009 Round Table discussion Sednet will review several River Basin Management Plans with invited speakers. We expect many more insights thereafter and hope to be in a position then to compare and to draw general conclusions.

You are invited to come to the SedNet conference to get latest news from that event, or to read the outcome report which will be published in due time after the Round Table discussion.

SedNet steering group  
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