Socio-economic assessment

Environmental objectives

The WFD is one of the first European Directives in the domain of water, which explicitly recognizes the role of economics in reaching environmental and ecological objectives. The Directive calls for the application of economic principles (e.g. polluter pays principle), approaches and tools (e.g. cost-effectiveness analysis) and for the consideration of economic instruments (e.g. water pricing methods) for achieving good water status for water bodies in the most effective manner. The Guidance Document on the Economic Analysis prepared in 2002 by the European Water and Economics Working Group (WATECO) advises that the various elements of the economic analysis should be integrated in the policy and management cycle in order to aid decision-making when preparing the river basin management plans. The integration of economics throughout the WFD policy and decision making cycle is presented.
The main elements of the economic analysis are found in Articles 5 and 9 and Annex III in the WFD. Economic arguments also play an important role in the political decision-making process surrounding the preparation of RBMP in Article 4 where derogation can be supported by the strength of economic arguments when setting environmental objectives.

The economic analysis can be summarised as follows:

1) Economic characterisation of the river basin (Article 5)
   · Assessment of the economic significance of water use in the river basin
   · Forecast of supply and demand of water in the river basin up to 2015
   · Assessment of current cost recovery by estimating the volume, prices, investments and costs associated with water services in order to be able to assess cost recovery of these water services, including environmental and resource costs

2) Cost-effectiveness analysis (Article 11 and Annex III)
   · Evaluation of the costs and effectiveness of the proposed programme of measures to reach the environmental objectives.

3) Disproportional costs (Article 4)
   · Evaluation whether costs are disproportionate.

4) Cost recovery and incentive pricing (Article 9)
   · Assessment of the distribution of costs and benefits and the potential impact on cost recovery and incentive pricing.

The three main steps in the economic analysis identified by Wateco (2002) and the associated time path are illustrated in the figure. The first step, the economic characterisation of river basins, has recently been completed. In the following the preliminary risk analysis carried out so far for the different European river basins will be further elaborated (including the more detailed definition of environmental objectives) and a start will be made with the identification of additional measures needed to reach good water status in a second step.
### Steps in the economic analysis in the WFD and corresponding time path (modified from the WATECO Guidance Document)

By the end of 2007 each EU Member State has to produce an overview of its basic and additional measures according to Article 11, from which the most cost-effective programme of measures will be selected in step 3 by the end of 2008. Based on a cost-effectiveness analysis of programmes of measures, the question whether the total costs of additional measures to reach good water status are disproportionate will be addressed by the end of 2009. Finally, the financial implications of the basic and additional measures for different groups in society has to be evaluated by 2010, including the level cost recovery, changes in the use and level of economic instruments (e.g. levies, taxes, water prices) and their role in achieving a more efficient and sustainable water use.
Location and type of investigated groundwater bodies

- Upper Rhine valley quaternary aquifer, France
- Scheldt basin in the Netherlands
- Lahti, Finland
- Aveiro Quaternary Aquifer in Portugal
- Riga, Latvia

Overall conclusions and key recommendations

- One of the main objectives of BRIDGE is to develop, apply and test economic methods for the identification of economically efficient groundwater threshold values. The objective is not to derive threshold values for specific groundwater pollutants for which no threshold values are available yet, but to demonstrate the use and usefulness of the economic methods in sustainable groundwater policy and management.

- In this field, the work focuses explicitly on practical and feasible groundwater management to reach possible groundwater threshold values. Corresponding with the way environmental objectives are set in the WFD, i.e. based on some ecological reference situation, the BRIDGE methodology to establish groundwater threshold values excludes any a priori economic considerations or criteria. Economic criteria start playing a role after the threshold values have been set, namely in the design of practical groundwater management measures. For example, measures have to be cost-effective according to the WFD, meaning that the environmental threshold values have to be reached at their lowest cost.

- Hence, the work in WP5 starts where work packages WP1 to WP4 stop, i.e. with the practical implementation of the groundwater quality objectives through concrete groundwater management actions and measures, and in particularly their economic implications in terms of costs and benefits and the distribution of these costs and benefits across various stakeholders (direct and indirect users and non-users of groundwater resources). This integrated environmental-economic impact assessment provides the basis for the evaluation of possible disproportionate costs, and consequently the basis for possible objective or time derogation as in the WFD, i.e. lowering environmental objectives or delaying them in time.

- The role of economics in establishing groundwater threshold values is comparable to the role of the economic analysis in the implementation of the WFD, where environmental objectives can be lowered or delayed in time if the costs of reaching the objectives are considered disproportional (WFD article 4). In order to be able to evaluate and assess whether the economic costs of reaching environmental groundwater threshold values are disproportional, an important step is to evaluate and assess the cost and effectiveness of possible practical management measures to reach these threshold values, including their distribution across various stakeholders, and compare these with the corresponding environmental, social and economic benefits.
The economic analysis is one important input in the decision-making procedure about disproportionate costs, but not the sole decision-making criterion. The definition of ‘economic threshold values’ or benchmarks for the assessment of disproportionate costs is subjective and political. In practice they will not be derived on the basis of an economic cost-benefit analysis only. Concrete national or European benchmarks for disproportionate costs do not exist, also not in comparable directives such as the IPPC Directive where the concept of best available techniques not entailing excessive costs (BATNEC) is introduced or the Habitats Directive which refers to ‘imperative reasons of overriding public interests, including those of a social or economic nature’ to justify exemptions.

In the WP5 case studies the researchers and analysts are unable to judge whether the estimated total costs are disproportional compared to their economic benefits. In the economic analysis it is observed that some courses of action are economically beneficial, while others are not. Two characteristic features of the economic analysis presented in the case studies are (1) the explicit examination of costs and benefits for different groundwater quality threshold values, including natural background levels, and (2) the spatial distribution of these economic costs and benefits for different groundwater threshold values. This distribution can be skewed and therefore be used as an important criterion to argue for disproportional costs.

For example, in the Dutch case study it is concluded that setting the groundwater threshold value at 50 milligrams per litre is economically speaking justified for most groundwater protection measures, but a threshold value of 25 milligrams is not. In the latter case the investment costs in this public decision-making context can be as high as 10 times the estimated benefits to reach a threshold value of maximum 25 milligrams nitrate per litre. In the Portuguese case study we find, for example, that up to 65 percent of the total costs for groundwater protection measures in agriculture are born in one specific (northern) area of the aquifer, while most of the benefits of improved groundwater quality (35%) accrue largely to the inhabitants in a specific other (central) part of the aquifer. The question whether a higher threshold value of 25 milligrams for the whole basin compared to the current threshold value of 50 milligrams results in disproportional costs or whether the skewed 65-35 distribution of costs and benefits across the aquifer depends on policy maker assessment of disproportionality. Different policymakers may hold different views depending on the available alternatives and their perceived viability, that is the political support they perceive to receive for the implementation of these measures from the affected sector and actors.

Another important role of the economic analysis in WP5 is to estimate the economic value of sustainable groundwater resources management by making the various use and non-use values of groundwater resources more explicit than currently is the case. This includes the so-called ‘existence’ value of groundwater, i.e. the value attached to groundwater protection and preservation for the sake of the resource itself as one of the ‘receptors’ in the BRIDGE methodology.

Improving groundwater quality is expected to yield direct economic benefits in that better quality will result in a reduction of the purification costs of groundwater used for human consumption. However, there may also be important so-called non-market benefits associated with the improvement of groundwater quality. The economic value of these non-market benefits is measured in terms of public willingness to pay for groundwater quality improvement. In large-scale public surveys, local residents are
asked in the case studies for their knowledge, awareness, perception, attitudes, preferences and valuation of different groundwater threshold values. Although economic use values dominate the economic values found for different groundwater threshold values, we find substantial non-use or existence values for groundwater protection in all case studies, providing support for the receptor-based approach advocated in BRIDGE.

• For the purpose of measuring public perception and values of groundwater quality threshold values, a ‘groundwater quality ladder’ was developed and tested in the public surveys in the WPS case studies, reflecting different use and non-use related economic values of groundwater quality. In order to be able to make the public at large understand the meaning of different groundwater quality threshold values as proposed in the Groundwater Directive, these threshold values have to be translated into ready understandable terms. We use for example irrigation, drinking water and a natural situation mimicking natural background levels as key triggers to inform local residents about the social and economic implications of different groundwater quality threshold values. In the Portuguese case study half of the local population has a private groundwater well, of whom 25 percent uses their well water directly for consumption and 80 percent for irrigating their crops and gardens. Public belief in the information provided in the survey about the current and expected groundwater situation plays a significant role in the case studies where the public survey was carried out.

• Asking local stakeholders who are and will be affected by future groundwater policy, either through extra taxes or an increase of their water bill, to inform policy makers about the importance and value these local stakeholders self attach to groundwater protection in term of their willingness to pay for different groundwater quality threshold values can be used as one of the possible ‘economic’ threshold values for disproportional costs, accounting for their ability to pay. In the Dutch case study we find, for example, that the cost of a more stringent groundwater threshold value up to 25 milligrams per litre for the whole basin should not exceed 30 euro per household per year over and above what local residents currently pay for water in their basin. This is what local residents are willing and able to pay for groundwater quality improvements up to 25 milligrams if policy makers would ask them to help decide.

• Risk and uncertainty are key concepts in the environmental and economic assessment of different groundwater quality threshold values. The environmental and human risks of groundwater quality are surrounded by uncertainty about the correct dose-pathway-effect relationships. This fundamental lack of knowledge was clearly demonstrated in the French case study for volatile organic compounds (VOC). Feasible management options for sustainable and cost-effective groundwater management cannot be identified and evaluated if the extent of the problem (i.e. risk of not meeting a threshold value or ‘gap’ between expected and desired quality level) cannot be identified and to some degree quantified first. Establishing threshold values and assessing their implication for different environmental and socio-economic receptors is in itself surrounded by fundamental sources of scientific uncertainty. These scientific uncertainties are translated and found back in the policy realm by adopting an ‘adaptive management’ approach based on for example the precautionary principle as in the overall BRIDGE ‘tiered approach’.

• The risk of not meeting certain threshold values is highly dependent on the limited available data and information and the confidence the analyst and policy-maker have in these data and information. In principle, economics also has a role to play here: in the development and design of alternative groundwater quality monitoring systems to
inform policy makers and groundwater managers about the appropriate course of action. In the case of setting up new monitoring systems or modifying existing monitoring networks, the economic value of additional information plays an important role, where the economic costs of extra monitoring will be weighted against the perceived additional benefits of better and more sustainable groundwater management. In other words, economic criteria are expected to be an integral part of the actual adoption and implementation of any groundwater monitoring and management plan.

- Assessing the environmental impact of programs of measures on water quality with some degree of confidence is one of the most important problems in the implementation of the WFD, and will also be one of the most important challenges in the implementation of the new European Groundwater Directive. Given the fact that the groundwater threshold values are fixed in terms of pollutant concentration levels, the effect of policy measures has to be evaluated in terms of their impact on water quality basin-wide. This is currently the weakest link: the relationship between socio-economic activities (pressures) and the actual impact of these activities or changes in these activities on groundwater quality. This includes groundwater-surface water interactions and the impact of groundwater quality on terrestrial ecosystems. In none of the WP5 case studies these links could be thoroughly established.

- The effects of most measures are evaluated in terms of their emission reduction potential, not their impact on water quality measured through the change in pollutant concentration levels basin-wide. Also in most WP5 case studies the relationship between pressure reduction (emission of a pollutant) and the actual impact on groundwater quality is weak and surrounded by uncertainty. More research is needed here in scientific models built with the help of expert judgment to better understand this relationship in time and space. Although common practice in the actual implementation of the WFD in many if not most European Member States, the use of qualitative expert judgment only in the selection of cost-effective programs of measures is considered a second-best alternative to more quantitative basin-wide modelling of the impacts of different measures on surface and groundwater quality. This should be a focal point in future EU water-related research programs.