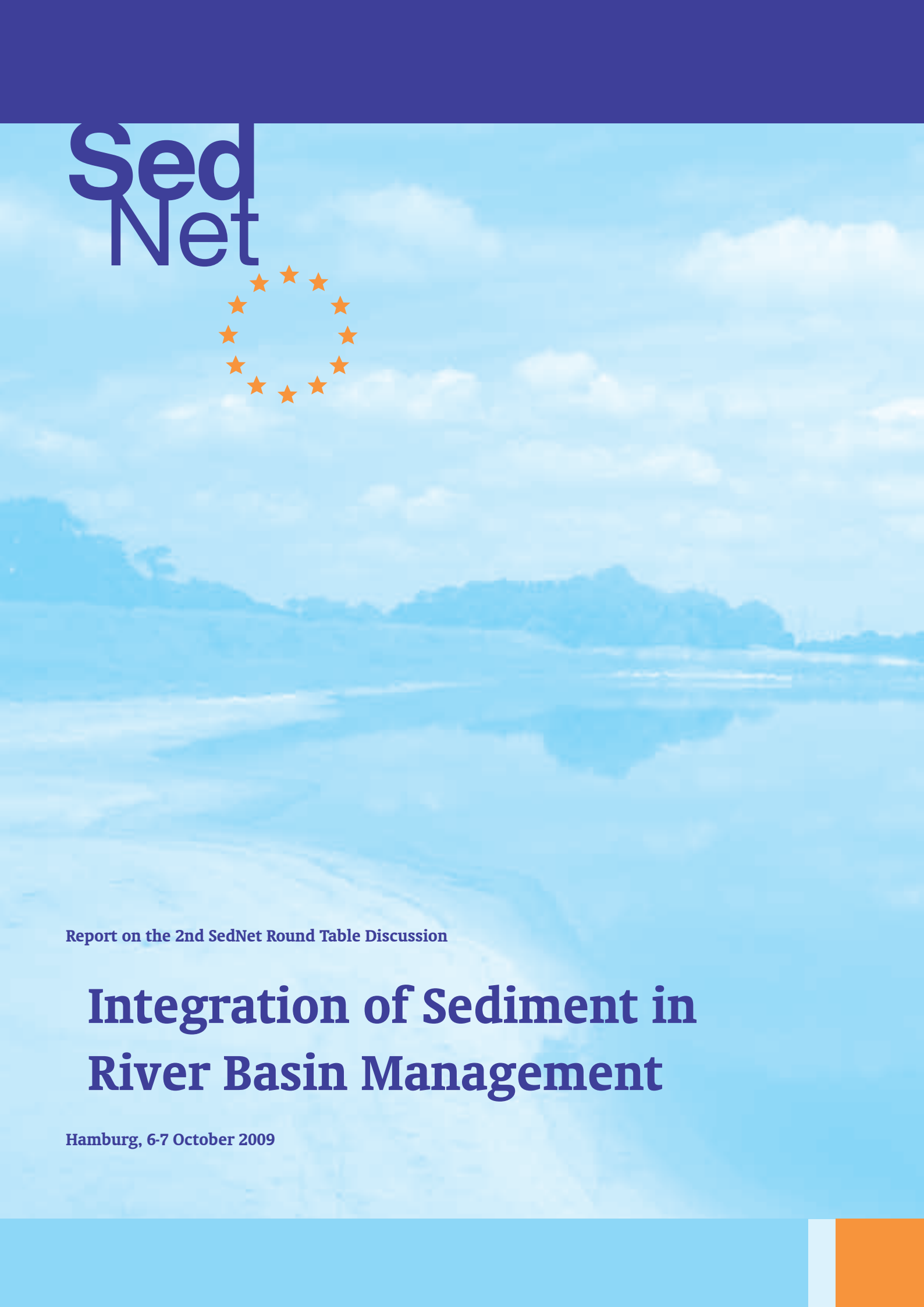


Report on the 2nd SedNet Round Table Discussion

Integration of Sediment in River Basin Management

Hamburg, 6-7 October 2009

About SedNet

SedNet is a leading European network aimed at incorporating sediment issues and knowledge into European strategies to support the achievement of good environmental status and to develop new tools for sediment management. SedNet focuses on all sediment quality and quantity issues at a river basin scale, ranging from freshwater to estuarine and marine sediments.

SedNet has regular conferences and workshops, including a 2006 workshop entitled 'Sediment management – an essential element of river basin management plans' and a subsequent round table meeting on this topic in October 2009 the findings of which are summarised in this paper. Further information about these events, other network information and documents, and various references can be found on: www.sednet.org.

SedNet started in 2002 as a Thematic Network with funding from the European Commission DG-Research under the 5th RTD Framework Programme. It was initially aimed at setting up a European network in the field of 'assessment of fate and impact of contaminants in sediment and dredged material and at sustainable solutions for their management and treatment'. Since 2005 SedNet has run independently from the European Commission and has broadened its scope.

SedNet brings together experts from science, administration and industry. It interacts with various other networks in Europe that operate at the national or international level and focus on specific fields such as science, policy making, sediment management, industry and education.

Acknowledgements

SedNet wishes to thank all Round Table participants who contributed their time, experience and energy to the discussion and who provided the information compiled in this report. Special thanks to Jan Brooke and Paul Bardos, who not only collated the information into this report but also assisted with the drafting and checked the English.

Contents

Key messages and recommendations

Sediment is an essential, integral and dynamic part of our river basins. Where human activities interfere with sediment quantity or quality, sediment management becomes necessary.

Effective sediment management requires a holistic approach taking into account:

- system understanding;
- the integrated management of soil, water and sediment;
- transboundary cooperation;
- upstream-downstream interrelationships; and
- stakeholder involvement.

The causes and effects of sediment issues can be widespread both in terms of area and time. Direct interrelationships may sometimes be difficult to determine. Sediment planning and management therefore have to deal with uncertainty. Decisions and actions cannot wait for a perfect understanding: they will need to be based on information where available and reasonable assumptions where not.

Sediment issues may affect various environmental and legal objectives, and many different uses and interests. Effective, integrated sediment management will benefit from early engagement with a wide range of stakeholders and true dialogue.

Sediments are an integral part of the river basin system. It therefore seems logical to seek to realise relevant opportunities to link sediment management to river basin management and, where appropriate, to the Water Framework Directive (WFD).

Although it is clear that good environmental status in a water body also requires a good sediment status, more knowledge is required to enable the various linkages between sediment management and WFD objectives to be properly understood. Win-win solutions aimed at achieving both WFD and sediment management objectives are often possible.

Guidance is needed on how to include sediment management in river basin planning. Short term actions could include the collation of case studies and the preparation of guidance to help sediment managers and river basin managers understand the links between sediment and water, to prepare sediment management plans, and to promote the inclusion of sediment management issues in the second round of River Basin Management Plans (RBMPs) where it is relevant and beneficial to do so. Work on these plans is likely to begin as early as 2012.

At river basin level work will be needed to identify relevant aspects of sediment management where there would be clear mutual benefits associated with integration. In some cases this may extend only to discrete aspects, for example particular win-win opportunities. In others, the comprehensive integration of a wide range of sediment management opportunities may be justified. In either case, guidance should enable sediment managers to take appropriate steps to ensure the necessary early engagement and true dialogue.

In the short term (say 2010-2015), research priorities will need to be set and/or reviewed and funding should be sought to help improve understanding of key sediment issues, either at a general or site-specific level. Such research might cover, for example, sediment balance, system dynamics or other physical processes, or knowledge of the linkages between sediments and ecosystem services. In some cases, a great deal of work is still needed. However, it will be important to ensure that uncertainty is not used as an excuse for doing nothing. As indicated above, decisions and actions will need to be based on information where available and reasonable assumptions where not.

In this regard it needs to be acknowledged that a lot of information is already available. It will be important to share and learn from existing experiences. SedNet is well-placed both to facilitate information exchange and knowledge transfer and to develop further guidance.

Introduction

The first River Basin Management Plans (RBMPs) prepared under the EU Water Framework Directive (WFD) are now published or are soon to be published (see Annex 1). The WFD river basins vary significantly in size and they present very different challenges. A review of some of the first round RBMPs suggests that there is equal diversity in the extent to which these Plans recognise the important role that sediment-related (quality and quantity) issues play in river systems.

In October 2009, SedNet convened a Round Table meeting[1] where national experts involved in sediment management and WFD implementation could meet to exchange experiences, to identify gaps in knowledge/understanding, and to make recommendations on practical ways to better integrate sediment management into the future WFD implementation process where it is relevant to do so. The other objectives of the Round Table were as follows:

- to develop a better understanding of situations in which sediment issues are already addressed in some RBMPs and the interests behind their inclusion;
- to discuss the extent to which sediment management is linked to WFD objectives, and to recognise those aspects which may not fall appropriately under the WFD remit; and
- to identify opportunities and to make recommendations for the better inclusion of relevant sediment issues in the second round RBMPs.

30 participants from river commissions, governmental bodies, water agencies, port authorities, research institutes, consultancies, NGOs and the SedNet Steering Group took part in the Round Table, representing river basins from across Europe: Douro, Ebro, Danube, Sava, Drava/Mura, Elbe, Rhine, Scheldt, and Anglian River Basin District.

A case study based on real-life examples but set in the hypothetical 'Blue River' basin was discussed to illustrate the complexity of real-life sediment issues and hence to assist in the achievement of the Round Table objectives. This case study can be found on www.SedNet.org.

As part of the Round Table process, participants also collated and submitted details about the implementation of the WFD in river basins with which they are involved. 'Snapshots' of this information are presented in the next chapter.

[1] The Round Table meeting took place in Hamburg immediately prior to the SedNet conference on "The Role of Sediments in Coastal Management", 7-9 October 2009, in the same location.

Courtesy Roger Morris

Snapshots of sediment management in River Basin Management Plans

RBMPs describe the ecological and chemical objectives designed to protect the status of surface water bodies and, where necessary, discuss the actions which must be taken to achieve these objectives. In accordance with the requirements of the Directive, RBMPs must be reviewed in 2015 and in 2021. More information on the WFD and its requirements is provided in Annex 1.

The information on WFD implementation and sediment issues in several European river basins which was collated by Round Table participants is presented in Annex 2 and summarised in the Table below. Neither the Annex nor this Table are intended to be comprehensive. Rather, through a series of 'snapshots', the Table aims to illustrate the degree of variation in how sediment issues are considered in some of the first round RBMPs.

River / Region	Snapshot of how sediment management issues are dealt with
Danube	Four Significant Water Management Issues (SWMIs) were identified in the Danube River Basin Management Plan: pollution by organic substances; nutrients; hazardous substances; and hydromorphological alterations. Because the identified SWMIs only partially cover the issues relevant for sediment management, it was decided to insert into the first river basin management plan for the Danube River Basin District an overview of pressures and impacts concerning the sediment quality and quantity. These included a summary of the preliminary recommendations as well as the necessary actions to be taken before the Programme of Measures can be set.
Rhine	The International Commission for the Protection of the Rhine has commissioned a comprehensive strategy for sediment management in the Rhine basin, which deals with both qualitative and quantitative aspects of the sediment regime. This strategy takes into account sediment contamination, which is substantial at a number of locations, and its role as an indirect source of contaminants to the water body. A sediment management plan has been set up and finalised at the end of 2009. In addition a variety of human interventions in the river system have caused drastic changes in sediment distribution in the Rhine. These changes directly affect navigation and the stability of constructions. Processes of active erosion and sedimentation are key elements of natural fluvial habitats. Giving these processes more freedom, as far as possible, is essential for river restoration (ecological rehabilitation).
Elbe	The first Elbe management plan highlights qualitative and quantitative aspects of the sediment regime. Sediments are an essential and integrated part of the river that need to be taken into account both in the assessment of the ecological status and in deriving supra-regional management objectives. Important sediment issues include the contaminant load in sediments and the flux of contamination from location to location as well as from sediment to water. A comprehensive baseline study has been undertaken of sediment contamination risks and their management. Measures for an improved bed load balance and sediment management are envisaged to reduce hydro- morphological stress. Stakeholders vary widely in their interest in and knowledge of sediment related issues.
Scheldt	The Scheldt is one of the most polluted aquatic systems within Western Europe. Monitoring networks for sediment quality and bioaccumulation are only available for Flanders. The RBMP in Flanders (and to a lesser extent in the Netherlands, Wallonia and France) recognises the importance of sediments as indirect sources of water contamination, but otherwise sediment issues are not considered.
Meuse	Sediment issues are indirectly considered in the context of the management of sluices, barrages, hydropower facilities and shipping. Sediment contamination is mentioned in the RBMPs of Wallonia and the Netherlands. In the Netherlands activities relating to dredging of contaminated sediments are included in the Programme of Measures.

River / Region	Snapshot of how sediment management issues are dealt with
Po	The river and its tributaries suffer from a solid transport reduction and a diffuse 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. Since a good morphological functionality is a prerequisite to achieving good ecological status, the present hydromorphological conditions have been identified in most cases as the main reason for not achieving the objectives. Sediment management is therefore focused on hydromorphology, rather than on contamination. Alluvial sediment management plans have been developed since 2001 and have been now updated and included in the RBMP.
Ebro	Changing land use has reduced sediment flow through the Ebro, which, together with dams and gravel mining, have led to a substantial decline of the river's sediment load to the lowlands and the delta. Measures relating to sediments will be included in the RBMP, but these mostly concern sediment as polluted waste and flood management, despite the well documented changes in sediment in the catchment. The Programme of Measures includes limited sediment measures (monitoring and some pilot restoration activities).
Sava	A protocol on sediment management to the "Framework Agreement on the Sava River Basin" is being developed in order to regulate the issue. The scope of the draft protocol encompasses quality issues such as sediment pollution (including risk assessment), control of source and deposition of polluted sediment, and quantity issues such as dredging, erosion and torrent control, reservoir sedimentation and morphological changes. The protocol sets out a series of sustainable sediment management principles and suggested sediment management measures. It also stipulates the development of a Sediment Management Plan for the basin including outlining its contents.
Anglian River Basin District, UK	As a mainly rural river basin district, many of the sediment-related issues discussed in the Anglian RBMP relate to agricultural run-off. Various measures are described which aim to improve agricultural practice so as to reduce both erosion/sediment loads and nutrients/diffuse pollution associated with run-off. Other issues identified and measures proposed relate to reducing run-off from highways and transport infrastructure; dredging (from navigable waterways and locks/sluices) and associated sediment management; and in-channel enhancement and beneficial use of sediment.

These 'snapshots' demonstrate that different approaches, at a wide variety of scales, have been taken to dealing with sediment issues in the RBMPs reviewed. However, they also indicate a range of important links between sediment and water management, and highlight the potential benefits associated with achieving better integration of certain sediment issues into a holistic approach to practical management.

Those providing information were also asked to indicate why there was such variation, and why they thought sediment issues had not been more thoroughly or consistently taken into account. A variety of reasons was suggested, but the most common were:

- the complexity of sediment issues; a lack of data, knowledge or system understanding;
- the lack of clear target values or guidelines; and
- sediments 'are not considered a priority in the WFD'.

Many of those responding further suggested that including sediment management in RBMPs was a promising future approach, but that it is important to recognise that other legitimate approaches also exist - for example as part of navigation or flood risk management planning. Thus RBMPs will not be the only solution for effective sediment management.

Integrated management opportunities

Discussions at the Round Table identified a wide range of sediment-related issues requiring effective integrated management, including:

- historic or recent/ongoing contamination of sediments;
- eutrophication associated with sediment run-off or re-suspension;
- erosion or accumulation (accretion) of sediments; lack of sediments in parts of the system;
- sediment transport; sediment continuity;
- dredging;
- loss of habitat; ecological impacts.

The Round Table discussions also demonstrated the myriad of intrinsic links between sediments and water. Many aspects of sediment quality, sediment quantity and sediment transport are inexorably linked to water – through both natural process (rainfall, run-off, river flow, erosion and deposition) and through anthropogenic influences (historic or current run-off from agriculture or discharges from industry, or morphological modifications such as embanking, damming, deepening, widening and straightening). Human activities including agriculture, industry, power generation or navigation can thus affect the quality or quantity of both water and sediments - with potential consequences for ecology and the wider environment.
Effective sediment management therefore requires a holistic approach to management taking into account:

- system understanding;
- the integrated management of water, sediment and soil;
- transboundary cooperation;
- upstream-downstream interrelationships; and
- stakeholder involvement.

Synergies between sediment and water management

The implications of sediment management are often integral to the management of water and vice versa. Opportunities for truly effective solutions may also be inter-related. Further, as the natural processes which determine the movement of water or sediments (or both) do not respect administrative boundaries, a holistic, river basin-wide approach is frequently more appropriate than a local or national approach. Improved integration between relevant sediment management and water management objectives is therefore an important aim and opportunities which contribute to both sets of objectives should be identified and exploited.

Another area in which there are potential practical synergies between the WFD and sediment management is in recognising the need to deal not only with current pressures and impacts but also with past (i.e. 'legacy') issues - for example contamination caused by previous activities, or historic physical modifications, and with future challenges such as climate change.

Sediment management in WFD implementation

There are few clear references to sediment in the text of the EU Water Framework Directive (2000) other than those on sediment-related contamination issues (see Annex 1). However, some of the important linkages between sediment and water management have more recently been highlighted and elaborated in the outputs of the EU level Common Implementation Strategy (CIS) process. In addition to CIS guidance documents which are in preparation dealing with the setting of Environmental Quality Standards (EQS) and with the monitoring of sediment and biota, the WFD guidance document on climate change[2] highlights the importance of potential future changes for sediment quantity and transport as well as for sediment quality and contamination issues. The CIS hydromorphology guidance[3] meanwhile covers sediment-related activities such as dredging, erosion control works and impoundments.

Win-win opportunities

Discussions at the Round Table highlighted a number of potential 'win-win' measures which illustrate how it is possible to achieve both WFD and sediment management objectives, cost effectively and in a way which could also prevent adverse environmental impacts elsewhere. For example:

- Using clean dredged sediment beneficially for beach nourishment, foreshore recharge or land reclamation can help to avoid the adverse environmental impacts associated with aggregate extraction (whether from marine or land-based sources);
- Creating buffer strips to prevent run-off of sediment into watercourses can help to reduce contaminants from agricultural land-use entering the water body;
- Education campaigns and practical measures to manage urban diffuse run-off can help to reduce both the amount of sediment and the various contaminants entering surface water bodies;
- Retaining dredged sediment within the same coastal or estuarine water body instead of relocation offshore can help to mitigate the effects of sea level rise and associated coastal squeeze by ensuring that intertidal habitats are not starved of sediment;
- Bypassing sediment which has built up behind a dam, in the lee of breakwaters, or between groynes can help to maintain a supply, thus helping to reduce rates of erosion downstream or down-drift.

Many Member States already have experience of implementing one or more of these measures, albeit maybe not with WFD objectives in mind. Examples of good practice do therefore exist to be collated and shared.

---

[2] CIS Guidance No. 24 'River Basin Management in a changing climate' (CIS, 2009).
See http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/management_finalpdf/_EN_1.0_&a=d

[3] CIS Hydromorphology technical report 'Good practice in managing the ecological impacts of hydropower schemes; flood protection works; and works designed to facilitate navigation under the Water Framework Directive' (CIS, 2006).
See http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/hydromorphology/technical_reportpdf/_EN_1.0_&a=d

Challenges

Insofar as it provides a framework for integrated management, it seems logical that many sediment management issues could be addressed (in whole or in part) through WFD RBMPs. Indeed, the snapshots in the Table above illustrate how this process has already started in some river basins. In seeking to optimise the opportunities for integrated sediment and water management in a river basin context, however, a number of challenges also need to be addressed.

Science, knowledge and understanding

Recent years have seen a significant improvement in our knowledge of sediment quality and quantity issues, and our understanding of the role sediments play in wider ecosystems including the often complex natural processes and cause-and-effect relationships. Notwithstanding this improvement, however, Round Table participants confirmed that there are still a number of gaps. A better understanding of sediment balance and system dynamics is required for many natural systems and (particularly if links with the WFD are to be promoted) more work is needed to link sediment features to ecological and chemical status criteria. Sediment budgets, patterns of erosion and accretion and pathways for (new) contaminants are often imperfectly understood, and more work is needed on conceptual sediment flux models and contaminant transport models. Such work also needs to consider the possible implications of climate change.

In addition to understanding physical processes, knowledge of the linkages between sediments and ecosystem services such as flood protection, habitats, navigation, recreation and food production will allow sediment managers to communicate with representatives from the equivalent range of stakeholder interests. Issues can then be identified and contributions to the problem and to the solution can be discussed. Where common objectives are established, it may be possible to agree on mutually beneficial or 'win-win' solutions.

Effective sediment management also needs to take into account the environmental and societal context. Developing such understanding can similarly help in facilitating communication and collaboration, in turn enabling joint solutions to be identified.

Dealing with uncertainty

Dealing with the above mentioned uncertainties sometimes presents a significant challenge for sediment managers. But it is important to ensure that uncertainty is not used as an excuse for doing nothing. Sediment planning and management cannot wait for a perfect understanding: decisions and actions will need to be based on available information where we have it and reasonable assumptions where we do not.

Wherever possible, decisions should be based on evidence. An authoritative baseline, if this is available, provides a useful starting point. Technical tools such as multi-criteria analysis or sensitivity testing may then help to resolve some issues, but discussions and agreement amongst key interested parties will arguably be more important in practical terms. Sediment managers will need to engage both with other sectors and with other organisations involved in strategic planning and management: spatial planners, coastal zone managers, and those engaged in climate change adaptation. Decisions must also take into account others' interests, for example water resource managers responsible for dams which prevent the movement of sediment downstream; agricultural uses of headwater areas or floodplains which are common sources of sediment inputs or contaminants; gravel mining companies; industrial dischargers; and recreational users.

Stakeholder engagement

Societal concerns can be as complex as technical issues. Consensus and sometimes compromise will be needed. Some stakeholders – for example non-governmental organisations or community groups - may not have the expertise or resources to be able to participate in the process. Consideration will therefore need to be given to how their interests can be properly represented, and how local issues can best be reconciled with a river basin level approach. Careful attention also needs to be paid to ensuring effective engagement between the various organisations including institutions with interests up- and downstream, or across borders.

Stakeholder engagement is similarly an important requirement of the WFD and lessons can be learned from the river basin planning process, particularly insofar as transboundary cooperation is concerned.

As indicated earlier, effective, integrated sediment management will benefit from early engagement and true dialogue.

Role of the WFD

Since sediments are an integral part of the ecosystem and affect ecological and chemical status, the Round Table meeting reaffirmed the importance of linking sediment management to the WFD where relevant opportunities exist. However, whilst there are many common objectives, synergies and opportunities, and the WFD provides a systematic approach for river basin management, it is not an explicit legal framework for sediment management. Further, some aspects of sediment management may be better suited to delivery through other mechanisms. Thus it will be important to retain flexibility.

A pragmatic approach could be to work alongside the river basin planning process, using the logistical management framework of the WFD and integrating objectives or measures where it is appropriate to do so - whether through a strategic or top-down approach or a bottom-up approach as required to meet local objectives.

WFD timescales

The first round of WFD RBMPs was (due to be) published in December 2009. RBMPs are to be reviewed by 2015 and again by 2021. Round Table participants concluded that there is therefore a window of opportunity to take the steps required to promote more informed and consistent integration of relevant sediment management issues into the second and third round RBMPs.

Courtesy Melchert Meijer zu Schlochtern

Developing linkages

Sediments are an integral part of the river basin system. A healthy river depends on healthy sediments. A clear message from the participants was that SedNet has an important role to play in improving sediment management on a river basin scale. It therefore seems logical to seek to realise appropriate opportunities to link sediment management to river basin management and, where appropriate, to the WFD. However, as discussed above, it should also be recognised that sediment management is a concept in its own right and for some sediment-related issues there may be other more relevant, alternative delivery mechanisms.

Preparation of guidance on incorporating sediment management interests

Round Table participants concluded that SedNet should consider what steps can be taken to prepare for and to facilitate the integration of relevant aspects of sediment management into the second and third cycle RBMPs as far as it is practicable to do so. To this end, guidance will be required to help both sediment managers and river basin managers understand the links between sediment and water and how effective management can be delivered. Ideally such guidance should cover:

- How to include sediment management in RBMPs;
- How to organise the process (from system understanding to practical management);
- How to identify and facilitate the engagement of the full range of stakeholders;
- Relevant examples of good practice illustrating how sediment management can make an effective contribution to the objectives of the WFD.

Several key audiences for this guidance were identified: DG Environment; the international river commissions; national competent authorities; and individual river basin managers.

The guidance needs to be understandable, readable and transferable to practical river basin management. Its effectiveness would be greatly improved by the translation of documents to different European languages. With appropriate support, SedNet could facilitate the writing and translation of such guidance.

The first stage of this process might be to find a consensus-based view on how to include a holistic and integrated consideration of sediment management in river basin planning. Through its membership, SedNet can collect practical examples of how sediment and river basin management can be integrated, at least in an informal way. SedNet can also act as a common platform to secure a funded project to develop and deliver the guidance document.

Contribution to WFD CIS guidance

The willingness of the experts involved in preparing the CIS guidance documents to incorporate sediment-related matters indicates a growing acceptance of the need for better integration between water and sediment considerations. SedNet should therefore explore future opportunities for greater integration of relevant sediment management issues into other aspects of WFD implementation. Early discussions/communication with the Commission should help to ensure that the products prepared by SedNet will make an effective contribution as and when an opportunity arises to discuss the inclusion of sediment management as a topic under the CIS process.

Timing and logistics

As noted earlier, explicit integration of sediment issues is not a requirement of the WFD. Given the already unprecedented scope and breadth of the WFD, the benefits of integrating relevant sediment management issues into RBMPs will need to be clearly communicated.

In this respect it will make sense to give priority to identifying cost-effective measures with a high certainty of positive effects for achieving management objectives, in particular win-win measures that are reversible and/or have linkages with other environmental management objectives. It will also be important to accept that in other cases, particularly those where there is significant outstanding uncertainty, it may be necessary to wait until the third WFD planning cycle to achieve the desired integration. As such, SedNet will need to give careful consideration to setting realistic and appropriate priorities for contributing to the 2009-2015 river basin planning cycle.

Research needs on sediments

Finally, SedNet could help in identifying sediment-related issues and processes which need to be investigated or better understood, both to improve sustainable sediment management and, more specifically, to help properly consider sediment-related aspects in River Basin Management under the WFD.

Annexes

Annex 1
The Water Framework Directive and sediments

The Water Framework Directive, 2000 (WFD) requires EU Member States to develop and implement an integrated system of water protection, improvement and sustainable use. The Directive applies to all groundwater and surface water bodies including estuaries and coastal waters, and to artificial water bodies such as docks and canals.

Together with its priority substances 'daughter' Directive[4], the WFD sets new ecological and chemical targets for all surface water bodies. The priority substances daughter Directive introduces chemical objectives through the setting of environmental quality standards (EQS). It also delivers the WFD objective regarding the cessation and reduction of discharges, emissions and losses of priority hazardous substances and priority substances respectively.

Under the WFD, all water bodies are expected to reach good ecological status (GES) or good ecological potential and good chemical status (GCS) by the end of 2015.

WFD guidance produced under the Common Implementation Strategy (CIS) can be found at http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title

River Basin Management Plans

Under the WFD, an integrated water management plan has to be prepared for each river basin district[5]. These new river basin management plans (RBMP) must describe the current status of the water bodies within the river basin district; set out the objectives for each water body; and identify the Programme of Measures (i.e. actions) required to deliver these objectives. All measures required under the WFD should be technically feasible and not disproportionately costly. Unless exemptions have been justified, these measures have to be in place by the end of 2012 in order that the WFD objectives are achieved by the end of 2015. To comply with the Directive, the first RBMPs were published in final form before 22nd December 2009. There will be two further cycles of WFD river basin management plans from 2015 to 2021 and from 2022 to 2027.

The deadline for publishing River Basin management Plans (22.12.2009) and the deadline for reporting these plans to the Commission (22.3.2010) have expired. DG Environment has provided a website where information about RBMPs by country can be obtained. By clicking on a map more can be found about the River Basin Management Plans available in each River Basin District, as well as the status of consultations which are still ongoing in the different EU Member States.
http://ec.europa.eu/environment/water/participation/map_mc/map.htm

Sediments in the WFD

There are a number of references to sediment in the WFD. However, these are all in respect of the chemical quality, for example:

- Article 2 (35) (definitions) states that 'Environmental quality standard' means the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment
- Article 16 (7) requires the Commission to 'submit proposals for quality standards applicable to the concentrations of the priority substances in surface water, sediments or biota'[6].

More generally, Article 16 requires the adoption of specific measures against pollution of water by individual pollutants or groups of pollutants presenting a significant risk to or via the aquatic environment. Measures are required to deliver the progressive reduction and, for priority hazardous substances, the cessation or phasing-out of discharges, emissions and losses. Article 16 thus provides the basis for the priority substances daughter Directive referred to above.

Section 1.2.1 of Annex V reads for the definition of good status for phytoplankton, macrophytes and phytobenthos that: There are slight changes in the composition and abundance of planktonic taxa compared to the type-specific communities. Such changes do not indicate any accelerated growth of algae resulting in undesirable disturbances to the balance of organisms present in the water body or to the physico-chemical quality of the water or sediment.

The same section classifies high status for river continuity as: The continuity of the river is not disturbed by anthropogenic activities and allows undisturbed migration of aquatic organisms and sediment transport.

The only other allusion to sediments in the WFD itself is in Annex VIII, the indicative list of main pollutants which includes, as number 10 on its list 'materials in suspension'.

---

[4] The WFD priority substances daughter Directive, 2008/105/EC on Environmental Quality Standards (EQS)

[5] River basin means the area of land from which all surface run-off flows through a sequence of streams, rivers and possibly lakes into the sea at a single river mouth, estuary or delta; a river basin district includes associated groundwaters and coastal waters. A river basin district can be sub-national or international.

[6] To date, the focus has been mainly on setting water-related Environmental Quality Standards although biota not water standards have been set for three substances: mercury and it compounds; hexachlorobenzene; and hexchlorobutadiene. The daughter Directive meanwhile confirms that Member States may 'opt to apply EQS for sediment and/or biota' where the EQS will provide the same level of protection as that for water. In such cases, there will be associated monitoring and reporting requirements.

Meanwhile, according to the Article 3(2) of the Directive 2008/105/EC Member States may opt to apply EQS for sediment and/or biota instead of those laid down in Part A of Annex I in certain categories of surface water. Member States that apply this option shall:

- apply, for mercury and its compounds, an EQS of 20 μg/kg, and/or for hexachlorobenzene, an EQS of 10 μg/kg, and/or for hexachlorobutadiene, an EQS of 55 μg/kg, these EQS being for prey tissue (wet weight), choosing the most appropriate indicator from among fish, molluscs, crustaceans and other biota;
- establish and apply EQS other than those mentioned in point (a) for sediment and/or biota for specified substances. These EQS shall offer at least the same level of protection as the EQS for water set out in Part A of Annex I.

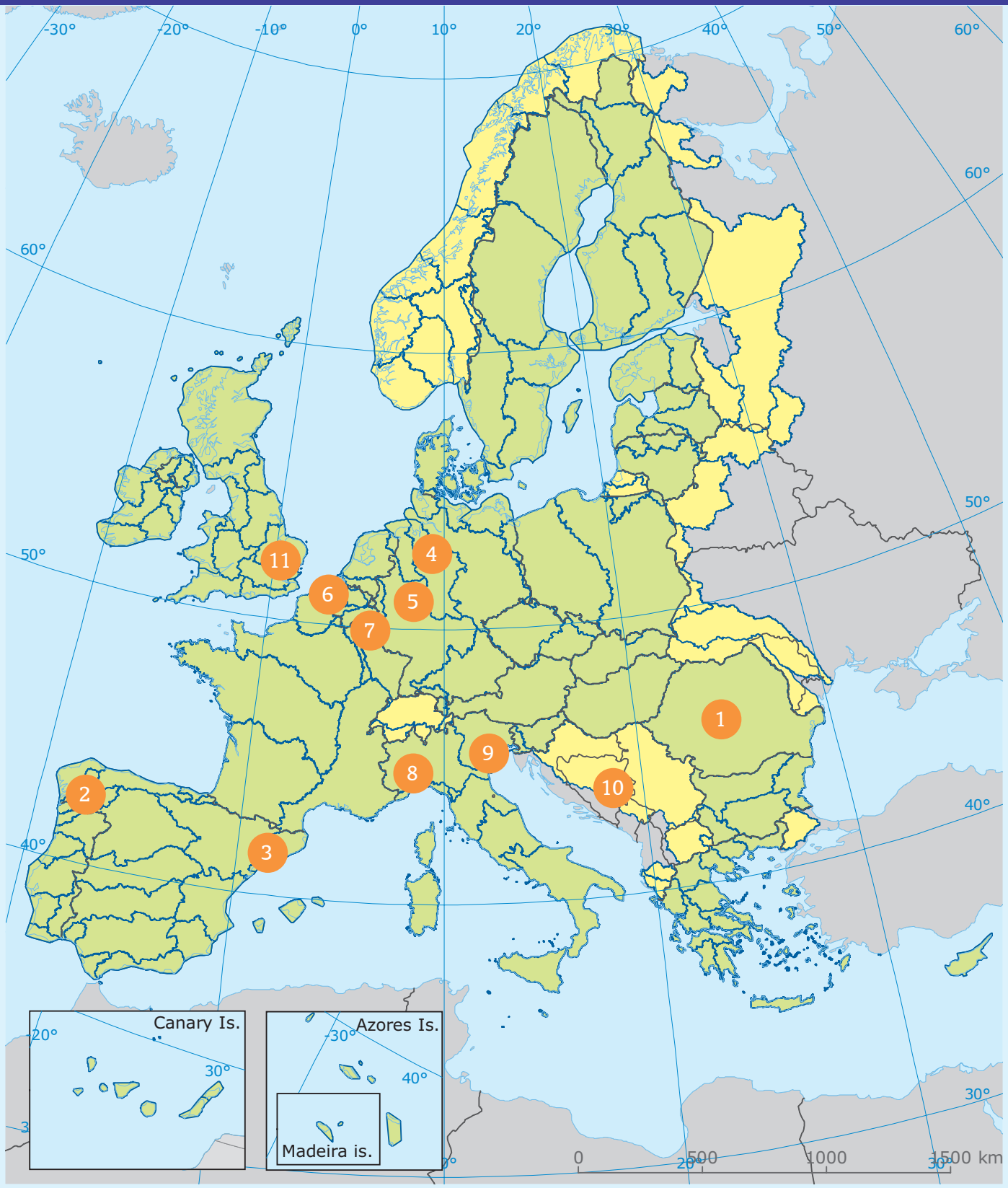
Article 3(3) of Directive 2008/105/EC requires Member States to arrange for the long-term trend analysis of concentrations of those priority substances listed in Part A of Annex I that tend to accumulate in sediment and/or biota, giving particular consideration to substances numbers 2, 5, 6, 7, 12, 15, 16, 17, 18, 20, 21, 26, 28 and 30, on the basis of monitoring of water status carried out in accordance with Article 8 of Directive 2000/60/EC. They shall take measures aimed at ensuring, subject to Article 4 of Directive 2000/60/EC,that such concentrations do not significantly increase in sediment and/or relevant biota.

Guidance on various aspects of the WFD is currently being elaborated through the European-level implementation process for the WFD and daughter Directives: the Common Implementation Strategy. Specifically, Member States and stakeholder groups involved in the CIS Working Group E are preparing a guidance document entitled 'Technical Guidance for deriving Environmental Quality Standards' which includes guidance on sediment EQSs in line with the Directive 2008/105/EC. In addition, the Chemical Monitoring Activity group is preparing a guidance document on sediment and biota monitoring. Once finalised, these documents will be available on the WFD CIRCA website.

Annex 2
River Basin information

This section provides more detailed information about several European rivers and River Basin Management Plans as collected by Round Table participants. The overview does not claim to be exhaustive, but it shows the range of situations, challenges, and existing answers.
Editorial deadline for the information was April 2010.

1. Danube
2. Douro
3. Ebro
4. Elbe
5. Rhine
6. Scheldt
7. Meuse
8. Po
9. Venice Lagoon
10. Sava
11. Anglian River Basin District



WISE River basin districts (RBDs)

RBDs in EU

RBDs outside EU

Outside data coverage

Annex 2
The River Danube

Length	2,857 km
Catchment area	801,463 km²
Population	80,5 million

Short river basin description

The Danube River is the second largest river in Europe, shared by 19 states.

The Danube River Basin catchment covers all of Hungary; nearly all of Austria, Romania, Slovenia, Slovakia and Serbia; significant areas of Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Moldova and Montenegro; and parts of Germany and Ukraine. Five more countries share areas of the Danube basin smaller than 2,000 km²: Switzerland, Italy, Poland, Albania and Macedonia.

Due to its richness in landscape including high Alpine zones, large plains, sand dunes, forested and marshy wetlands the Danube River Basin hosts a tremendous diversity of habitats.

Important water uses and services include water abstraction (industry, irrigation, household supply), drinking water supply, wastewater discharge (municipalities, industry), hydropower generation, navigation, dredging and gravel exploitation, and recreation.

Sediment issues and challenges

At present the sediment balance of most large rivers within the Danube River Basin can be characterised as disturbed or severely altered. Morphological changes during the last 150 years due to river engineering works, torrent control, hydropower development and dredging, as well as the reduction of adjacent floodplains by nearly 90%, are the most significant causes of impacts.

Sediment deposition upstream of dams and erosion downstream are also amongst the key sediment issues.

Contamination of sediments by priority substances was detected in the past and needs to be further investigated.

Web link basin organisation and WFD RBMP

All Danube countries with territories >2,000 km² in the DRB are Contracting Parties to the Danube River Protection Convention (DRPC). The DRPC represents the legal, as well as political, framework for cooperation and transboundary water management in the DRB. The International Commission for the Protection of the Danube River (ICPDR) served as the coordinating platform to compile multilateral and basin-wide issues at the "Roof level" of the DRB and facilitated the compilation of the Danube River Basin Management Plan (Part A).
www.icpdr.org

Sediments in the WFD RBMP

The Danube River Basin Management Plan contains a chapter on quantity and quality aspects of sediments. This chapter provides a brief summary overview of the pressures and impacts related to sediment quantity and quality in the DRB. In the conclusions, follow-up actions are proposed that are required for drafting the necessary measures in the future:

Sediment quantity:

- There is an increasing discrepancy in the DRB between sediment surplus in reservoirs and retention basins of torrent control works and sediment deficit in the remaining free-flowing sections. In combination with river channelisation, this leads to river bed degradation and a loss of morphodynamic structures with associated problems concerning ecological status.
- To propose appropriate measures for improving the above mentioned situation, a sediment balance for the DRB has to be developed, including identification of possible consequences due to climate change (e.g. glacier retreat). Availability of sufficient and reliable data on sediment transport is a prerequisite for any future decisions on sediment management in DRB.
- Attention should be given to ensuring the sediment continuum (improving existing barriers and avoiding additional interruptions).
- Additional investigations are needed to identify the significance of sediment transport on the Danube basin-wide scale.
- River regulation works (e.g. to increase transport capacity) contribute to river bed degradation. River restoration is of key importance for reducing degradation and improving morphodynamics, which are necessary for achieving good ecological status (initiation of river type specific morphodynamics, including floodplains).
- Dredging contributes significantly to the bed load deficit. It is therefore recommended that commercial extraction of sediments be prevented and that material dredged for maintenance be relocated back into the river.

Sediment quality:

- While Joint Danube Survey 2 (JDS2) in 2007 results for the organochlorinated compounds in sediments and suspended particulate material (SPM) indicated relatively low concentration profiles of these contaminants in the Danube, concentrations of PAHs have been occasionally found at elevated levels. An appropriate assessment of sediment quality necessitates the establishment of environmental quality standards for sediments and suspended particulate matter (SPM).

- Contamination of sediments and SPM by heavy metals (in particular by lead, cadmium, mercury and nickel) should be further investigated. A thorough evaluation of this issue requires the establishment of natural background concentrations of heavy metals to distinguish the anthropogenic impacts.
- Investigation on sediment grain size (fine suspended sediments) should be performed with regard to adsorption capacity and impact on aquatic communities (i.e. by decreasing photosynthesis, impairing fish-gills and filter-feeders, clogging the interstitial that homes amphibian and fish eggs, subsequent reduction of biodiversity, etc.).

Additional documents

Annex 8 of the DRBMP
www.icpdr.org/icpdr-files/15092

The Danube River Basin

Annex 2
The River Douro

Length	930 km
Catchment area	97,700 km^2
Population	4,2 million

Short river basin description

The Douro River and its tributaries form the largest river basin of the Iberian Peninsula, shared between Spain (81% of the total area) and Portugal (19%). The mountainous Douro valley in Portugal is an outstanding wine-growing region. The river has been heavily modified by hydropower development. The protection and the sustainable use of its waters are regulated by the Portuguese-Spanish Convention on Shared River Basins signed in 1998.

Sediment issues and challenges

- Hydromorphological degradation in Spain.
- Alteration of sediment fluxes and river and coastal erosion, due to dam construction (about 50 large dams); aggregate extraction (in the lower river, above the Crestuma Dam); and dredging for navigation purposes (in the estuary, below the Crestuma Dam), in Portugal.

(see also SedNet Round Table report Venice 2006 on www.sednet.org)

Web link basin organisation and WFD RBMP

- Confederación Hidrográfica del Duero (Spain); www.chduero.es
- Administração da Região Hidrográfica do Norte (Portugal); www.arhnorte.pt

Sediments in the WFD RBMP

As required by Article 14 of the WFD, Significant Water Management Issues reports were published in Spain and Portugal in early 2009. The reports were available for consultation, and public meetings were held in both countries in April-May 2009.

The main sediment-related issues identified in the SWMI reports were hydromorphological degradation, in Spain, and erosion, the alteration of sediment fluxes and the degradation of coastal zones in Portugal. Sediment quality was not regarded as a main priority.

In Portugal, the Douro RBMP is not expected to be concluded before February 2011. In the meantime, the river basin plan approved in 2001 (before the WFD came into force) remains in place. This plan identified erosion as a risk situation but set no objectives.

Specific measures addressing sediment issues, such as the reduction of aggregate extraction above the Crestuma Dam, have been implemented over the past 5 years. It is important that these measures, established at local level, are maintained and integrated into coherent, basin level planning, in the upcoming Douro RBMP.

Douro River Basin. Source: www.grid.unep.ch/

Annex 2
The River Ebro

Length	910 km
Catchment area	85,362 km²
Population	2,8 million

Short river basin description

The River Ebro is the second largest basin in the Iberian Peninsula and one of the largest in the Mediterranean basin. The watershed includes most parts of north-eastern Spain. Its natural boundaries are: the Cantabric and Pyrenees Range in the North, the Iberian Range in the Southwest, and the Catalan Coastal Range in the East.

Agriculture is the most important land use, with irrigation covering hundreds of thousands of hectares throughout the catchment.

Sediment issues and challenges

Extensive afforestation has taken place during the second half of the 20th century, especially in mid-mountain areas both in the Pyrenean and the Iberian ranges. This has reduced water and sediment reaching drainage networks and the lowlands. Together with changes in land use, dams and gravel mining are seen as the key factors responsible for the substantial decline of the river's sediment load to the lowlands and the delta.

The Ebro river morphology has therefore dramatically changed (narrowing and deepening), and its outstanding delta (320 km²) is degrading.

In the lower Ebro, polluted sediments have been deposited into the Flix reservoir over a period of decades, and special works are being conducted to remove them.

Ongoing studies are trying to evaluate how best to manage sediments in the lower Ebro. Recent results show 16 hm3 of sediment siltation in the lowest Ebro reservoir (Riba-roja-Flix). The remobilisation of this sediment could help to reduce river and delta degradation.

Web link basin organisation and WFD RBMP

- Confederación Hidrográfica del Ebro www.chebro.org; http://oph.chebro.es/DOCUMENTACION/DirectivaMarco/DirectivaMarco.htm
- Catalan Water Agency proposals for Catalan Ebro basins: http://aca-web.gencat.cat/aca/appmanager/aca/aca?_nfpb=true&_pageLabel=P23200336241260527233471&_nfls=false

Sediments in the WFD RBMP

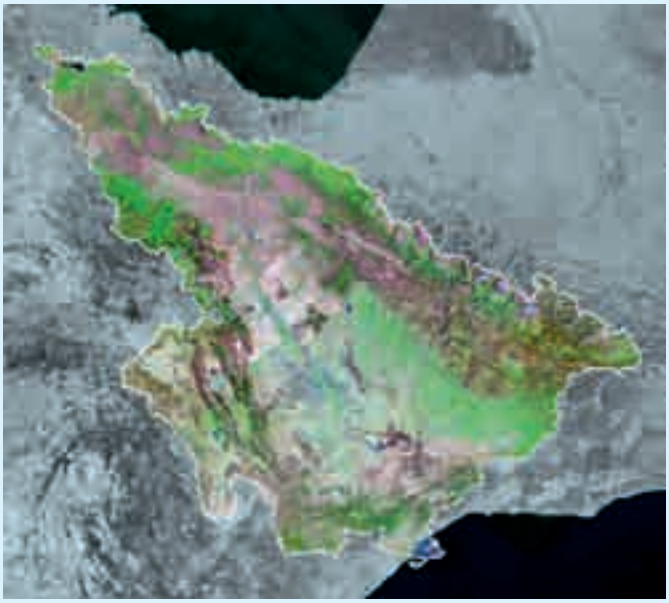
The RBMP is to date (April 2010) still not available, although there is some information on the website about proposed measures.

Available documentation includes a list of measures suggested during public participation, it is not specified whether they have been accepted or not. Proposals for river dredging and river restoration also exist, as well as sediment management programmes for reservoirs.

Measures on sediments will be indeed part of the RBMP, but at the time of writing their focus is still not clear.

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 solids transport and sedimentation is only mentioned in relation to flood mitigation.

On the other hand, the Catalan Water Agency has included a Sediment Management Programme in its RBMP, and has sent CHE proposals to include in the Ebro RBMP, with enhancing sediment studies and planning in the Ebro Catalan basins, also for the lower Ebro and its Delta.



Ebro River Basin. Source: www.grid.unep.ch/

Annex 2
The River Elbe

Length	1,091 km
Catchment area	148,268 km²
Population	24,5 million

Short river basin description

The Elbe is the third largest river of Central Europe. The German part of the basin encompasses two thirds of the entire Elbe RBD 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.

Sediment issues and challenges

- Mining activities (since the Middle Ages) and industrial emissions have led to elevated contaminant concentrations in sediments.
- River bed degradation in the German Middle Elbe.
- Dredging in the estuary and the Port of Hamburg.
- Estuary development in relation with the Wadden Sea.

(see also SedNet Round Table report Venice 2006 on www.sednet.org)

Web link basin organisation and WFD RBMP

- International Commission for the Protection of the Elbe www.ikse-mkol.org
- German River Basin Community Elbe; www.fgg-elbe.de

Sediments in the WFD RBMP

The states belonging to the international river-basin district of the Elbe developed 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. It is based on the national planning efforts (Parts B), which are coordinated in the case of Germany by the River Basin Community Elbe.

The 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 a view both to the assessment of the ecological status and to the derivation of supra-regional management objectives.

First measures for improving the sediment budget and the quality of sediments have been planned. Important statements in the first plan are:

- Measures for an improved bed load balance and sediment management are envisaged to reduce hydromorphological stress. The express objective for the future is to establish and implement principles of bed load 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 within 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 were considered through model analyses and exposure scenarios.

Additional documents

Risk studies contaminated Elbe sediments, summary in English: www.tideelbe.de/files/zusammenfassungen_elbestudien.pdf

The River Elbe

Annex 2
The River Rhine

Length	1,230 km
Catchment area	200,000 km²
Population	58 million

Short river basin description

The River Rhine is the second largest river of Central Europe, both in terms of length and catchment area and runs between the Alps and the North Sea. The Rhine basin goes through 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 areas, and about 10% is urbanised.

Sediment issues and challenges

- Mining activities and industrial emissions led to elevated contaminant concentrations in sediments.
- Dredging in the Port of Rotterdam and at barrages.
- Interventions in the river system (training works, construction of dikes and barrages) changed the sediment flow and the sediment distribution in the Rhine.
- High floods or dredging activities have redistributed historic contaminated sediments.

See also under 'Sediments in the WFD RBMP' and the Sediment Management Plan: www.iksr.org/uploads/media/Bericht_175e_01.pdf

Web link basin organisation and WFD RBMP

The Rhine states which are members of 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). It is based on the national planning efforts (Parts B), that are coordinated by the different Member States (e.g. for the Netherlands at www.kaderrichtlijnwater.nl) and in the case of Germany by the different federal states (e.g. for Rheinland-Pfalz www.wrrl.rlp.de).

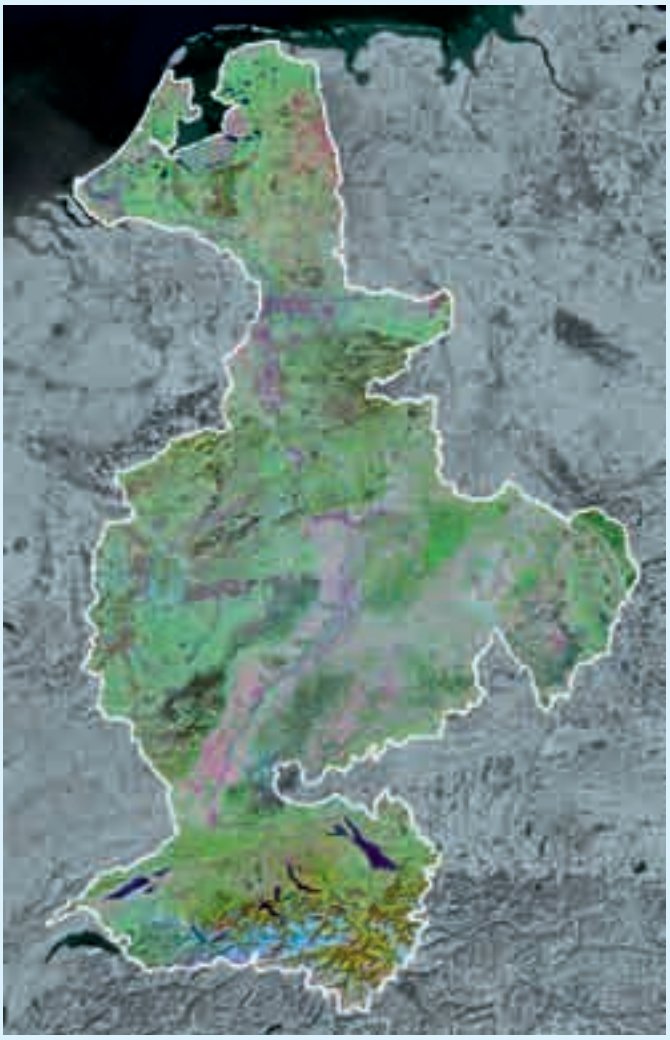
Sediments in the WFD RBMP

Mandated by the ICPR, the ICPR expert group "SEDI" was initiated in 2005. It has elaborated a comprehensive strategy for sediment management in the Rhine basin. Key objectives are a Sediment Management Plan for contaminated sediments addressed to competent authorities for implementation in WFD Programmes of Measures 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 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 in the long term can cause problems with regard to reaching good chemical status.
- HCB, just like PCB, is one of the contaminants which negatively influence 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.
- Interventions in the river system (training works, construction of dikes and barrages) have drastically changed the sediment flow and the sediment distribution in the Rhine.
- 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. Sediment quality has been negatively influenced by this, because due to high floods or dredging activities historic contaminated sediments have been redistributed in the Rhine basin and its tributaries.
- Measures to improve sediment dynamics are also summed up. The measures mentioned are the improvement of barrages, the adjustment of groynes, and the restoration of sediment transport in appropriate areas to retain and maintain the morphodynamic functioning of the river.

For the River Rhine, 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 m³ contaminated sediments.



The River Rhine

Additional documents

- Inventory of historical contaminated sediment in Rhine Basin and its tributaries: www.sednet.org/download/0410%20Rhine%2002%20-%20Executive%20Summary%20-%20October%202004.pdf
- Dredged Material in the Port of Rotterdam – Interface between Rhine Catchment Area and North Sea: http://www.sednet.org/download/Part_A_Executive_summary_and_introduction_(POR_II).pdf
- Erosion, Transport and Deposition of Sediment. - Case Study Rhine – ; Report no II-20 of the CHR, 2009 KHR/CHR: www.chr-khr.org/en/publications

Annex 2
The Scheldt River

Length	350 km
Catchment area	21,000 km^2
Population	10 million

Short river basin description

The Scheldt River is a small transboundary river system in North-Western Europe. The source is in the North of France from where it continues through Wallonia and 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 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 programmes have been established especially in the Flemish and Dutch areas.

Sediment issues and challenges

In Flanders sediments are considered as a major obstacle to reaching good ecological status, but at the same time sediments are a problem for nautical and hydraulic functions of the water systems.

Web link basin organisation and WFD RBMP

Each region developed its own River Basin Management Plan (RBMP) and the International Commission for the Scheldt (ISC, 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.

Sediments in the WFD RBMP

Monitoring networks for sediment quality and bioaccumulation are only available for Flanders. The overall RBMP of the ISC 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 relation to 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 only recognised as a diffuse source of phosphorus, nitrogen and arsenic for groundwater. No measures are further suggested for this. In the RBMPs of Walloon and France sediments are not considered. In Flanders sediments are identified as a major obstacle in reaching good ecological status, but at the same time sediments are a problem for nautical and hydraulic functions of the water systems. Therefore both 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 the quality of the sediment and on erosion and transport processes.
The Programme of Measures in the RBMP of Flanders is divided into nine groups of which one focuses on sediment related issues. The objectives that are kept in mind with the suggested Programme of Measures are:

- Reducing land erosion and sediment transport to surface water;
- Reducing transport and settlement of sediments to protect nautical and hydraulic functions;
- Prioritisation 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 contaminated sediments.

The costs for the basic Programme 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 ± 30% of the costs of the total Programme of Measures. When additional measures are incorporated the estimated operational costs for the sediment related measures are 350-441 million Euro per year, excluding costs for temporary storage or disposal capacity.
The Programme 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 Scheldt River Basin. Source: www.scheldenet.nl

Annex 2
The River Meuse

Length	905 km
Catchment area	34,548 km^2
Population	9 million

Short river basin description

The River Meuse rises in France (in Pouilly-en-Bassingy) at an altitude of 384 m above sea level and flows through Belgium and the Netherlands to the North Sea. Its basin covers parts of France, Luxemburg, 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, Samber, Ourthe, Roer, Swalm, Niers, Dommel and Mark. Several of these rivers are transboundary. The average discharge of the river Meuse is 250 m^3/s, but, being a 'rain-fed river', the discharge fluctuates greatly over the year. The Meuse is used as a water source for Brussels, Antwerp, Rotterdam and other towns. Other important functions are the use of water for agriculture and shipping.

Sediment Issues and Challenges

- Reducing land erosion and sediment transport to surface water;
- Urgent dredging for security reasons;
- Sustainable and efficient dredging;
- Sustainable remediation of contaminated sediments;
- Treatment, reuse and disposal of dredged material.

Web link basin organisation and WFD RBMP

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). 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.

Sediments in the WFD RBMP

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 organisation 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 Programme 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 is included in the Programme of Measures.

The Meuse River Basin

Annex 2
The River Po

Length	652 km
Catchment area	71,000 km^2
Population	16 million

Short river basin description

The River Po is the largest Italian river, both in terms of length and catchment area. The watershed includes most part of northern Italy, is heavily industrialised, but agriculture and animal farming are also 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.

Sediment issues and challenges

The river and its tributaries suffer from a solid transport reduction and a diffused deepening of their beds, associated with narrowing and deactivation of secondary branches. This in turn causes difficulties in 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 that on contamination.

Web link basin organisation and WFD RBMP

The Po River Basin is recognised by the Italian law as a District, according to the WFD definition.

The development of the RBMP in the Po River District has been coordinated by the Po River Basin Authority (www.adbpo.it), established since 1989. The RBMP was adopted on February 24, 2010, following the 6-months consultation phase required by Article 14 of the WFD, and is published on the River Basin Authority website.

Sediments in the WFD RBMP

The evaluation of hydromorphological status carried out within the RBMP identified that only a small proportion of the Po district water bodies can be considered in good status, while most of them are in moderate, poor or even bad status.

Since a good morphological functionality is a prerequisite to achieving good ecological status, the present hydromorphological conditions have been identified in most cases as the main causes of not achieving the objectives.

At the same time, defence against flooding cannot be achieved exclusively through structures for passive containment but must be strategically reorganised with the complementary objective of recovering water body functionality through:

- the reactivation of morphological processes, which are presently heavily limited by the defence structures and by the deepening of the riverbed;
- the recovery of the capability of expansion and lamination in the perifluvial areas.

For these reasons, from year 2001 (“Piano Stralcio per l’Assetto Idrogeologico”) and year 2006 (“Programma generale di gestione dei sedimenti per l’asta principale del fiume Po”), the River Authority defined measures for sediment management and morphological recovery of riverbeds. These are now being integrated and transferred into the RBMP and will soon be integrated in the Flood Risk Management Plan, according to Directive 2007/60/CE.

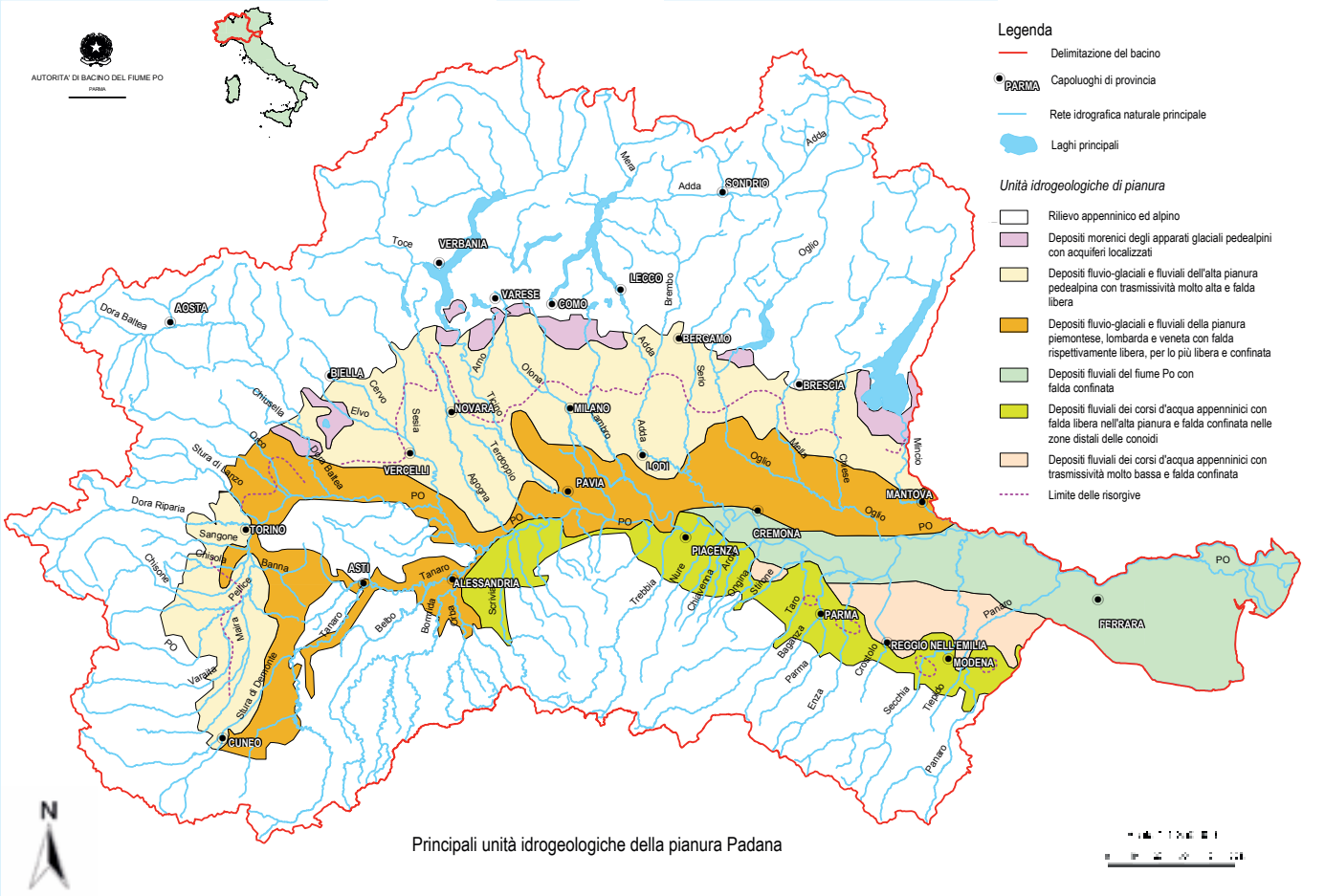
Strategic guidelines are the following:

- 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 structures;
- restoration of natural forms, through the reactivation of lateral branches.

Additional documents

Section 2.3 Part II of the RBMP contains the description of the hydromorphological status of surface water bodies, while Sections 6, 7 and 13 illustrate the main measures adopted to improve the hydromorphological status and mitigate their impact on the ecological status.

Specific measures of morphological restoration on the Po riverbed are documented in:
www.adbpo.it/on-multi/ADBPO/Home/Pianificazione/AttuazionedelPianodibacino/AttuazionedelPAI/Gestionedeisedimentideglialvei.html



Principali unità idrogeologiche della pianura Padana

The Po River Basin. Source: www.adbpo.it

Annex 2
The Venice Lagoon

Length	3,780 km
Catchment area	2,038 km²
Population	1,018 million

Short river basin description

The Sub-Hydrographic Unit of the Venice Lagoon, its drainage basin and the sea front area is part of the Eastern Alps River Basin District. It includes a wide territory which is strongly interconnected from a hydrological and ecological point of view, but also clearly distinct in terms of morphology and environmental characteristics and issues. Exploitation of water resources for industrial purposes, irrigation, household supply are among the major uses and services, along with recreation, fisheries and navigation. The Venice lagoon ecosystem is of great importance for the inhabitants of a wide area in its surroundings and it represents a unique asset for the Veneto Region. It is the largest wetland in Italy and one of the most important coastal ecosystems in the whole Mediterranean basin, with a total area of 550 km². While highly populated with urban settlements, a strong infrastructure (airport, rail road bridge and the lagoon, sea port) and the large industrial area of Porto Marghera, the Venice lagoon still maintains high biodiversity and unique ecological characteristics.

Sediment issues and challenges

In aiming to achieve good ecological status as required by the WFD, both sediment quantity and quality issues in the Venice lagoon represent major concerns. The morphological state and evolution of the lagoon has been under formal study since the early 1970s when special legislation to protect Venice and its lagoon came into force. Mainly due to lagoon hydrodynamics (waves and currents) and the reduced inputs of sediment, the lagoon is presently experiencing constant erosion and a loss of morphological diversity. Most lagoon channels are undergoing siltation from sediments being eroded from shallows and salt-marshes. Thus, dredging for maintenance purposes in the last decade amounted to about 1 million m³ per year. On top of this, dredging for the construction of the mobile gates to protect Venice from high tides, dredging for navigational and environmental purposes of the Porto Marghera industrial canals, and the enlargement of the Port of Chioggia will produce a further 20 million m³ of material with various levels of contamination to be managed. The chemical quality of the sediments (intertidal areas, shallows, canals) is the result of complex interactions between a number of factors and processes, including present and past pollution sources; hydrodynamics and sediment transport; erosional and depositional processes; fishing activities; boat traffic; dredging; and early diagenetic processes. The main currently active sources of pollution are the rivers of the watershed; treated and untreated wastewater directly entering the lagoon from the industrial area of Porto Marghera and surroundings and the Venice historical centre; atmospheric fall-out; erosion of contaminated soils; and advection of contaminated ground waters from the canal embankments of Porto Marghera.

Given the importance of sediments in determining the general status of water bodies, one of the main challenges to achieving the general WFD goal for the Venice lagoon ecosystem should be the development of a comprehensive framework reviewing and updating the current sediment management practice to achieve both ecological (erosion, habitat loss, morphology) and socioeconomic goals (e.g. construction, navigational dredging, flood defence, habitat improvement or maintenance).

Web link basin organisation and WFD RBMP

As required by the WFD, the River Basin Authorities territorially concerned (Authority of Adige river and Authority of Rivers of Northern Adriatic Sea) presented a River Basin Management Plan (RBMP) for the Eastern Alps Hydrographic District. Regions and Autonomous Provinces contributed to the drafting of the Management Plan through specific cognitive activities and the complex system of information already collected and reformed in the preparation of their plans for protection. Since the breadth and specificity of the whole area, the RBMP general framework is structured on the basis of different hydrographic sub units. With specific reference to the "Sub-Hydrographic Unit of the Venice Lagoon, its drainage basin and the sea front area" the River Basin Authority (www.adbve.it) coordinated the preparation of a specific management plan, with contributions from the Venice Water Authority (MAV), the Veneto Region (RdV) and the Ministry of Environment for territory and sea protection (MATTM).

Sediments in the WFD RBMP

At present, sediment issues in the RBMP for Venice sub-unit are taken into account in the overview of pressures and impacts on the ecosystem, with particular reference to: hydro-morphological impacts due to the trend of erosion, sediment loss and consequent impacts on submerged habitats, contamination and associated biological effects. The Programme of Measures which aims at reducing impacts and improving ecological status includes actions on sediments addressed towards:

- pollution reduction (e.g. dredging of canals in the industrial area and in the city centre of Venice; improvement of sediment quality in shallow areas);
- hydromorphological protection (protection and reconstruction of shallow areas, tidal flats and salt marches);
- sustainable use of resources (maintenance of canals for navigation, improvement of sediment quality to allow fishing and clams collection and cultivation).

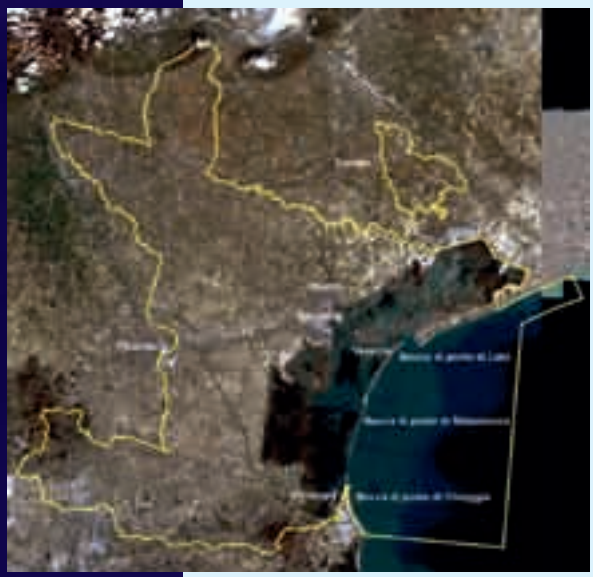
In recognition of the importance of qualitative and quantitative management of sediments to reach and maintain good quality status, the River Basin Management Plan will be supplemented by Sediment Management Framework Guidelines. Criteria and

management practises will be reviewed taking into account the underlying needs. This represents part of an agreed maintenance plan linked to the measures necessary to achieve the sediment quality targets. An institutional round table will be established within 120 days from the approval of RBMP to achieve such objective.

Additional documents

Annex 6 – 2
http://alpiorientali.it/documenti/list_doc/pub/PdP_doc/04_PG_laguna_di_Venezia_2010_02_24.pdf

The Venice Lagoon



Sub-Hydrographic Unit of the Venice Lagoon, its drainage basin and the sea front area

Annex 2
The River Sava

Length	945 km
Catchment area	97,713 km^2
Population	8,2 million

Short river basin description

The Sava river is the third longest, and the largest by discharge, tributary of the Danube river. The basin covers considerable parts of Slovenia, Croatia, Bosnia and Herzegovina, Montenegro and Serbia, and a small part of Albania (see 'Additional documents', reference 1).

With its average discharge of about 1,700 m^3/s, the Sava river contributes with almost 25% to the Danube's total discharge.

The Sava is of a great significance due to its remarkable environmental and socio-economic value, based on high biological and landscape diversity, large retention capacity and high potential for different forms of water use (i.e. navigation, hydropower generation, irrigation, water supply, recreation and tourism).

Urbanised areas cover about 2,2% of the Sava basin, the rest of the basin is dominated by agricultural areas and forests.

Detailed description of the basin is provided in 'Additional documents', reference 2.

Sediment issues and challenges

Generally, the challenges include:

- Contamination of sediment due to industrial emissions;
- Sediment distribution, affected by interventions in the river system (construction of dikes and dams);
- River bed degradation in some sections of the Sava river;
- Over-exploitation of sediment and its use as a construction material.

Web link, basin organisation and WFD RBMP

International Sava River Basin Commission (ISRBC), established by the Parties to the Framework Agreement on the Sava River Basin (Bosnia & Herzegovina, Croatia, Serbia, Slovenia).
www.savacommission.org
The first Sava RBM Plan is to date (April 2010) under development, as a result of the commitment of the Parties to respect the WFD, although not all of them are legally bound to do so. The first Plan is expected to be finalised by the end of 2011.

Sediments in the WFD RBMP

As indicated above, the first Sava RBMP is currently being developed under the coordination of the ISRBC and with the support of the European Commission.

The RBMP is envisaged to be complemented by outcomes of the projects dealing with a number of challenging issues, such as, for example, climate change, groundwater management and sediment management.

At the same time, a number of protocols to the Framework Agreement on the Sava River Basin (FASRB), regulating various issues related to quality and quantity of water and sediment, have been developed or are in the process of development. One of them is the Protocol on Sediment Management to the FASRB, which has been drafted at ISRBC level (see reference 3) and entered a process of negotiations for final harmonisation and signing of the Protocol.

The Protocol stipulates the development of the Sediment Management Plan for the Sava River Basin. This will include the following issues:

- evaluation of sediment balance and sediment quality and quantity;
- monitoring of sediment;
- measures to prevent impacts and pollution of water or sediment;
- measures to control erosion processes;
- measures to ensure integrity of water regime comprising quality and quantity and to protect wetland, floodplains and retention areas;
- measures to provide, ensure and maintain conditions for safe navigation;
- determination of designated areas for capital dredging;
- guidance for sediment disposal, sediment treatment and use.

The Sava River Basin Sediment Management Plan will be adopted by the Parties no later than six years after the Protocol enters into force and it will be revised in the six year cycles afterwards. It will be harmonized with the Sava RBM Plan and with relevant plans and programmes of the Parties as well.

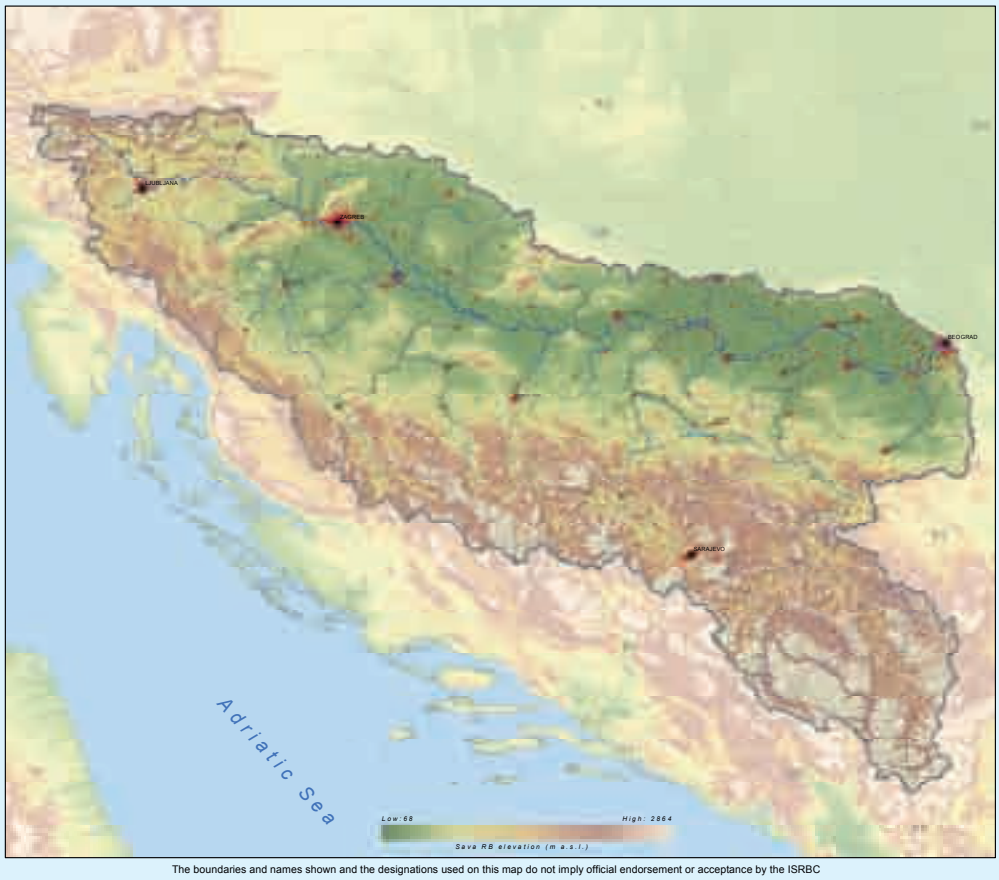
On a yearly basis, the Parties will develop the Dredging Programmes which will be sent to the ISRBC. Through the ISRBC, all the Parties will be informed, among other sediment issues, about the planned dredging locations and the quantities of material to be dredged.

Maintenance dredging will be allowed in the Sava River Basin. Capital dredging will only be allowed in designated areas which will be harmonised with the Sava RBM Plan.

The Parties will establish a coordinated monitoring system in order to provide all the data necessary for development of the Sediment Management Plan. The Parties will exchange information related to implementation of the Protocol and initiate and cooperate in the conduct of research of technologies for the sustainable sediment management.

Additional documents

Reference 1: Sava River Basin Overview Map (available for download at www.savacommission.org/publication)
Reference 2: Sava River Basin Analysis Report (available for download at www.savacommission.org/publication)
Reference 3: Draft Protocol on Sediment Management to the FASRB (available for download at www.SedNet.org)



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the ISRBC

Data sources:
DEM data: The NASA Shuttle Radar Topographic Mission (SRTM) processed by the CIAT-CSI (http://srtm.csi.cgiar.org), USGS
CORINE land cover: EEA (http://www.eea.europa.eu)
Other data: ICPDR, ESRI, the Parties to the FASRB (SI,HR,BA,RS)

0 40 80 120 160 Km

Coordinate system: ETRS 1989
Projection: Lambert Azimuthal Equal Area

Sava River Basin overview map

Legend

- *Sava RB boundary*
- *State borders*
- *Urban areas*
  - Continuous urban areas
  - Discontinuous urban areas
  - Industrial or commercial units
  - Green urban areas
  - Sport and leisure facilities
  - Capitals of the FASRB Parties
  - Urban centers
- *Sava RB rivers (Catchments >=1000 sq.km)**
  - Sava River
  - 1st order tributary
  - 2nd order tributary
  - 3rd order tributary
- *Reservoirs* (V>=5 mil m3)

*except Sutla/Sotla, Lašva and Tinja

Processed and compiled by the Secretariat of the ISRBC
April 2010

Annex 2
Anglian River Basin District, UK

Length	7,000 km
Catchment area	27,890 km^2
Population	5,2 million

Short river basin description

The Anglian River Basin District in the east of England includes the rivers Witham, Welland, Nene, Great Ouse, Yare, Waveney, Cam, Stour, Orwell, Colne, Lee and Darent; also Middle Level and Norfolk/ Suffolk Broads Navigations and various estuaries and coastal waters. The district comprises a wide variety of landscapes: from gentle chalk and limestone ridges to the extensive lowlands of the Fens and the coastal estuaries and marshes. Water underpins these landscapes and their wildlife, and it is vital to the livelihoods of those who live and work there. In the past there has been considerable progress in protecting the natural assets of the river basin district and in resolving many of the problems for the water environment. However, a range of challenges remain, which will need to be addressed to secure the predicted improvements. They include:

- point source pollution from sewage treatment works;
- the physical modification of water bodies;
- diffuse pollution from agricultural activities;
- water abstraction; and
- diffuse pollution from urban sources.

Sediment issues and challenges

Sediments are referred to in the RBMP as a WFD 'pressure', as a 'direct pollutant', and indirectly in relation both to priority and priority hazardous substances and to hydromorphology. Dredging, disposal and similar activities involving the physical removal or deposition of sediment meanwhile are assessed as hydromorphological pressures; and nutrients and priority substances associated with sediments are considered as contamination pressures.

During preparation of the RBMP, the process of characterising the risks associated with sediment did not attempt to model any processes of sediment generation, transport or impact on specific receptors. The lack of routine monitoring data and the absence of specific sediment standards were also recognised. Local knowledge and expert judgement were therefore used to assess sediment impacts at catchment level, often based on anecdotal evidence. If there was no evidence that sediment is compromising WFD objectives, it was assumed that conditions are adequate for good ecological status.

Web link basin organisation and WFD RBMP

WFD competent authority: England and Wales Environment Agency at: http://www.environment-agency.gov.uk/research/planning/33106.aspx
Anglian River Basin Management Plan at: http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/anglian/Intro.aspx

Sediments in the WFD RBMP

Potential new national measures to be introduced in English and Welsh water bodies affected by sediment pressures include:

- the designation of 'Water Protection Zones' (areas within which the Environment Agency could manage or prohibit a specific set of high risk activities identified as causing direct or indirect damage to the bed, banks and riparian zone of surface water bodies); and
- the development of a national Code of Practice for dredging and disposal.

In addition, a number of existing national measures primarily aimed at other pressures (e.g. phosphorus, TBT) can also be used for sediment management purposes. These include:

- minimising sediment and suspended solids in consented discharges;
- use of anti-pollution Works Notices;
- agricultural cross-compliance measures to reduce sediment-laden run-off from farming;
- pollution reduction plans for priority hazardous substances such as TBT.

In addition to these national measures, Annex E of the RBMP sets out generic measures which would be elaborated at River Basin or catchment level for water bodies where sediment remains a problem:

- catchment sensitive farming initiatives;
- partnerships with developers, with the farming community, recreational boaters, and others as appropriate;
- codes of practice to help improve land drainage, dredging and weed-cutting operations;
- bank and shore habitat restoration or stabilisation projects.

In the meantime, further work is being undertaken at a national level to inform sediment-management measures for the second round RBMPs (see 'Additional documents' below)

Amongst the RBMP-specific sediment-related measures described in the Anglian RBMP are a number which aim to improve agricultural practice so as to reduce both erosion and associated sediment loads and to reduce nutrients or other diffuse pollutants in run-off. Measures include raising awareness of the problems and working in partnership with farmers to change soil management practices, create buffer strips and improve fencing for livestock. Other issues identified and measures proposed relate to reducing run-off from highways and transport infrastructure; Codes of Practice to guide dredging from navigable waterways and locks/sluices and related sediment management; and exploiting opportunities for in-channel enhancement and beneficial use of sediment.

Additional documents

Many draft RBMPs for England and Wales recognise sediment as a pressure needing management. Many state that a Sediment Management Plan will be developed for the second round RBMPs. Meanwhile EA and other organisations have liaised to prepare a range of tools for assessing and managing sediment within catchments.

Agriculture is a major contributor to enhanced sediment loads in watercourses, often with associated contaminant issues (particularly phosphate and pesticides). Two initiatives address this directly:

- Think Soils, "a practical guide to soil assessment which aims to help farmers, land managers, etc. to recognise problems with erosion and run-off from agricultural land" is available from http://publications.environment-agency.gov.uk/epages/eapublications.storefront/4bf669c40434b202273fc0a802960683/Product/View/GEHO1007BNFF&2DE&2DP
- The Soil Protection Review is part of the UK Single-farm payment scheme and aims to give farmers greater responsibility in identifying risks to their soils, remedying any damage (due to erosion, compaction or loss of soil organic matter) and taking preventative measures to reduce the risk of soil degradation. Available from: http://www.rpa.gov.uk/rpa/index.nsf/0/c39ae2bb7b8ab8158025768e005e57cd/$FILE/Soil%20Protection%20Review%202010.pdf

Two further initiatives in development aim to enhance understanding and awareness of sediment issues, and to allow catchment scale assessment of such issues and the impacts of measures to address them:

- Sediment Matters "a practical guide to sediment and its impact in rivers … aims to help people managing sediment-related problems in catchments to understand sediment sources, pathways and stores, and to identify and monitor sediment problems". Further information available from Natalie. phillips@environment-agency.gov.uk
- The Sediment Relative Risk Model provides a framework for semi-quantitative analysis of multiple sediment sources, locations and types of impact. It works at multiple scales and permits changes in risk profile to be assessed as potential cost-effective management options are applied. Further information available from sue.white@cranfield.ac.uk


Courtesy Roger Morris

Anglian River Basin Districkt, UK.
Source: www.environment-agency.gov.uk

Annex 3
Round Table Participants

Name	Organisation	Country
Paul Bardos	r3 Environmental Technology Ltd	UK
Jan Brooke	Freelance consultant	UK
Susan Casper	Environment Agency	UK
Emil Gölz	Federal Institute of Hydrology	Germany
Dorien ten Hulscher	RWS Centre for Water Management	The Netherlands
Martin Keller	Federal Institute of Hydrology	Germany
Dejan Komatina	International Sava River Basin Commission	Croatia
Peter von der Ohe	Helmholtz-Centre for Environmental Research	Germany
Luis Portela	LNEC	Portugal
Georg Rast	WWF - World Wide Fund for Nature	Germany
Klaus Rehda	State office of environment protection Saxony-Anhalt	Germany
Ulrich Schwarz	Fluvius	Austria
Adriaan Slob	TNO	The Netherlands
Ivana Teodorovic	University of Novi Sad	Serbia
Joan Verdú	Catalan Water Agency	Spain
Astrid Van Vosselen	Dept. Mobility and Public Works Flemish Government	Belgium

SedNet Steer Group team

Antonella Ausili	ISPRA	Italy
Andrea Barbanti	Thetis SpA	Italy
Piet den Besten	RWS Centre for Water Management	The Netherlands
Jos Brils	Deltares	The Netherlands
Eric de Deckere	University of Antwerp	Belgium
Marc Eisma	Port of Rotterdam Authority	The Netherlands
Peter Heininger	Federal Institute of Hydrology	Germany
Susanne Heise	Hamburg University of Applied Sciences	Germany
Igor Liska	ICPDR	Austria
Axel Netzband	Hamburg Port Authority	Germany
Amy Oen	Norwegian Geotechnical Institute	Norway
Elena Romano	ISPRA	Italy

Glossary

CIS	Common Implementation Strategy for the Water Framework Directive, agreed by Member States, Norway and the Commission after the entry into force of the Directive.
EQS / SQS	Environmental Quality Standard; Sediment Quality Standard
MSFD	Marine Strategy Framework Directive
RBMP	River Basin Management Plan
RTD	Research and Technology Development
SWMI	Significant Water Management Issue
WFD	Water Framework Directive

Colofon

SedNet Secretariat
Marjan Euser
Deltares
PO Box 85467
3508 AL Utrecht
The Netherlands
www.sednet.org

July 2010

SedNet

www.sednet.org