

# PROTECTION OF THE QUALITY AND SUPPLY OF FRESHWATER RESOURCES

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## Summary

Water resources are spread unevenly across Europe. This spatial variability places stresses and strains on the water environment and its use. Water quality and flood risk also vary significantly across Europe due to both natural causes and anthropogenic influences. A key feature of water management in Europe is the dependence of a number of countries on international lakes and rivers for their water supplies and for the discharge of effluents.

With the continuing enlargement of the EU, this institution will provide the focused framework for delivering a more sustainable approach to river-basin management across Europe, through the range of policy and legislative mechanisms that it develops. However, it will rest with each Member State to undertake the changes in management practices and attitudes that will be required to deliver real environmental improvements. Through EU policy, Member States are being encouraged to use a variety of mechanisms to deliver sustainable river-basin management. These include economic instruments and the development and implementation of best practice in addition to traditional regulatory and infrastructure approaches.

There is, however, still a largely sectoral approach to managing the water environment with management action usually focused on one issue, often relating to water quality. As a result, much progress has been made in water-quality management and to a lesser extent, water resources management. Management of international rivers and lakes has provided a focus for integrated management on a catchment-wide basis.

A further impetus will be provided by the Water Framework Directive, which should stimulate a more holistic and integrated approach to managing the water environment. It

will provide a focus for reconciling social, economic, and environmental pressures on catchments.

A particular concern is the lack of a coordinated or consistent approach to flood risk management within broader environmental management across Europe. There is much opportunity to develop a common framework and stimulate the sharing of best practice. This could become even more imperative with continued and increasing risk of flooding due to development in floodplains and the likely consequences of climate change in parts of Europe.

A further area requiring more development before river-basin management will be wholly sustainable will be the involvement of communities and key stakeholders in decisionmaking. Again the implementation of the Water Framework Directive should give this more impetus.

Significant advances have been made within Europe toward sustainable river-basin management. However, the current status of the water environment varies widely across Europe, largely reflecting historical starting points, different legislative and administrative arrangements, and the speed with which Member States are able to make improvements. As a result, there is much to be achieved before river-basin management is truly sustainable across Europe.

## **1. Background**

Water resources are spread unevenly across Europe. The nature of their monitoring and reporting makes consistent comparisons difficult. However, there are some conclusions that can be made regarding the management of river basins across Europe to establish whether this is being carried out in a sustainable way in line with what was perceived within *Agenda 21* in relation to the sustainable management of water resources.

Europe contains some of the largest rivers of the world. The Danube River, 2860 km long and with runoff of 214 km<sup>3</sup> per year, compares with the Volga and the Indus Rivers. Europe also contains seas such as the Baltic and many major lakes including the Caspian Sea, Lakes Vanern and Vattern in Sweden, and the lakes such as Lake Geneva and Lake Como. It has large numbers of wetlands and significant groundwater resources.

The runoff across Europe varies significantly from an average annual value of 3000 mm in Norway, to 100 mm over much of Eastern Europe to 25 mm in central and southern Spain. This spatial variability places stresses and strains on the water environment and its use. The challenge is to ensure that this balance is appropriate and in harmony with the maintenance of the environment.

Water quality also varies significantly across Europe, with respect to both natural causes and anthropogenic influences. This, too, affords major challenges for sustainable management. A key feature of water management in Europe is the dependence of a number of countries on international lakes and rivers for their water supplies and the

discharge of their effluents. This presents further challenges in ensuring the sustainable planning and management of water use.

With the continuing enlargement of the European Union (EU), this institution will provide the focused framework for delivering a more sustainable approach to river-basin management across Europe, through the range of policy and legislative mechanisms that it develops. However, it will rest with each Member State to undertake the changes in management practices and attitudes that will be required to deliver real environmental improvements.

## **2. Objectives of Agenda 21 in the Context of River Basins**

Within the *Agenda 21* discussions, it was recognized that freshwater resources are an essential component of the Earth's natural systems and are needed to support all aspects of life. In this context, a general objective was established to ensure that adequate supplies of good quality water were maintained to support the entire population of the planet, while preserving the functions of ecosystems and adapting human activities within natural carrying capacity and combating water-related diseases. It was recognized that innovative technologies, including the improvement of indigenous technologies, were needed to fully utilize limited water resources and safeguard these resources against pollution.

In addressing such challenges it was recognized that fundamental to success was the need to apply an integrated approach to the development, management, and use of water resources. This would need to be underpinned by a robust assessment of water resources. Water resources would require protection not just in relation to their quantity but also to their quality and aquatic ecosystems. This protection would ensure adequate resources for drinking water supply and sanitation and sufficient resources for sustainable urban development and sustainable food production and rural development. Recognition of the potential impact of climate change on water resources is also required.

The value of an integrated approach to water resources management to include all aspects of river-basin management is now well-recognized in a scientific and theoretical sense. However, its achievement in practice is somewhat limited in a European context. The need to balance environmental, social, and economic pressures on river basins is increasingly being accepted as a goal. However, the extent to which the water environment contributes to economic development and social well-being is poorly understood by decisionmakers and the community at large.

In developing a sustainable approach to water resources management, it is essential to recognize that catchment processes are interdependent. There is a need to understand the interaction between the catchment area and the watercourses and the groundwater system. The value of lakes and wetlands should not be underestimated. The interaction with ecosystems and institutional and management systems must also be recognized. Land and water management issues must be considered together. The importance of managing on a whole-river basis rather than a reach-by-reach approach is paramount. This presents particular challenges where a river catchment falls within more than one

administrative unit or transcends national boundaries, as is the case with many European rivers.

A cross-sectoral approach to management, which recognizes all these interactions, is essential to delivering sustainable management. In this way the cross-linkages between water supply and sanitation, water resources, water quality, flood control, fisheries, recreation, navigation, and other water uses can be considered in making decisions. Decisions would be underpinned by an approach that seeks to enhance biodiversity and promote appropriate urban and rural economic development to the benefit of the communities who depend on the catchment for their home, health, livelihood, and amenity. The need for a coordinated approach among land-use planning, regional economic planning, and water resources management is fundamental to a sustainable approach, although is rarely recognized in the administrative and legislative arrangements within Europe.

The implementation of a sustainable approach to river-basin management requires the development of appropriate institutional arrangements to implement regulatory and operational procedures. These arrangements need to include some element of community involvement, particularly of those sections of the society who may be highly dependent on water resources but who traditionally may not be well represented in decisionmaking frameworks. These include, for example, women, the socially disadvantaged, and ethnic minorities. There needs to be recognition of the value of a suite of approaches to management of water resources which goes beyond the traditional legal and regulatory approaches. These include economic instruments and the development of best practice and education. This should allow the development of an element of choice in stakeholder behavior, once basic human and environmental needs have been satisfied. In allowing such choices, it must be recognized that while institutional policies must be based on sound science, knowledge about the behavior of river basins remains imperfect. Hence a precautionary approach encouraged by the EU will be appropriate in a number of instances. This may lead to some restriction in stakeholder choice and behavior, in delivering the common good, or in ensuring that our actions today do not compromise tomorrow's choices.

Fundamental to the delivery of sustainable management of river basins is the need to ensure that management actions are underpinned by a robust assessment of water resources and the environmental, social, and economic pressures that impinge upon the river basin. This includes basic parameters such as the location, size, reliability, and resilience of surface and groundwater resources, together with an assessment of their hydrological basis and flow regime. Risk assessment, in terms of vulnerability to floods and droughts and pollution will be an important feature. An assessment is also needed of the biological, chemical, physical, ecological, and aesthetic quality of river basins to support human and ecosystem health.

Where a river basin is shared among different administrative or national units, it is challenging to ensure that protocols are developed to require common standards for monitoring and data collection and storage to allow efficient and effective information gathering and sharing among all interested parties.

An understanding of the demands placed on the water resources both now and in the future will be an essential element in determining management options. The demands should include hard demands such as the need for water for abstraction to support domestic use, agriculture, and industry. Indirect demands should be considered, such as the need to have sufficient water for in-stream needs such as for dilution of effluents, navigation, fisheries, and to promote biodiversity. Softer demands such as those that establish the conditions needed to provide reduced flood risk or an aesthetic or amenity resource also need to be considered.

Also required is an assessment of the nature and scale of the impact of alternative management strategies on the river basin. This may relate to the physical nature of the catchment—for example, the further demands which could be met from existing sources or the impact of a new resource on flow regime or water level in reservoirs or lakes.

It may also relate to the wider environment, economy, or society. An example is the impact on the economy and community of refusing to allow an abstraction or discharge to support an industrial concern which would otherwise close its factory.

A key challenge to the sustainable management of water resources is the need to protect the quantity and quality of water and associated aquatic habitats. The interaction between water quantity and water quality and habitat quality is increasingly being understood. However there are still major difficulties in ensuring that river basins are not degraded. Abstraction for water supply can reduce flows to levels that adversely impact on ecosystems, reduce recreation potential, or reduce the dilution of effluents.

Water quality, including sediment load, can be adversely affected by discharges from industrial complexes and sewage works. Non-point pollution from agricultural areas, forestry, road construction, and other catchment-based activities is particularly difficult to either eradicate or treat. Runoff from contaminated land can impact both surface water and groundwater. Pollution incidents, for example due to the accidental spillage of oil, can have an immediate and long-term, devastating impact on water quality.

Pollution of watercourses can be much more expensive to treat than control of the pollution at the source. Pollution of groundwater can be extremely long-lived and may be expensive and technically difficult, if not impossible, to treat. This may impact on water supplies or the quality of base flows to watercourses and wetlands.

Development in floodplains can lead to an increase in flood risk, an increase in erosion, and a loss of biodiversity associated with natural and active floodplains. Some activities within the channel such as the excavation of pools for fisheries purposes, channel maintenance, and the crossing of pipelines and bridges can inhibit biodiversity, landscape value, and amenity, and may also lead to an increase in flood risk, erosion, and sediment loading.

A more sustainable approach would be to ensure that works carried out within channels and floodplains work alongside natural processes. In particular, urban development and construction within rivers should be sited such that they do not increase flood risk at the site or elsewhere.

While the quality of freshwater should be valued for its own sake, there are clearly human health effects that should be considered when ensuring safe drinking water and adequate sanitation. There are public health considerations if pollutants such as heavy metals, pesticides, and herbicides enter drinking waters.

There are current concerns about the extent and effect of endocrine-disrupting substances and their impact on human health. Waterborne diseases can be prevalent and require control through robust catchment management and the protection and treatment of sources of water supplies, effective sanitation services, and the appropriate treatment and disposal of wastes. This is essential for the sustainable management of water resources and indeed the wider environment.

In many parts of Europe, the availability of water resources underpins economic development in both urban and rural contexts. As local water resources become fully utilized, pressure develops for the transfer of water over significant distances. While it is important to sustain economic growth overall, the long-distance transfer of water resources with its associated environmental impact may be a less sustainable approach than other solutions.

These may include the more efficient use of water, precluding the need for the new development. Alternately, economic growth may be encouraged in areas that are water self-sufficient in preference to those experiencing water stress.

In making such decisions it is important to consider the whole-life construction, maintenance, and environmental costs of a scheme. This includes, for example, the ongoing energy costs of water transfer and the social and economic consequences costs and benefits of the urban or rural development. Clearly the institutional mechanisms need to be in place to ensure that this holistic approach to decisionmaking can be accommodated.

While the nature and extent of climate change remains unclear, there is a developing consensus that recognizes the need to develop water-resource management strategies that are sensitive to potential climate change.

Such strategies need to take into account, for example, the potential for changing the pattern and frequency of floods and droughts, the implications of sea-level rise on groundwater and surface water quality and flood risk, the changed demand for water brought about by a changed temperature and rainfall distribution impacting on both human use of water, and the in-river need for water by a potential change in the character of aquatic ecosystems. Climate change, irrespective of its pattern, is likely to increase the stresses on the water environment and the balance among potentially conflicting environmental, economic, and social pressures.

Opportunities will need to be taken through enhanced monitoring and research to understand and assess as far as possible the potential implications of climate change in a European context. This will allow the development of strategies to accommodate the changing circumstances. This is likely to require collaboration on an international scale and locally based strategies for adaptation to the changing regime.

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