ECONOMICS AND THE ENVIRONMENT

THE IMPLEMENTATION CHALLENGE OF THE WATER FRAMEWORK DIRECTIVE

ACCOMPANYING DOCUMENTS TO THE GUIDANCE

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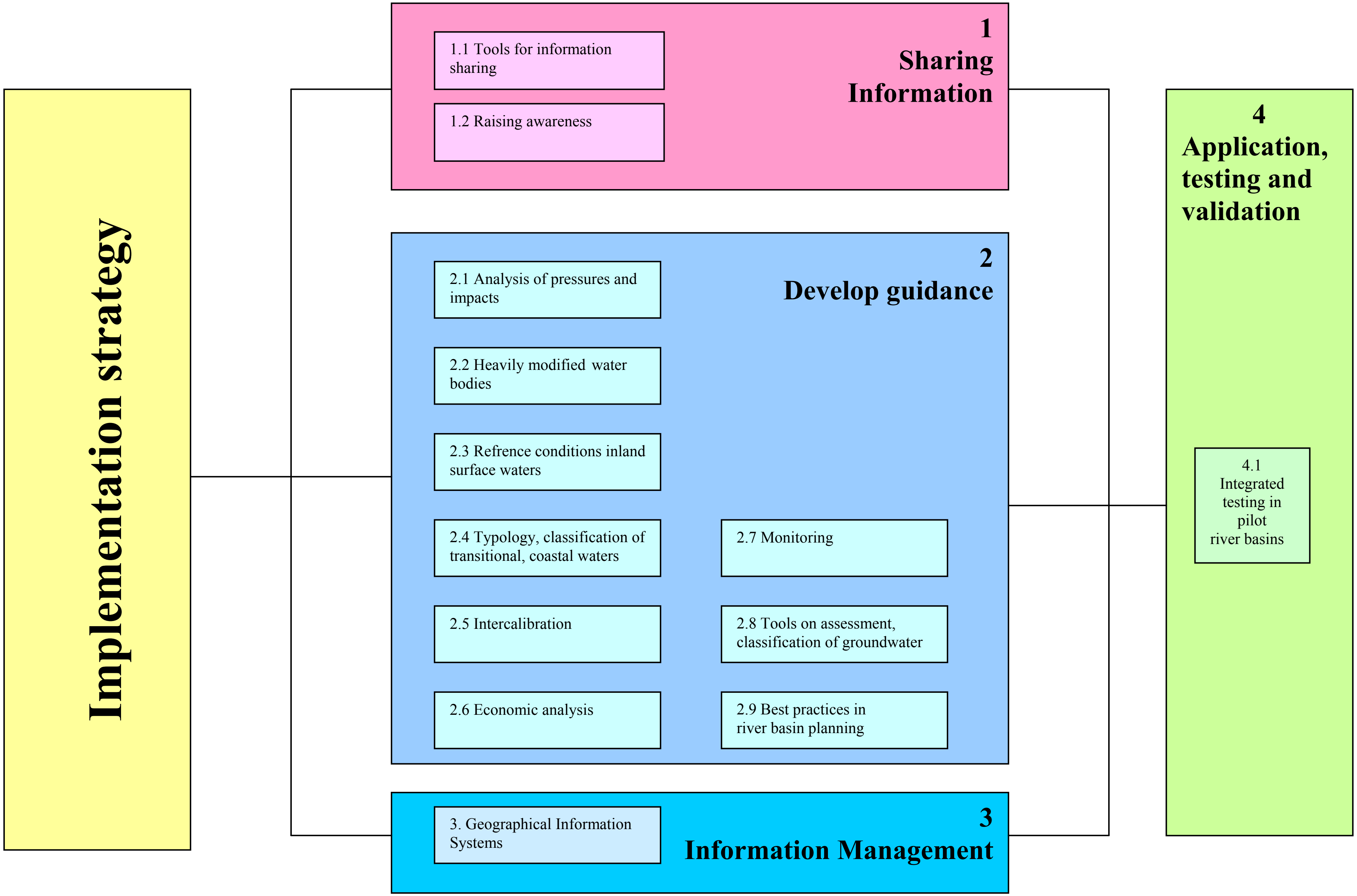
Annex I

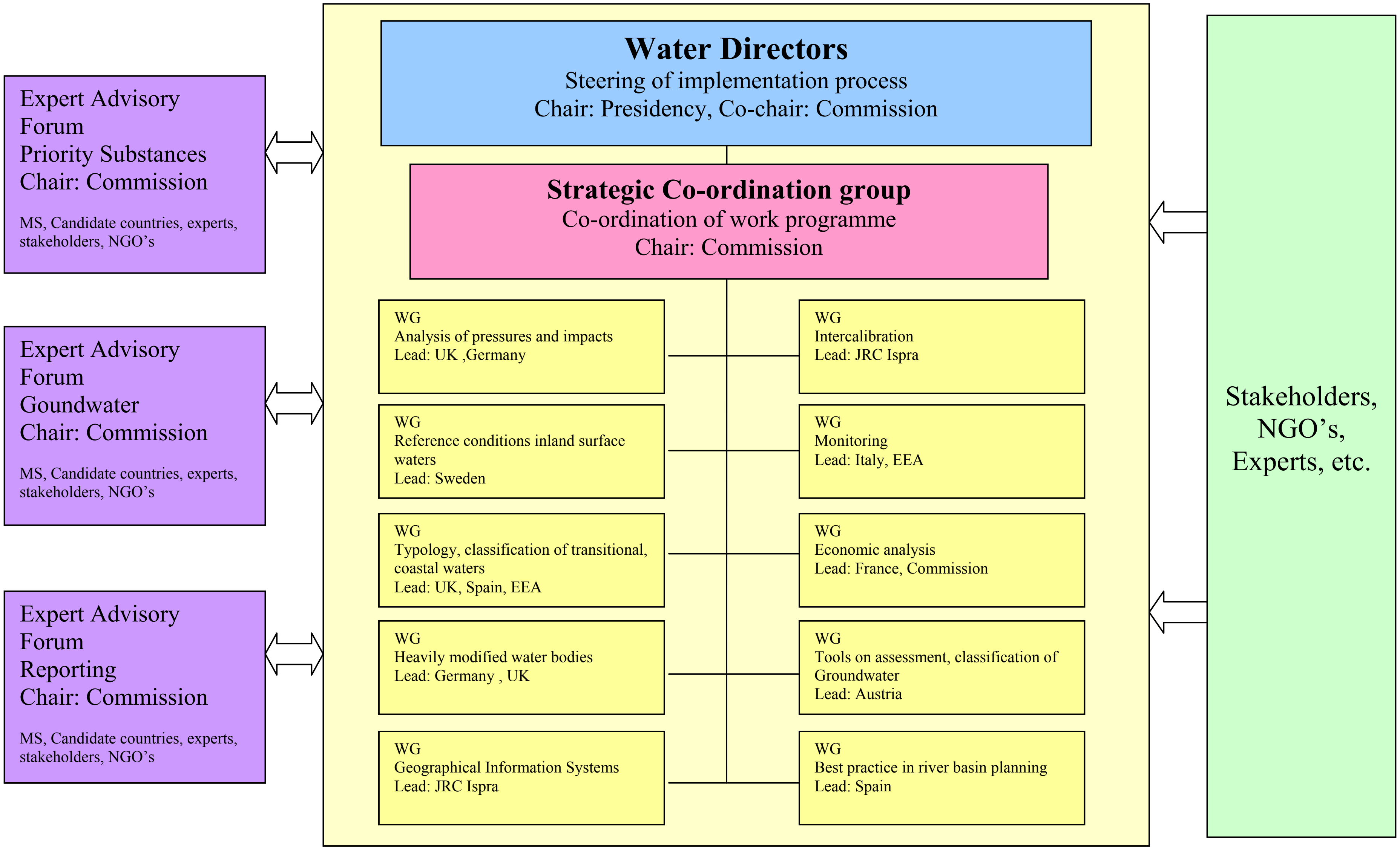
Implementation of the Water Framework Directive

I.I The Common Implementation Strategy

Annex I.I - The Common Implementation Strategy



Overall organisational structure of the Common Implementation Strategy



ANNEX I.I.2

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Annex II

Definitions

II.I Economic Elements of the Water Framework Directive: Legal Text

Title	Specification	Provision
Preambles		
	No. 11	'[...] environmental damage should, as a priority, be rectified at source and the polluter should pay.'
	No. 12	'[...] the Community is to take account of available technical data, environmental conditions in the various regions of the Community, and the economic and social development of the Community as a whole and the balanced development of its regions as well as potential costs and benefits of action or lack of action.'
	No. 29	'[...] Member States may phase implementation of the programme of measures in order to spread the costs of implementation.'
	No. 31	In cases where a body of water is so affected by human activity or its natural condition is such that it may be infeasible or unreasonably expensive to achieve good status, less stringent objectives may be set [...] and all practicable steps should be taken to prevent any further deterioration of the status of waters.'
	No. 36	'It is necessary to undertake analyses of the characteristics of a river basin and the impacts of human activity as well as an economic analysis of water use [...]'
	No. 38	'The use of economic instruments by Member States may be appropriate as part of a programme of measures. The principle of recovery of the costs of water services, including environmental and resource costs associated with damage or negative impact on the aquatic environment should be taken into account in accordance with, in particular, the polluter pays principle. An economic analysis based on long-term forecasts of supply and demand for water in the RBD will be necessary for this purpose.'
	No. 43	'Pollution through the discharge, emission or loss of priority hazardous substances must cease or be phased out. The European Parliament and Council should [...] agree [...] on the substances to be considered for action as a priority and on specific measures to be taken against pollution of water by those substances, taking into account all significant sources and identifying the cost-effective and proportionate level and combination of controls.'
	No. 53	'Full implementation and enforcement of existing environmental legislation for the protection of waters should be ensured. It is necessary to ensure the proper application of the provisions implementing this Directive [...] by appropriate penalties [...]. Such penalties should be effective, proportionate and dissuasive.'
Article 2	*Definitions*	
	Paragraph 38	"Water services" means all services which provide, for households, public institutions or any economic activity: (a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater (b) waste water collection and treatment facilities which subsequently discharge into surface water.'
	Paragraph 39	"Water use" means water services together with any other activity identified under Article 5 and Annex II having a significant impact on the status of water. This concept applies for the purposes of Article 1 and of the economic analysis carried out according to Article 5 and Annex III, point (b).'

Title	Specification	Provision
Article 4	*Environmental objectives*	
	Paragraph 4.3	'Member States may designate a body of surface water as artificial or heavily modified, when: (a) the changes to the hydromorphological characteristics of that body which would be necessary for achieving good ecological status would have significant adverse effects [...].'(b) the beneficial objectives served by the artificial or modified characteristics of the water body cannot, for reasons of technical feasibility or disproportionate costs, reasonably be achieved by other means, which are a significantly better environmental option. Such designation and the reasons for it shall be specifically mentioned in the RBMPs required under Art. 13 and reviewed every six years.'
	Paragraph 4.4	'The deadlines established under paragraph 1 may be extended for the purposes of phased achievement of the objectives for bodies of water, provided that no further deterioration occurs in the status of the affected body of water when all of the following conditions are met: (a) Member States determine that all necessary improvements in the status of bodies of water cannot reasonably be achieved within the timescales set out in that paragraph for at least one of the following reasons: [...] (ii) completing the improvements within the timescale would be disproportionately expensive (b) Extension of the deadline, and the reasons for it, are specifically set out and explained in the RBMP required under Art. 13 [...].'
	Paragraph 4.5	'Member States may aim to achieve less stringent environmental objectives than those required under Paragraph 1 for specific bodies of water when they are so affected by human activity, as determined in accordance with Art. 5.1, or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive and all of the following conditions are met: (a) the environmental and socio-economic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs; (b) Member States ensure, - for surface water, the highest ecological and chemical status possible is achieved, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution; - for groundwater, the least possible changes to good groundwater status, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution; [...] (d) the establishment of less stringent environmental objectives, and the reasons for it, are specifically mentioned in the RBMP required under Art. 13 and those objectives are reviewed every six years.'
	Paragraph 4.6	'Temporary deterioration in the status of bodies of water shall not be in breach of the requirements of this Directive if this is the result of circumstances of natural cause [...] or the result of circumstances due to accidents [...] when all of the following conditions have been met: (a) all practicable steps are taken to prevent further deterioration in status and in order not to compromise the achievement of the objectives of this Directive in other bodies of water not affected by those circumstances; (b) the conditions under which circumstances that are exceptional or that could reasonably have been foreseen may be declared, including the adoption of the appropriate indicators, are stated in the RBMP; [...] (d) [...] all practicable measures are taken with the aim of restoring the body of water to its status prior to the effects of those circumstances as soon as reasonably practicable; (e) a summary of the effects of the circumstances and of such measures taken or to be taken in accordance with paragraphs (a) and (d) are included in the next update of the RBMP.'

Title	Specification	Provision
	Paragraph 4.7	'Member States will not be in breach of this Directive when: failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alteration to the level of bodies of groundwater, or failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions are met: ... (d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.'
Article 5	*Characteristics of the River Basin District, review of the environmental impact of human activity and the economic analysis of water use*	
	Paragraph 5.1	'Each Member State shall ensure that for each RBD or for the portion of an international RBD falling within its territory an analysis of its characteristics, a review of the impact of human activity on the status of surface waters and on ground water, and an economic analysis of water use is undertaken according to the technical specifications set out in Annexes II and III and that it is completed at the latest four years after the date of entry into force of this Directive.'
	Paragraph 5.2	'The analyses and reviews mentioned under paragraph 1 shall be reviewed, and if necessary updated at the latest 13 years after the date of entry into force of this Directive [2013] and every six years thereafter.'
Article 6	*Register of Protected Areas*	
	Paragraph 6.1	'Member States shall ensure the establishment of a register or registers of all areas lying within each RBD which have been designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species directly depending on water. They shall ensure that the register is completed the latest four years after the date of entry into force of this Directive.'
	Paragraph 6.2	'The register or registers [of protected areas] shall include all bodies of water identified under Article 7(1) and all Protected Areas covered by Annex IV [i.e. ...areas designated for the protection of economically significant aquatic species...].'
Article 9	*Recovery of costs for water services*	
	Paragraph 9.1	'Member States shall take account of the principle of recovery of costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle. Member States shall ensure by 2010: (i) that water pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive(ii) an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, based on the economic analysis conducted according to Annex III and taking account of the polluter pays principle. Member States may in do doing have regard to the social, environmental and economic effects of the recovery as well as the geographic and climatic conditions of the region or regions affected.'

Title	Specification	Provision
	Paragraph 9.2	'Member States shall report in the RBMPs [to be published at the latest 9 years after the date of entry into force of this Directive, 2009] on the planned steps towards implementing paragraph 1 [...] which will contribute to achieving the environmental objectives of this Directive and on the contribution made by the various water uses to the recovery of the costs of the water services.
	Paragraph 9.3	'Nothing in this Article shall prevent the funding of particular preventative or remedial measures in order to achieve the objectives of this Directive.'
	Paragraph 9.4	'[...] Member States shall report the reasons for not fully applying paragraph 1, second sentence, in the RBMPs.'
Article 11	*Programme of measures*	
	Paragraph 11.1	'Each Member State shall ensure the establishment for each RBD, or for the part of an international RBD [IBRD] within its territory, of a programme of measures, taking account of the results of the analyses required under Art. in order to achieve the objectives established under Art. 4 [...]'
	Paragraph 11.2	'Each programme of measures shall include the "basic" measures specified in paragraph 3 and, where necessary, "supplementary" measures.'
	Paragraph 11.3	"Basic" measures are the minimum requirements to be complied with and shall consist of [...] (b) measures deemed appropriate for the purposes of Art. 9. (c) measures to promote an efficient and sustainable water use in order to avoid compromising the achievement of the objectives specified in Art. 4. [...] (i) for any other significant adverse impacts on the status of water identified under Art.. 5 and Annex II.'
	Paragraph 11.4	"Supplementary" measures are those measures designed and implemented in addition to the basic measures, with the aim of achieving the objectives established pursuant to Art. 4.'
	Paragraph 11.7	'The programmes of measures shall be established at the latest nine years after the date of entry into force of this Directive [2009] and all the measures shall be made operational at the latest 12 years after that date [2012].'
Article 13	*River basin management plans*	
	Paragraph 13.1	'Member States shall ensure that a RBMP is produced for each RBD lying entirely within their territory.'
	Paragraph 13.2	'In the case of international RBD falling entirely within the Community, Member States shall produce a single International RBMP. Where such a plan is not produced, a RBMP should be produced covering at least those parts of the IRBMP falling within its territory to achieve the objectives of this Directive.'
	Paragraph 13.4	'The RBMP shall include the information detailed in Annex VII.'
	Paragraph 13.5	'RBMPs may be supplemented by the production of more detailed programmes and management plans for sub-basin, sector, issue or water type, to deal with particular aspects of water management. Implementation of these measures shall not exempt Member States from any of their obligations under the rest of this Directive.'
	Paragraph 13.6	'RBMPs shall be published at the latest nine years after the date of entry into force of this Directive (2009).'
	Paragraph 13.7	'RBMPs shall be reviewed and updated at the latest 15 years after the date of entry into force of this Directive and every six years thereafter.'
Article 14	*Public Information and Consultation*	

Title	Specification	Provision
	Paragraph 1	'Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the River Basin Management Plans. Member States shall ensure that, for each River Basin District, they publish and make available for comments to the public, including users: (a) a timetable and work programme for the production of the plan […] at least three years before the beginning of the period to which the plan refers; (b) an interim overview of the significant water management issues identified in the river basin at least two years before […]; (c) draft copies of the River Basin Management Plan, at least one year before […].
Article 15	*Reporting*	
	Paragraph 15.2	'Member States shall submit summary reports of the Reporting of the analyses under Article 5 [...] undertaken for the purposes of the first RBMP within 3 months of their completion.'
Article 16	*Strategies against pollution of water*	
	Paragraph 16.6	'For the priority substances, the Commission shall submit proposals of controls for the progressive reduction of discharges, emissions and losses of the substances concerned and, in particular, the cessation or phasing out of discharges [...]. In doing so it shall identify the appropriate cost-effective and proportionate level and combination of product and process controls for both point and diffuse sources [...].'
Article 17	*Strategies to prevent and control pollution of groundwater*	
	Paragraph 17.2	'In proposing measures, the Commission shall have regard to the analysis carried out according to Article 5 and Annex II [due in at the latest 4 years after the implementation of this Directive, i.e. 2004].'
Article 23	*Penalties*	'Member States shall determine penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties thus provided for shall be effective, proportionate and dissuasive.'
Annex II	*Identification of pressures*	
	Paragraph 1.4	'Member States shall collect and maintain information on the type and magnitude of the significant anthropogenic pressures to which the surface water bodies in each RBD are liable to be subject, in particular: • estimation and identification of significant point [... and...] diffuse source pollution [...]; • estimation and identification of significant water abstraction for urban, industrial, agricultural and other uses, including seasonal variations and total annual demand, and loss of water in distribution systems; • estimation and identification of the impact of significant water flow regulation [...]; • identification of significant morphological alterations to water bodies; • estimation and identification of other significant anthropogenic impacts on the status of surface waters; and • estimation of land use patterns [...].'

Title	Specification	Provision
Annex III	*Economic analysis*	'The economic analysis shall contain enough information in sufficient detail (taking into account the costs associated with collection of the relevant data) in order to: (a) make the relevant calculations necessary for taking into account under Art. 9 the principle of recovery of the costs of the water services, taking account of the long term forecasts of supply and demand for water in the RBD and, where necessary: • estimates of the volume, prices and costs associated with water services; and • estimates of relevant investment including forecasts of such investments (b) make judgements about the most cost effective combination of measures in respect of water uses to be included in the programme under Art. 11 based on estimates of the potential costs of such measures.'
Annex IV	*Protected areas*	
	Paragraph 1	'The register of Protected Areas required under Article 6 shall include the following types of protected areas: [...] areas designated for the protection of economically significant aquatic species [...].'
Annex VI	*Lists of measures to be included within the programmes of measures*	'The following is a non-exclusive list of supplementary measures which Member States within each RBD may choose to adopt as part of the Programme of Measures required under Art. 11(4) [...] (iii) economic or fiscal instruments [...].'
Annex VII	*River Basin Management Plans*	'RBMPs shall cover the following elements:
	Paragraph 1	a general description of the characteristics of the RBD required under Article 5 and Annex II [...];
	Paragraph 2	a summary of significant pressures and impact of human activity on the status of surface water and groundwater, including: • estimation of point source pollution • estimation of diffuse source pollution, including a summary of land use • estimation of pressures on the quantitative status of water including abstractions • analysis of other impacts of human activity on the status of water
	Paragraph 6	a summary of the economic analysis of water use as required by Article 5 and Annex III;
	Paragraph 7	a summary of the programme or programmes of measures adopted under Art. 11, including the ways in which the objectives established under Art. 4 are thereby to be achieved:
	Paragraph 7.2	[...] a report on the practical steps and measures taken to apply the principle of recovery of the costs of water use in accordance to Art. 9;
	Paragraph 7.10	[...] details of the supplementary measures identified as necessary in order to meet the environmental objectives established;
	Paragraph 8	a register of any more detailed programmes and management plans for the RBD dealing with particular sub-basins, sectors, issues or water types, together with a summary of their contents [...].'

Abbreviations: RBMP- River Basin Management Plan, IRBMP - International River Basin Management Plan, RBD - River Basin District, IBRD - International River Basin District

II.II Glossary

Source	Term	Definition
Information sheet – Estimating Costs (and Benefits)	Administrative costs	Administrative costs related to water resource management. Examples include costs of administering a charging system or monitoring costs.
	Affordability	The relative importance of water service costs in users' disposable income, either on average or for low-income users only.
Art. 2 (11)	Aquifer	A sub-surface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.*
Art. 2 (8)	Artificial water body	A body of surface water created by human activity.*
Art. 2 (27)	Available groundwater resource	The long-term annual average rate of overall recharge of the body of groundwater less the long-term annual rate of flow required to achieve the ecological quality objectives for associated surface waters specified under Article 4, to avoid any significant damage to associated terrestrial ecosystems.*
Information sheet – Baseline Scenario	Baseline Scenario	Projection of the development of a chosen set of factors in the absence of policy interventions.
Art. 11 (3)	Basic measures	See Article 11(3) of the Directive.
Art 4 (7)	Benefits	See information sheet *Assessing Costs and Benefits*
Art. 2 (12)	Body of groundwater	A distinct volume of groundwater within an aquifer or aquifers.*
Art. 2 (10)	Body of surface water	A discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.*
Information sheet – Estimating Costs (and Benefits)	Capital costs	For the purpose of this guidance document divided into three categories: ➢ *New investments*. Cost of new investment expenditures and associated costs (e.g. site preparation costs, start-up costs, legal fees); ➢ *Depreciation*. Annualised cost of replacing existing assets in future. ➢ *Cost of capital*. Opportunity cost of capital, i.e. an estimate of the rate of return that can be earned on alternative investments.
Art. 2 (7)	Coastal water	Surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.*
Art. 2 (36)	Combined approach	The control of discharges and emissions into surface waters according to the approach set out in Article 10.*
Art. 2 (16)	Competent authority	An authority or authorities identified under Article 3(2) or 3(3).*
Information sheet – Assessing Costs and Benefits	Contingent valuation	Valuation of commodities not traded in markets, e.g. clean air, landscapes and wildlife. The valuation is based upon the responses of individuals to questions about what their actions would be if a particular hypothetical situation were to occur. When the average of responses has been calculated, with weighting if necessary, the valuation of a **public good** is ascertained.**

Source	Term	Definition
Information sheet – Assessing Costs and Benefits	Cost-benefit analysis	The evaluation of an investment project with a long-perspective from the viewpoint of the economy as a whole by comparing the effects of undertaking the project with not doing so.**
Information sheet – Cost-effectiveness analysis	Cost-effectiveness analysis	An analysis of the costs of alternative programmes designed to meet a single objective. The programme which costs least will be the most cost effective.**
Annex III	Cost-effective combination of measures	A combination of measures chosen subject to a cost-effectiveness analysis (see 'cost-effectiveness analysis')
Information sheet – Assessing Costs and Benefits	Damage function	A function of how pollution damage varies with the level of pollution emitted, giving a monetary value for that damage.***
Information sheet – Cost-effectiveness Analysis	Direct cost	A production cost directly attributable to the cost of producing one unit of a particular output.**
Art. 2 (32)	Direct discharge to groundwater	Discharge of pollutants into groundwater without percolation throughout the soil or subsoil.*
Information sheet – Estimating Costs (and Benefits)	Discounting	A method used to value at the same date economic flows and stocks which have originated at different dates.**
Information sheet – Estimating Costs (and Benefits)	Discount rate	The rate used for discounting future values to the present. In cost-benefit analysis, there is a distinction between a private and a social rate of discount. A private rate of discount reflects the time preference of private consumers; a social rate is based on the government's view, which can be more long-sighted as it attempts, in most cases, to take into account the welfare of future generations.**
Art. 4 (3, 5 & 7)	Disproportionate costs	See information sheet *Disproportionate Costs*
Art. 4 (5)	Disproportionately expensive	See information sheet *Disproportionate Costs*
Art. 2 (21)	Ecological status	An expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, classified in accordance with Annex V.**
Art. 5 (1)	Economic analysis	See Annex III of the Directive
Information sheet – Estimating Costs (and Benefits)	Economic costs	See 'opportunity costs'**
Art. 2 (41)	Emission controls	Controls requiring a specific emission limitation, for instance an emission limit value, or otherwise specifying limits or conditions on the effects, nature or other characteristics of an emission or operating conditions which affect emissions. Use of the term 'emission control, in the Directive in respect of the provision of any other Directive shall not be held as reinterpreting those provisions in any respect.*
Art. 2 (40)	Emission limit values	The mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during any one or more periods of time. Emission limit values may also be laid down for certain groups, families or categories of substances, in particular for those identified under Article 16.*
Information sheet – Estimating Costs (and Benefits)	Environmental costs	Represent the costs of damage that water uses impose on the environment and ecosystems and those who use the environment (e.g. a reduction in the ecological quality of aquatic ecosystems or the salinisation and degradation of productive soils).

Source	Term	Definition
Art. 2 (34)	Environmental objectives	The objectives set out in Article 4.*
Art. 2 (35)	Environmental quality standard	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.*
Section 2	Explicit economic function	Refers to the economic components that are specifically outlined in Annex III of the Directive.
Information sheet – Estimating Costs (and Benefits)	External cost	An external cost exists when the following two conditions prevail 1. An activity by one agent causes a loss of welfare to another agent; and 2. The loss of welfare is uncompensated.***
Information sheet – Cost Recovery	Financial costs of water services	Include the costs of providing and administering these services. They include all operation and maintenance costs, and capital costs (principal and interest payment), and return on equity where appropriate).
Art. 2 (23)	Good ecological potential	The status of a heavily modified or an artificial body of water, so classified in accordance with the relevant provisions of Annex V.*
Art. 2 (22)	Good ecological status	The status of a body of surface water, so classified in accordance with Annex V.*
Art. 2 (25)	Good groundwater chemical status	The chemical status of a body of groundwater, which meets all the conditions set out in table 2.3.2 of Annex V.*
Art. 2 (28)	Good quantitative status	The status defined in table 2.1.2 of Annex V.*
Art. 2 (18)	Good surface water status	The status achieved by a surface water body when both its ecological status and its chemical status are at least 'good'.*
Art. 2 (24)	Good surface water chemical status	The chemical status required to meet the environmental objectives for surface waters established in Article 4(1)(a), that is the chemical status achieved by a body of surface water in which concentrations of pollutants do not exceed the environmental quality standards established in #Annex IX and under Article 16(7), and under other relevant Community legislation setting environmental quality standards at Community level.*
Art. 2 (2)	Groundwater	All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.*
Art. 2 (19)	Groundwater status	The general expression of the status of a body of groundwater, determined by the poorer of its quantitative status and its chemical status.*
Art.2 (29)	Hazardous substances	Substances or groups of substances that are toxic, persistent and liable to bioaccumulate, and other substances or groups of substances which give rise to an equivalent level of concern.*
Art. 2 (9)	Heavily modified water body	A body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II.*
Information sheet – Scale issues	Homogenous areas	Geographical areas that: ➢ Present homogeneous socio-economic characteristics today (a given economic sector or sub-sector localised in one geographical area of the river basin); and ➢ Are likely to react in a homogenous manner to measures or interventions.

Source	Term	Definition
Section 2	Implicit economic functions	Refers to references made to economic issues in other parts of the Directive text that will also require some economic analysis but which have not been mentioned nor made explicit in Annex III.
Information sheet – Estimating Costs (and Benefits)	Indirect cost	Overhead and other costs not directly attributable to the cost of producing one unit of output; a fixed cost.**
Art. 2 (3)	Inland water	All standing or flowing water on the surface of the land, and all groundwater on the landward side of the baseline from which the breadth of territorial waters is measured.*
Art. 2 (5)	Lake	A body of standing inland surface water*
Information sheet – Estimating Costs (and Benefits)	Maintenance costs	Costs for maintaining existing (or new) assets in good functioning order till the end of their useful life.
Information sheet – Disproportionate Costs and 'Analysis of derogation for new modifications/ activities based on Article 4.7' (Annex IV.II of this guidance document)	New modifications	All direct modifications to the physical characteristics of a surface or groundwater body, or alterations to the level of bodies of groundwater (e.g. straightening a river reach and alterations to the level of groundwater bodies). It does not deal with the chemical and ecological dimensions of good water status. *
Analysis of derogation for new modifications/ activities based on Article 4.7 (Annex IV.II of this guidance document)	New sustainable human development activities	*New human development activities* are activities that relate to changes from high to good status in surface water. It includes all ecological, qualitative and quantitative elements in the definition of the water status. The focus is on the use that leads to the change in the water status. *Sustainable new human development activities* are activities described above that considers and integrates social, economic and environmental impacts with a temporal dimension (e.g. future generations) and potentially, a global dimension. See also *Annex IV.II* of this guidance document.
Information sheet – Estimating Costs (and Benefits)	Operating costs	All costs incurred to keep an environmental facility running (e.g. material and staff costs).
Information sheet – Estimating Costs (and Benefits)	Opportunity costs	The value of the alternative foregone by choosing a particular activity.**
Art. 2 (31)	Pollutant	Any substance liable to cause pollution, in particular those listed in Annex VIII.*
Art. 2 (33)	Pollution	The direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment.*
	Price elasticity of demand	The responsiveness of quantity demanded of a good or service to a change in its price or in a consumer's income.**

Source	Term	Definition
Art. 2 (30)	Priority substances	Substances identified in accordance with Article 16 (2) and listed in Annex X. Among these substances there are 'priority hazardous substances' which means substances identified in accordance with Article 16 (3) and (6) for which measures have to be taken in accordance with Article 16(1) and 16(8).*
Art. 2 (26)	Quantitative status	An expression of the degree to which a body of groundwater is affected by direct and indirect abstractions.*
Art. 6 (2)	Register of protected areas	Shall include all bodies of water identified under Article 7 (1) and all protected areas covered by Annex IV.*
Information sheet – Estimating Costs (and Benefits)	Resource costs	Represents the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. linked to the over-abstraction of groundwater).
Art. 2 (4)	River	Body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course.*
Art. 2 (13)	River basin	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.*
Art. 13 (4)	River basin management plan	Shall include the information detailed in Annex VII*
Art. 2 (14)	Sub-basin	The area of land from which all surface run-off flows through a series of streams, rivers and, possibly, lakes to a particular point in a water course (normally a lake or a river confluence).*
Preamble (15)	Supply of water	A service of general interest as defined in the Commission communication on services of general interest in Europe.
Art. 2 (1)	Surface water	Inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters.*
Art. 2 (17)	Surface water status	The general expression of the status of a body of surface water, determined by the poorer of its ecological status and its chemical status.*
Information sheet – Disproportionate Cost	Time derogation	A temporary extension of deadlines to achieve the environmental objectives set out in Article 4 of the Directive.
Information sheet – Estimating Costs (and Benefits)	Unit cost	The cost of producing one unit of a product.**
	Utility	The satisfaction derived from an activity, particularly consumption.**
Water Uses and Services (Annex II.III of this guidance document)	Water services	All services which provide, for households, public institutions or any economic activity: ➢ Abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; ➢ Wastewater collection and treatment facilities which subsequently discharge into surface water.* See also information sheet *Water Uses and Services*
Water Uses and Services (Annex II.III of this guidance document)	Water uses	Water services together with any other activity identified under Article 5 and Annex II having significant impact on the status of water.* See also information sheet *Water Uses and Services*

Sources:
* Water Framework Directive (2000), Article 2 'Definitions'.
** Donald Rutherford (1995), 'Routledge Dictionary of Economics', Routledge.
*** David W. Pearce and R. Kerry Turner (1990), 'Economics of Natural Resources and the Environment', Harvester Wheatsheaf.

II.III Water Uses and Services

Directive references: *Article 1, Article 2 (paragraphs 38 & 39), Article 5 and Article 9*

This Information Sheet helps you understand the definition of water services and water uses and how these categories are dealt with in the Directive.

What is the difference between water services and water uses?

A key objective of the Directive is to promote sustainable **water use**, based on a long-term protection of available water resources (Article 1). The Directive distinguishes human activities into 'water services' and 'water uses'. Those terms are defined in *Article 2* of the Directive (see *Box 1*) and are represented graphically in *Figure 1*. Water services are specifically referred to in the context of Article 9 and cost-recovery.

Box 1 – Water Uses and Services as Defined in Article 2

*38) **'Water services'*** means all services, which provide, for households, public institutions or any economic activity:

(a) Abstraction, impoundment, storage, treatment and distribution of surface water or groundwater,
(b) Wastewater collection and treatment facilities, which subsequently discharge into surface water.

*39) **'Water use'*** means water services together with any other activity identified under Article 5 and Annex II having a significant impact on the status of water. This concept applies for the purposes of Article 1 and of the economic analysis carried out according to Article 5 and Annex III, point (b).

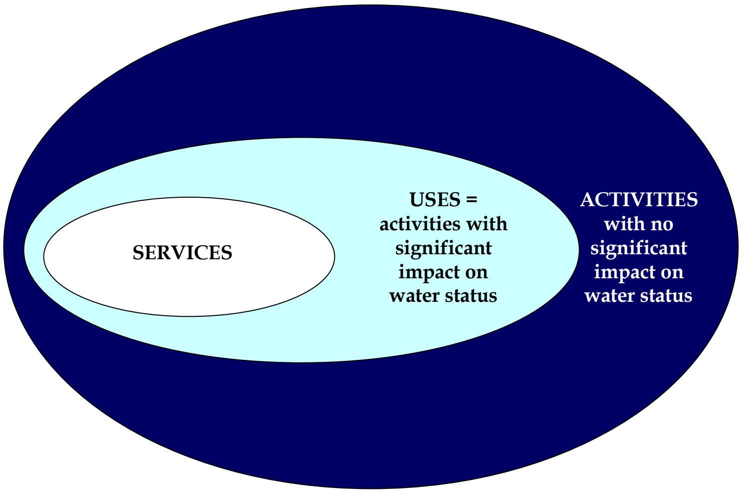
Overall, a water service represents an intermediary between the natural environment and the water use itself. The main purpose of the water service is to ensure that:

- Key characteristics of natural waters are modified (i.e. the service offered is this modification) so as to ensure it fits with the requirements of well-identified users (e.g. provision of drinking water), or
- Key characteristics of water 'discharged' by users are modified (i.e. the service offered is also this modification, e.g. waste water treatment) so that it can go back to the natural environment without damaging it.

Overall, a water service *per se* does not consume water nor produce pollution, although it can directly lead to morphological changes to the water ecosystem. Characteristics of waters that are modified through a water service include:

- Its **spatial distribution**, e.g. a water supply network for ensuring that water is reallocated spatially to every individual user;
- Its **temporal distribution**/flows, e.g. dams ;
- Its **height**, e.g. weirs and dams;
- Its **chemical composition**, e.g. treatment of water, and wastewater;
- Its **temperature**, e.g. temperature impact on water.

Figure 1 – Water Uses and Services

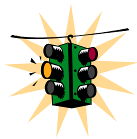


Key Points to Remember:

- ***Water Services*** include **all services** (public or private) of abstraction, impoundment, storage, treatment and distribution of surface water or groundwater, along with wastewater collection and treatment facilities. Member States shall account for the recovery of the costs of water services according to *Article 9*.

- ***Water Uses*** are all activities that have a significant impact on water status, according to the analysis of pressures and impacts developed in accordance to *Article 5 and its Annex II*. Economic analysis must be performed for all water uses *(Article 5 and Annex III).* Also, Member States shall ensure an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services *(Article 9)*

- Some ***activities*** with no significant impact on water status are neither water services nor water uses. Clearly, this distinction can not be made systematic as it is based on the analysis undertaken in accordance to *Article5 and Annex II*, e.g. in some cases, fishing will have no impact on water status, but over-fishing has a significant impact on the ecology of a river and water status.



Look Out! Read Article 9 carefully.

Be careful when you read Article 9. Overall, this article states that Member States must ensure by 2010

- That water pricing policies provide adequate incentive for users to use water resource efficiently;
- An adequate contribution of the different water uses to the recovery of the costs of water services.

In complying with this obligation, Member States may take account of the social, environmental and economic effects of the recovery.

The first sentence introduces the principle of cost recovery for ***water services***. Later, it specifies that Member States shall ensure an adequate contribution of the different ***water uses*** to the recovery of the costs of ***water services***…. Thus, Article 9 combines both water services and water uses. For example, diffuse pollution to surface water or groundwater is not a water service as defined in Article 2. However, if it has a significant impact on the status of water, it is a water use. It will then be asked to contribute in an adequate manner to the costs of water services they have caused (e.g. costs of water treatment), based on the economic analysis undertaken according to annex III and in accordance with the polluter pays principle.

More work lies ahead for the definition of Water Uses

By contrast to the approach taken for water services, the Directive does not specify a list of water uses to be considered. Basically, only the activities that cause significant impacts on water bodies and therefore pose a risk to achieving good status are covered by the definition of water uses. General experience shows that navigation, hydropower generation, domestic, agriculture and industrial activities are important water uses which may cause significant impacts and therefore have to be taken in consideration.

Thus, more work is needed…

- To determine a list of main water uses based on the assessment of significant human impact on water bodies (Article 5 and Annex II) before 2004. This is the same deadline as for the economic analysis of water uses required for the overall characterisation of river basins.

This work will be developed in the context of the review of the impact of human activity on the status of surface waters and on groundwater according to Article 5 and Annex II (see guidance on the assessment of 'Impacts and Pressures').

Recommendations for a practical approach to assessing cost-recovery

The proposed approach is based on the application of key principles for improving decision making and ultimately water status, i.e. **transparency** and **effectiveness,** and on pragmatism and best use of available resources for targeting the analysis to aid decision making where it is most required, i.e. **proportionality**.

For the purpose of reporting and cost-recovery assessment, the following elements should be considered.

1. **Proportionality** – cost recovery is assessed (i) when water services have a significant impact on water status, and (ii) when water uses have a significant impact on water status resulting in services developed for other water users for mitigating/reducing the observed negative damage. Thus, the cost-recovery assessment for 2004 should closely link to the analysis of pressures and impacts that needs to be undertaken by the same deadline.
2. **Effectiveness** – cost-recovery is assessed when cost-recovery and pricing is seen as effective for changing behaviour and are key elements in decision-making.
3. **Transparency** - for the areas/water bodies where water, water services have an impact on water status, should then systematically identified and the assessment of cost-recovery and pricing is performed. This ensures **transparency** as required by the Water Framework Directive. It also provides the basis for assessing the integration between water policy and other sector policies. To achieve maximum transparency, to ensure equitable and effective treatment *vis-à-vis* the internalisation of environmental and resource costs, and to preserve competition between economic sectors, water services should, where necessary, include both services provided by third parties and self services.

In the short term, for the first characterisation of the river basin district (Article 5):

- As little may be known on the effectiveness of cost-recovery and pricing for achieving the environmental objectives of the Directive, a more systematic cost-recovery assessment of all services should be performed as sound basis for follow-up effectiveness analyses as support to targeted policy intervention.
- Mainly available information will be used. This first identification will lead to the identification of missing data required for assessing cost-recovery coherently in accordance with the proportionality and effectiveness principles mentioned above.

In the longer term, for the river basin management plans, water services to be considered for assessing cost-recovery will build on the identification of water bodies at risk of failing good water status, along with input from the public consultation on the overview on significant water management issues in the river basin.

Whatever the outcome of the cost-recovery assessment, and as specified in Article 9.1, 9.3 and 9.4 of the Directive, it will not prevent Member States to decide on the level of cost recovery of the water services being identified, and on the contribution of water uses to the costs of water services, as long as it is duly reported on in the river basin management plans.

Annex III

Support to Implementation

III.I Illustrative Terms of Reference for a Virtual Scoping Study on Cost-effectiveness Analysis

Aims and objectives

The aim of the study is to scope out how the cost-effectiveness analysis of measures to achieve good water status and related consultation could be carried out so as to aid decision-making on these measures and identify and investigate any issues and problems regarding such economic analysis. The scoping deals with both economic and technical issues and expertise as investigated in the cost-effectiveness analysis.

Issues

The specific issues to be examined include:

- Characterise and differentiate the various stretches of water bodies in the selected basin so as to identify bodies of water for which objectives must be set and measures identified and appraised,

- Characterise the various possible measures to achieve good water status in terms of the level (eg national or local) at which decisions have to be taken on them and the level at which these measures have to be implemented.

- Characterise the diverse parties affected positively or negatively by the impacts of these various possible measures to achieve good quality status so as to help inform (in subsequent research) how their views could be input to decision-makers.

- How best to use the available information given by existing scientific, risk assessment and economic appraisal systems on the environmental, economic or social impacts of the possible measures so as to aid decision-making on them. What are the key gaps in technical expertise and information that need to be addressed to undertake cost-effectiveness analysis?

- Identify outstanding staff resourcing and capability issues. For example, are there sufficient numbers of trained staff at regional level and centrally to co-ordinate data collection and economic analysis?

- Identify outstanding specific research issues that need to be addressed in subsequent studies.

Specific Tasks to be carried out

1. Characterise and differentiate the various stretches of water bodies in the selected basin so as to identify the appraisals needed for particular stretches of water for which objectives must be set and measures identified. These could form appropriate separate building block elements of the appraisal (and subsequent monitoring) of measures in the river basin management plans. This might characterise the main different types of water bodies in the basin in respect of, for example:

    - Their different water quality states and the extent to which individual water bodies now fail to achieve good status and will fail to achieve good status by 2015 and 2021;

    - the pressures on water quality now and in the future;

- the different types of options to achieve good status;

- The scale of costs and complexity involved in these measures (and hence the extent of the appraisals (of varying degrees of complexity/depth) that will be needed

The study will need to extrapolate the findings for the selected basin to other river basins to give a qualitative and approximate assessment of the various depths of economic analysis that would be needed for all river basins in the country.

2. The consultants should devise a simple schematic way of presenting information from the appraisal of individual river basin management plans in a way that can be aggregated to aid decision-making at the national level.

3. Characterise the various possible measures to achieve good water status in terms of the level (eg national or local) at which decisions have to be taken on them and the level at which these measures have to be implemented.

4. Characterise the parties affected positively or negatively by the environmental, economic or social impacts of the options, especially who benefits and who pays for the costs of the options? In particular specify whether they live within the basin. Investigate how this geographical characterisation of the parties affected could relate to the level at which the possible measures are decided upon and implemented (see above).

5. Identify what information is needed regarding consultation for the effective implementation of the WFD under article 14. This should take account of the complex mix of local and national decisions and parties affected by them - see above - and the need for the consultation to input views rather than determine the decisions (especially at national level).

6. Review the availability of scientific, risk assessment and economic information on the environmental, economic or social impacts of the possible measures and options and show how these could best be used in the cost-effectiveness analysis and to present information on the impacts of options for the consultation. Show how to present clearly the findings and their assumptions and limitations? Identify what additional information, analysis and appraisal processes are needed and how could these best be provided?

7. Show how to present information on measures and combinations of measures to show costs, effectiveness and other factors (e.g. benefits) where appropriate and relevant

8. Identify what information (in what form) is needed on the costs and economic impacts of the various types of measures (see (3) above) covering the different sectors (water industry, non-water industry, agriculture and other). Review the availability of this information.

9. Indicate how much time and resources would be available to carry out the cost-effectiveness analysis of measures in the selected river basin? Estimate how much time and resource would be required to carry out a similar analysis in various types of river basins (e.g. with different sizes, different pressures and impacts, different availability of

information and research results). Identify or seek means of reconciling the likely imbalance between needs and available resources (eg streamline the cost-effectiveness analysis process while maintaining its key elements).

10. Identify specific research subjects and pilot RBMP studies that will then be needed to research in depth and clarify particular outstanding issues and problems regarding the practical application of the various elements of the cost-effectiveness analysis.

Outputs from the Study

The intended outputs from the study include:

- Show what information (in what form) is needed to inform decision-making (at which level and for which decisions) on the various types of options

- Show how the various elements of the cost-effectiveness analysis could best generate this information and how this information could fit together well in practice.

- Identify key information gaps and specific research needs and priorities, especially regarding the development and application of economic appraisal and analysis tools and techniques. This would then form the basis and terms of reference for specific follow up work (eg to improve specific tailored economic appraisal techniques).

Study Form

This is essentially a scoping and ground clearing study anchored in a specific basin.

It will entail consultants reviewing the available material (eg on water quality states and reasons for failure, available economic information, reports on existing consultation procedures, planning documents with forecasts for key economic sectors/water users, etc).

They would then seek out and analyse the views and knowledge of experts (eg from government departments and key stakeholders) on **how** they could carry out **hypothetically (or virtually)** in a specific basin a cost-effectiveness analysis of the measures for developing the river basin management plans.

This virtual study will involve no original research and the consultants should not get bogged down in any detailed investigations. Thus, where data are not currently available, the consultants should use assumed illustrative dummy data and plausible information that might be generated by the available sources and appraisal processes to give a virtual illustration of how the cost-effectiveness analysis could be applied in practice - ie use assumptions and judgement to report the type of outputs from each element rather than do any actual data collection as such.

The consultants would interview (probably by telephone) the appropriate experts and prepare a review and issues paper. They will organise a 2-day brainstorming workshop with key experts (mostly from relevant Government departments and devolved administrations, and also from key stakeholders) to work through and thrash out the issues concerned with carrying out the cost-effectiveness analysis.

There will be close links between this study and other scoping studies and research that the government departments are carrying out in the context of the implementation of the Water Framework Directive. For example, case studies on Heavily Modified Water Bodies or studies on scientific aspects such as specification of water quality objectives and monitoring and characterisation of river basins.

The preliminary results and draft report will be discussed in a 2 day workshop with experts from government and key stakeholders. The main objectives of the workshop will be the discussion and evaluation of the preliminary results of scoping study, the assessment of the relevance of the results to other river basins in the country, and a first discussion with stakeholders on the economic analysis carried out and its integration into the decision making process for developing river basin management plans.

Expertise Required

The successful contractors' team will have to have the following expertise:

- Project management and managing a team of diverse experts so as to pull together their views

- Economic appraisal and presentation of economic-related information for different audiences

- Appraisal of the control measures covering the various sectors (households, industry, agriculture, etc)

- Stakeholder consultation

- Experts knowledgeable about scientific and risk assessment work relevant to the appraisals for the WFD and how this could effectively input into the cost-effectiveness analysis and consultation processes in this study

- Organising and animating workshops with diversity of participants from government departments and key stakeholders

The study period is 6 months. Experts' input to the study is estimated at 6 full man-months.

III.II Stakeholder Analysis: Methodology and Key Issues

Introduction

When embarking on an interactive process it is of utmost importance to consider who will be participating in the process. To get an overview of all the relevant stakeholders (or actors) in the field of interest, a so-called "stakeholder-analysis" can be performed. This analysis reduces the risk of forgetting an important actor and will give an idea about the different angles from which the subject can be viewed. The stakeholder-analysis itself is a relatively simple and a methodological exercise, and a possible methodology is presented in this annex along with an illustration. However, it is left to the reader to assess how this can be adapted to her/his own situation and made relevant to the economic analysis process.

Background

A stakeholder can be any *relevant* person, group or organisation with an interest in the issue, either because he is going to be affected by the subject (victim, gainer) or because he has influence, knowledge or experience with the subject. The analysis will bring transparency in what stakeholders already exist and which interests they represent. Types of stakeholders are: government, local authorities, non-governmental institutions, political organisations, research institutes, industries, agriculture, households or other businesses. A stakeholder-analysis is usually performed starting from the contents of a project using the "who?" question (for example: we want to build a house, who knows how to build it?). Be aware that the problem definition must be clear from the beginning and that the problem shall be viewed from as many different angles as possible.

Besides analysing the stakeholders it can be useful to map the environment of a project to identify external influences. The map could tell something about the interests, motives and relationships of the actors identified, the field of force they operate in and risks. For example: which stakeholders have a positive or negative influence on the project, who has power, who has the biggest monetary interest? Similar mapping can be done for *factors* influencing the process, often expressed as threats (e.g. weather, financial or human capacities).

Generally, a process consists of several stages (as illustrated in Figure 1). For every single stage, it should be reviewed which stakeholders are relevant to involve in the process and if the stakeholders have the same "rights". The role and involvement of the stakeholder can differ from stage to stage, and the stakeholder-analysis will make this more transparent.

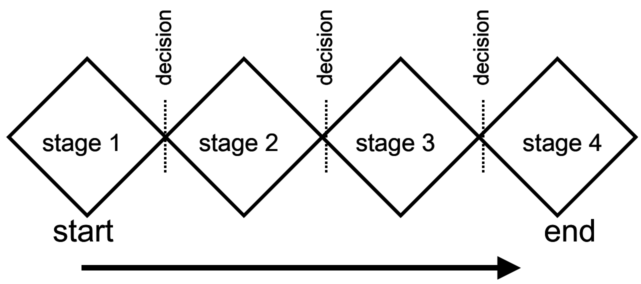


Figure 1: A process represented in diagram form

During the stakeholder-analysis the *degree of involvement* of every stakeholder (per stage) can be labelled as either (see Figure 2):

- *co-operating*: the stakeholder that will actually participate in and contribute actively to the process;
- *co-thinking*: the stakeholder of which you want input with respect to content, it is a source of knowledge like experts;
- *co-knowing*: the stakeholder which does not play an active role in the process but should be informed of its progress.

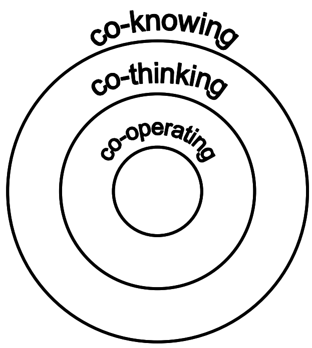


Figure 2: Target scheme to identify degree of involvement of stakeholder

If desired the identification approach can be refined by identifying the type of actor (see Figure 3):

- decision maker: stakeholders which decide about the project;
- user: stakeholders which use the result or are affected by it;
- implementer/executive: the stakeholders that have to implement the results or new policy;
- expert/supplier: stakeholders which put information, expertise or means at the disposal of the project.

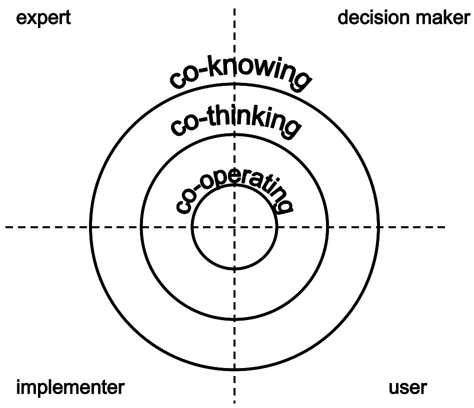


Figure 3: Refined target scheme to identify degree of involvement and type of stakeholder

Important! If the identified stakeholders are going to participate (actively or passively) in the project it is important to give feed-back to the stakeholder and specify clearly their role in order to avoid disappointments: management of expectations.

Stakeholder analysis: a simple methodology

Making the stakeholder analysis operational implies going through a series of steps of questioning and interaction. Although it needs to be adapted and refined to every situation, a simple methodology and series of steps is proposed below.

- Step 1 - Define the stage of the process that will be subject to a stakeholder analysis. Putting the subject in question-form makes it usually more accessible and facilitate the identification of key issues/stages. It appears rather wise to invite stakeholders (of which it is obvious that they are involved) to take part in a brainstorming session;
- Step 2 - A group of maximum 10 persons (the project team) including a chairman performs a brainstorming session in which as many stakeholders and perspectives or angles linked to the selected stages are mentioned.
  - Keep it rather general, name groups or organisations, not yet concrete names or people;
  - Every suggestion is written down without judgement.
- Step 3 - Check if the main perspectives/angles can be split up into sub-units/organised in types;
- Step 4 – Allocate to the stakeholders identified a concrete name (and address/contact information);
- Step 5 - Check the result:
  - Did we check all the stages of the process?
  - Do we have the ones that benefit and the victims?
  - Is the own project organisation included?
  - Did we identify the people behind umbrella organisations?
- Step 6 - Once the stakeholders are identified, the long list can be ordered by identifying the degree of involvement of each actor in each stage:
  - Write down every actor on a Post-it notepaper;
  - Draw up the "target"-scheme with circles on a flap over;
  - Be clear about the stage in the process that is effectively analysed.
- Step 7 - Put the notepapers in the right place in the "target"[2)] (Figure 2 and if refinement is desired this can be repeated for Figure 3);
- Step 8 - Check if there are no big gaps;
- Step 9 - Use the result! e.g. for a communication plan to notify concerned stakeholders. Be very clear with each stakeholder about his expected role and involvement in the process (management of expectations);
- Step 10 - The brainstorming session can be continued to identify relationships between stakeholders, their interests and motives and factors that influence the process.

[2)] Keep in mind that the degree of influence of the stakeholders is a factor to be considered. It might be useful more closely to involve "big" actors with much influence to ensure commitment and a supporting basis.

Illustration of the stakeholder-analysis

A small case is presented for the illlustration of the methodology. Subject of the case is the pollution at the downstream part of the River Scheldt. The municipalities along the river recognise the problem and and want to improve the water quality, they are initiating this case. The process is described in Figure 4:

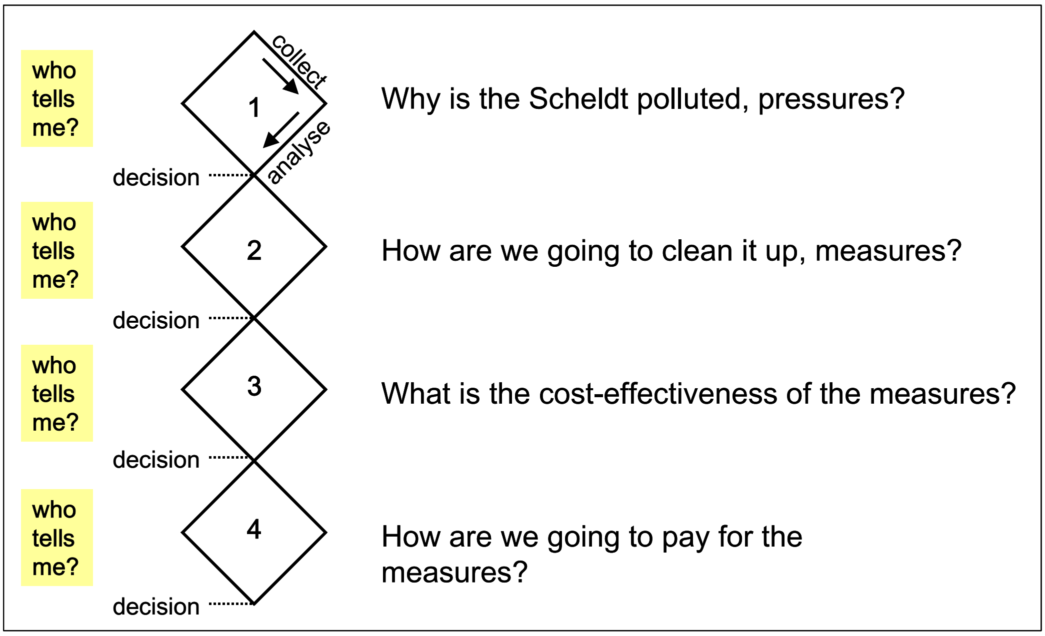


Figure 4: Different stages of a process concerning the pollution of the River Scheldt

Analogous to the presented methodology in the former sub-section, the possible results are presented below for the different steps of the stakeholder analysis and for the stage 1 of the process (i.e. why is the Scheldt polluter, pressures?).

- Step 1 - Information is wanted about the pollution in the Scheldt, e.g. “Why is the Scheldt polluted?”, who tells me that it is polluted?
- Step 2 - The proposed project team will include the municipalities and they have decided to invite also representatives of the harbour of Antwerp and Vlissingen. As many different angles as possible are viewed during a brainstorming session. The output of this session is a (finite) list of stakeholders involved:

ICPS (Scheldt commission)	people in the neighbourhood
Agriculture	harbours
Recreation	municipalities
dredging companies	shipping traffic
Fisherman	industries
Government	WWTP

- Step 3 – More detailed discussions show that the type “Industries” can be split up into:

  - Industries with emission to the air (deposit)
  - Industries with discharge to the water

- Step 4 - The list is defined more precisely:

ICPS (Scheldt Commission)	**people in the neighbourhood**
agriculture: - farmer A, B, C - poultry farm D - pig farm E, F	**harbours**: - Antwerp (B) - Ghent (B) - Terneuzen (NL) - Vlissingen (NL)
recreation: - anglers - canoeists - cyclists	**municipalities** Antwerp, Ghent, Terneuzen, Vlissingen
dredging companies: - company X - company Y	**shipping traffic:** - EU umbrella organisation for shipping traffic
Fisheries	**industries:** - emissions to air: industry G - discharge to water: industry H
Government Belgium (Flandres, Wallonia, Brussels) The Netherlands	**WWTP** Antwerp, Ghent, Vlissingen, Terneuzen

For all stakeholders the contact person/competent authority should be identified and the address/contact information identified.

- Step 5 - Checking the result shows that it is unclear which shipping companies are represented by the "European umbrella organisation for shipping traffic", as only shipping companies operating in the Scheldt area are seen as relevant. This will need further checks by the project team. It is also noticed that environmental NGO's are missing from the list of stakeholders identified so far, and the union for the "Protection of the Scheldt landscape" is added to this list.
- Step 6 & 7 - The degree of involvement of the stakeholders is expressed by allocating stakeholders into the target scheme (Figure 5). For the first stage of the process (why is the Schedlt polluted, what are pressures?), much information needs to be collected. Thus many stakeholders end up in the second circle (co-thinking) of the target scheme. Some stakeholders are known to have a great socio-economic influence and are asked to co-operate together with the project team (inner circle). The outer border of the figure show the organisations that will be informed about the project.
- Step 8 - Check for gaps in Figure 5, refine it.
- Step 9 - The results of the brainstorming session are included into the project plan. Decision is taken that the harbours of Gent and Terneuzen and Industry H that are not yet part of the project team will be approached for co-operation.
- Step 10 - The brainstorming session can be continued to refine the target scheme according to Figure 3 and/or to map the environment. Simple questions such as: What is the interest of Industry H?; What is the relationship between municipality A or harbour W? will help increasing the project team understanding of the role and stakeholder relationships.

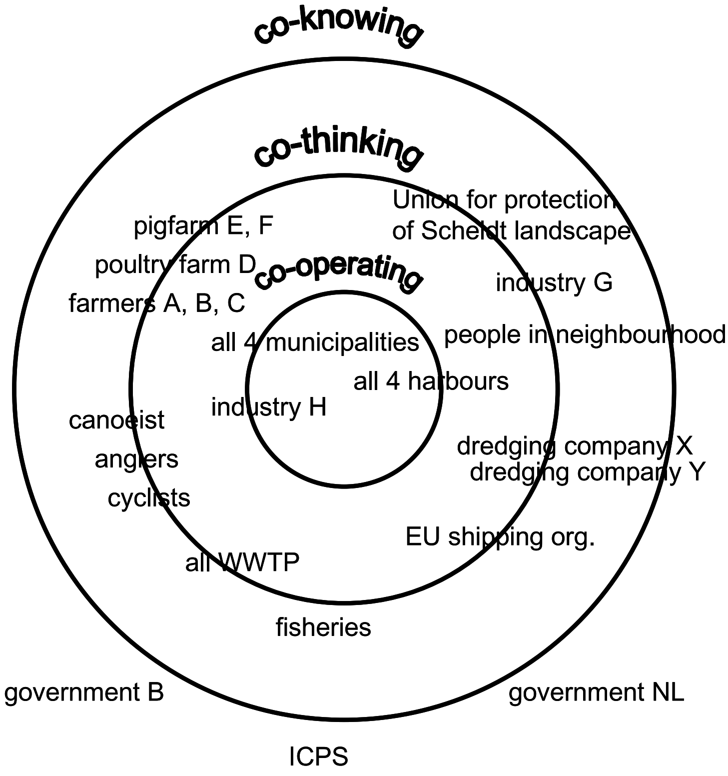


Figure 5: Target scheme with stakeholders who can tell about the pollution of the downstream part of the River Scheldt

References

1. ARB toolkit, Gereedschap voor het managen van open beleidsprocessen; *Adviesunit Resultaatgericht Beleid, Ministry of Public Works, Transport and Water Management*, The Netherlands, 2000.

2. WWF's preliminary comments on Public Participation in the context of the Water Framework Directive and Integrated River Basin Management; *Adam Harrison, Guido Schmidt, Charlie Avis, Rayka Hauser*, WWF, june 2001.

III.III Possible Reporting Tables

Assessing the existing information and knowledge base for the economic characterisation of river basins

The tables presented below are by no means exhaustive and final. They have been developed as examples to support experts in different countries and river basins in developing their own templates. The tables do not mention the information on water uses, wastewater treatment, pollution emitted, changes in hydromorphology, changes in ecology, etc that will come from the analysis of pressures and impacts as specified in Annex II of the Water Framework Directive. Clearly, similar tables can be draw for this biophysical information. Key is to ensure consistency and coherence (e.g. in selecting spatial scale of computation and reporting) between pressures and impacts and the economic analyses.

1. Economic analysis of water uses

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
Drinking water supply 1. Population connected to public water supply system 2. Population with self-supply 3. Number of water supply companies							
Wastewater treatment 1. Population connected to sewerage system 2. Population connected with wastewater treatment plant 3. Number of wastewater treatment companies							
Economic characteristics of key water uses 1. Agriculture ➢ Total cropped area ➢ Cropping pattern ➢ Livestock ➢ Gross production ➢ Income ➢ Total farm population 2. Industry ➢ Turn over for key sub-sectors ➢ Employment for key sub-sectors							

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
3. Hydropower							
➢ Installed power capacity							
➢ Electricity production							
4. Navigation/transport							
➢ Number of boats through key points per year							
➢ Employment linked to navigation							
➢ Quantity and value of goods transported							
➢ Quantity and value of goods through key harbours							
➢ Employment linked to harbour activities							
5. Gravel extraction							
➢ Number of extracting companies							
➢ Total employment							
➢ Total turnover							
6. Fish farming							
➢ Number of fish farms							
➢ Total employment							
➢ Total turnover							
7. Leisure fishing							
➢ Number of person-days							
8. Boating and wind-surfing							
➢ Number of person-days							
9. Water-related tourism							
➢ Total number of tourist-day							

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
➢ Daily expense per tourist day ➢ Total employment in the tourism sector ➢ Total turnover of the tourism sector 10. Flood control ➢ Total population protected ➢ Total turn-over of protected economic activities							

2. Assessing trends and baseline scenario

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
Trends in macro-economic policies 1. Existing studies and reports on trends in agricultural policy 2. Existing studies and reports on trends in industrial policy 3. Existing studies and reports on trends in energy policy 4. Existing studies and reports on trends in transport policy 5. Existing studies and reports on trends in … policies							

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
Trends in exogenous variables							
1. Population growth							
2. Changes in economic development (DGP change)							
3. Changes in water pricing policies							
4. Technological changes							
➢ Households water use							
➢ Agriculture and irrigation							
➢ Industry							
5. Climate change							
6. …							
Planned policies and investments							
1. Proposed investments in water supply and wastewater treatment							
2. Proposed investment in pollution reduction programmes for agriculture							
3. Proposed investments in flood protection							
4. Proposed investments in wetland restoration							
5. Proposed investments in improved technology							
6. Proposed investment in water supply enhancement							
7. Other programmes and measures							
8. …							

3. Assessing cost-recovery (for each water service considered)

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
Prices for water services							
1. Current water price							
➢ Price level							
➢ Price structure							
2. Subsidies							
➢ Government/regional authorities							
➢ Cross-sectors							
Financial costs of water services							
1. Capital costs							
➢ Historical							
➢ replacement value							
2. Operation and maintenance							
3. Administrative costs							
Environmental costs							
1. Internalised costs through charges/taxes							
2. Direct assessment							
➢ Changes in environmental quality							
➢ Economic value/willingness to pay							
3. Costs of preventive and mitigation measures							
➢ Implemented							
➢ Required for restoring good							

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
water status							

4. Basic economic information and indicators

Key variable	Source of data	Date	Spatial scale, lowest disaggregation level	Quality of data (good, medium, poor)	Availability of data	Cost	Comments
1. Discount rate							
2.							

Reporting the economic elements of the characterisation of river basins – example of an executive summary

The format of the executive summary presented below is by no means exhaustive and final. It has been developed as an illustration to support experts in different countries and river basins in developing their own reporting templates and reports. The format and tables do not mention the indicators on water uses, wastewater treatment, pollution emitted, changes in hydromorphology, changes in ecology, etc that will be computed as a result of the analysis of pressures and impacts as specified in Annex II of the Water Framework Directive. Clearly, similar tables or maps can be draw for this biophysical information. Key is to ensure consistency and coherence (e.g. in selecting spatial scale of computation and reporting) between reporting on pressures and impacts and the economic analyses.

Key messages with regards to the economics of water uses

1.

2.

3.

Description of the river basin and economic importance of key water uses

Table 1. Economic importance of key water uses for the river basin

Water use	Water consumption	Pollution	Total "production"	Turnover (€)	Employment	Number of beneficiaries
Use 1						
Use 2						
Use 3						
Use 4						
…						

Note: figures can be given in absolute terms and in relative terms (relative to the river basin as a whole or to the economic sector for the country if seen as of national strategic importance)

Map 1. Localisation of key water uses in the river basin

Assessing trends and identifying the baseline scenario

Table 2. Foreseen trends in key water uses in the river basin up to 2015

Water use	Change in beneficiaries	Change in production	Technological change	Overall change in pressure (qualitative)	Comments
Use 1					
Use 2					
Use 3					
Use 4					
…					

Table 3. Foreseen investments and measures targeted to the water sector up to 2015

Main policy	Planned measures	Proposed costs (€)	Likely change in water status	Comments
Policy 1				
Policy 2				
Policy 3				
…				

Assessing cost-recovery

Table 4. Current cost-recovery assessment in the river basin

Water services	Costs and prices	Use 1	Use 2	Use 3
Service 1	Financial costs			
	Tariffs for water services			
	Recovery of financial costs			
	Environmental costs			
	Internalised environmental costs			
	Recovery of environmental costs			
	Overall cost-recovery			
Service 2	Financial costs			
	Tariffs for water services			
	Recovery of financial costs			
	Environmental costs			
	Internalised environmental costs			
	Recovery of environmental costs			
	Overall cost-recovery			

Proposed activities for improving the information and knowledge base

Annex IV

Methodological Tools for Undertaking the Economic Analysis

IV.I Information Sheets

ANNEX IV.I. 1

INTRODUCTION

This Annex contains a series of information sheets providing methodological guidance for implementing the 3-step approach presented in the main part of this document. It is structured as follows:

- ***Scale issues***: This information sheet helps you understand at which geographical level you should carry out the economic analysis and report the results.

- ***Estimating costs (and benefits):*** This information sheet helps you understand how to estimate costs and benefits, which are seen as avoided costs.

- ***Reporting on cost recovery:*** This information sheet helps you understand what and how you should report on the recovery of costs of water services.

- ***Baseline scenario:*** This information sheet will help you develop one or several alternative baseline scenarios (or "business-as-usual" (BAU) scenarios). It proposes an optional approach to complement the forecasting analysis (to define the BAU scenarios) with prospective analysis.

- ***Cost-effectiveness analysis:*** This information sheet will help you carrying out a Cost-effectiveness Analysis (CEA). The CEA is used for assessing the cost-effectiveness of potential measures for achieving the environmental objectives set out by the Directive and construct a cost-effective Programme of Measures.

- ***Pricing as an economic instrument:*** This information sheet helps you assess the effectiveness of pricing as a measure to achieve the environmental objectives of the Directive.

- ***Disproportionate costs:*** This information sheet will help you assess whether the costs of the Programme of Measures are disproportionate and whether derogation from the Directive's objectives could be justified following an assessment of costs and benefits.

SCALE ISSUES

Directive references: No specific reference in the Directive but many implicit references and key issues for making the economic analysis operational. This sheet underlies the overall (3-step) approach to the analysis.

This information sheet helps you understand at which geographical level you should carry out the economic analysis and report the results.

1. Objective

Scale issues are central to the development of integrated river basin management plan. They are key to the integration between different disciplines and expertise and to the development of activities aimed at informing, consulting and ensuring active participation of stakeholders and collecting information.

For the economic analysis, it is important to understand the level of efforts required in conducting the economic analysis in terms of:

- The type of information to be collected;
- The spatial and temporal scale at which the information needs to be collected (coverage);
- The type and the level of disaggregation of the analysis that should (or can) be performed.

Although mostly mentioned in the context of large river basins, identifying the 'right' scale for the analysis is relevant to all river basins.

2. What spatial scales and levels of disaggregation are mentioned in the Directive?

The Directive mentions a wide range of spatial or aggregation units (see *Table 1*). Overall, the Directive promotes the **river basin** as the basic hydrological system for characterising, analysing, defining and implementing programmes of measures. In some cases, however:

- Several river basins can be aggregated into **river basin districts** that are the basis for compliance checking and reporting by Member States. River basin districts combine hydrological and practical/administrative considerations (e.g. combining several small but similar river basins to limit planning and administrative burden). Hydrological considerations may be strengthened if river basins of a given district are inter-connected through water transfers.
- Large river basins can be sub-divided into smaller **sub-basins** to facilitate the process of developing management plans or when different countries share a river basin district that is then disaggregated into national sub-basins.

Table 1 – What does the Directive specify about data collection and analysis?

Building block	When is it a reference?
Hydrological/Ecological	
Water Body	➢ Characterisation of water status (*Annex II*) ➢ Further characterisation for those bodies at risk of failing environmental objectives (*Annex II*) ➢ Determination of environmental objectives (based on cost and benefit assessment) if derogation (*Article 4*) ➢ Justification of deadlines extension (*Article 4*)
Group of water bodies (grouping based on bio-physical & ecological criteria)	➢ Initial characterisation of River Basins (*Annex II*) ➢ Possible detailed programmes and management plans for water types (*Article 13.5)*
Protected Areas	➢ Designation of protected areas (*Article 6, Annex IV*)
River Basin	➢ Characterising, analysing, defining and implementing programmes of measures. ➢ Carrying out cost-effectiveness analysis (*Annex III*) for the identification of the programme of measures (*Article 11*)
River Basin District	➢ Carrying out and reporting economic analysis (*Article 5 and Annex III*) ➢ Evaluating pricing policies (*Article 9 and Annex III*)
Sub-basin	➢ Developing management plans (e.g. for national parts of international river basins, see below and *Article 13*)
Socio-Economic	
Water services	➢ Assessment of cost-recovery for water services (*Article 9*)
Economic sector	➢ Estimate the contribution to cost recovery by key water uses: household, industry and agriculture (*Article 9*) ➢ Possible detailed programmes and management plans for economic sectors (*Article 13.5)*
Water uses	➢ Economic analysis of water uses (*Article 5*) ➢ Adequate contribution of water uses to the costs of water services (*Article 9*)
Administrative	
State/Regional	➢ All activities linked to implementation (Member State's responsibility, e.g. reporting obligations) ➢ Plans for national portion of international river basins
European	➢ Various reporting obligations from the Commission at the EU scale (*Article 18*) ➢ Cost-benefit assessment of the Directive at the EU scale (Commission's statement added to the Directive's text at the time of adoption)

3. At what scale should the economic analysis of water uses be conducted?

Reporting on the economic analysis of water uses (both the description of the existing situation and the analysis of the trends/baseline in key indicators and variables) has to be made at the river basin district scale (disaggregated into national portions of transboundary river basins whenever required).

However, lower spatial scales may be investigated according to:

- The scale at which **significant pressures and water uses** take place (e.g. a sub-region of the river basin or a specific sub-economic sector);
- The **decision making** scale, e.g. at which scales and for which decisions is the analysis used. For example, if some measures are applied at specific disaggregated scales (e.g. a specific watershed or a given economic sector), providing information on the economic importance of water uses at that scales may be appropriate; and
- The scale required for **information, consultation and participation**. It is important to ensure key indicators are computed at scales that are relevant to consultation and participation. Such scales are likely to be lower (e.g. a watershed or specific economic sector) than the river basin or river basin district.

Illustrations 1 to 3 below provide some lessons on the definition of the adequate scale for analysis from testing and scoping exercises conducted during the preparation of this Guidance.

Illustration 1 – Defining the adequate scale of analysis by combining biophysical and economic information in the Scheldt river basin in Lille (France)

The WFD quantitative objective for groundwater is to balance abstraction and recharge. For the chalk aquifer around Lille, the relevant level of disaggregation for the economic analysis corresponds to a set of groundwater units for which:

- The recharge can be assessed for each individual unit;
- One abstraction is located in only one unit (no abstraction on boundaries);
- Abstractions in one unit have no (or limited) effect on the piezometry in other units.

If all these conditions are met, the physical system can be considered as a pool and economic information can be gathered for abstractions from this pool. With respect to pressures, it is important to consider both abstractions registered by national offices or water agencies and self-service abstractions. The second type of information will be more difficult to collect as it is rarely collected by water service operators or public agencies in charge of monitoring water services.

Source: G. Bouleau & A. Courtecuisse, Testing the WFD guidance document on groundwaters in the area of Lille. See Annex V.

Illustration 2 – Identifying coherent areas in the Rhône-Méditerranée-Corse basin (France)

A testing exercise in the Rhône-Méditerranée-Corse river basin in the South of France highlighted that defining the appropriate scale for the economic analysis has to take into account a variety of criteria:

- Economic activities (agriculture, industries, tourism);
- Hydrographic components;
- Social and land uses aspects;
- Availability of different data required.

As a result, the relevant scale for the socio-economic analysis, especially for large and heterogeneous river basins, is somewhere between the water body and the river basin levels. To subdivide the basin into coherent socio-economic areas, it was proposed to gather socio-economic, planning and land use information and adapt it from existing scales of analysis, such as hydrographic or administrative ones, to scales that meet the needs of the Water Framework Directive. One of the main interests of this approach is to integrate land planning and economic considerations into the analysis to facilitate information, consultation and participation of the public and stakeholders.

Source: P. Dupont & O. Gorin, Testing a pertinent scale for the economic analysis in the Rhône-Méditterrannée-Cors river basin. See Annex V.

Illustration 3 – Matching biophysical and economic information with administrative boundaries in the Vouga River Basin (Portugal)

The monitoring network in the Vouga River Basin in Portugal is not complete today for complying with the requriemtnes of the Water Framework Directive. Thus, although it is possible to identify the existence of water quality problems and associated main pressures, the establishment of a clear link between pressures/discharges and water quality problems is not possible in most cases. The location of main polluting sources is known, but discharges are not fully characterized, and cause-effect relationships cannot be fully established. There is a need for the development and calibration of water quality models allowing for the establishment of such link, in the absence of a comprehensive monitoring network. This link is essential for the economic analysis, particularly for the cost effectiveness analysis of programmes of measures.

Different elements of economic information in Portugal are currently disaggregated into different administrative boundaries. At best, the scale is municipal, and in some cases it is regional (there are five regions in the mainland, which cut across river basins). Since regional and municipal boundaries do not coincide with river basin boundaries, the compatibility of scales is a relevant issue. As it is unlikely that all economic information will become available at a scale smaller than the municipal level, consistent criteria must be developed to partition municipal values between river basins (possibly using available GIS information to pinpoint clusters of users).

Source: P. Mendes. Scoping key elements of the economic analysis in the Vouga River Basin. See Annex V.

4. At which scale should we undertake the cost-effectiveness analysis?

From an economic point of view, and to account for the inter-connection between all water bodies of a given river basin, cost-effectiveness analysis is best performed at the scale of the **river basin**. But to undertake the analysis at lower scales is likely to be more manageable in cases of large numbers of water bodies, pressures and environmental problems within the river basin.

Identifying the scale at which environmental problems take place

The analysis of the pressures and impacts, along with the identification of significant water management issues, shows that specific scales can be attached to various environmental problems:

- Some pressures have an impact throughout the river basin, e.g. controlling flows in an upstream portion of a river basin will impact portions of downstream flows, while putting a dam downstream may stop migration of fish and thus impact the entire river's ecology;
- Some pressures have a local impact, e.g. abstraction into a confined aquifer, or polluted discharge into a river that will then be naturally diluted; and
- Diffuse pressures often need to be accounted for at the river basin scale, as it is the addition of all pressures taking place within the river basin that is to be investigated.

Cost-effectiveness analysis should be performed at the scale at which environmental issues take place to ensure that the costs (especially other direct economic costs) and effectiveness of measures are fully accounted for in the analysis. In many river basins a range of environmental issues attached to different scales are likely be considered.

One pragmatic way to ensure some coherence between these analyses would be:

- **Step 1** - To assess the scale at which environmental issues take place and classify these issues accordingly (from largest to lowest scale). This assessment is directly based on the analysis of pressures and impacts.
- **Step 2** – To undertake the cost-effectiveness analysis for the environmental issue that takes place at the river basin or largest scale considered, and select measures for solving this issue;
- **Step 3** – To assess the impact of these measures on other environmental issues, as it is likely that measures will impact on several issues. Identify the remaining environmental issues to be solved;
- **Step 4** – To undertake the cost-effectiveness analysis for the environmental issue that takes place at the next largest scale;
- The analysis continues as long as significant environmental issues remain. At the end of the process, add all the costs of the measures targeted to different environmental issues.

In some cases, cost-effectiveness analyses will be developed simultaneously for different environmental issues. It will be important then to ensure co-ordination and constant feedback between the different analyses undertaken.

Dealing with different sub-basins of the same river basin

For large river basins, sub-river basins may be proposed for undertaking the economic analysis. It is then recommended to adopt a stepped approach that follows the hydrological cycle/structure to ensure separate measures that are cost-effective for each sub-basin are also cost-effective at the river basin scale. A pragmatic approach is given below for a situation where pressures have a downstream impact on (surface) water status:

- **Step 1** – Start the analysis with the most upstream sub-basin. Identify cost-effective measures for this sub-basin along with their total costs and their impact on the status of water bodies;
- **Step 2** – Assess the impact (if any) of these measures on the status of water bodies of the next downstream sub-basin; and
- **Step 3** - If the predicted water status for the downstream sub-basin is below good water status for some/all water bodies, cost effectiveness analysis is then performed at the scale of this downstream sub-basin to identify new measures, their impact, their costs.

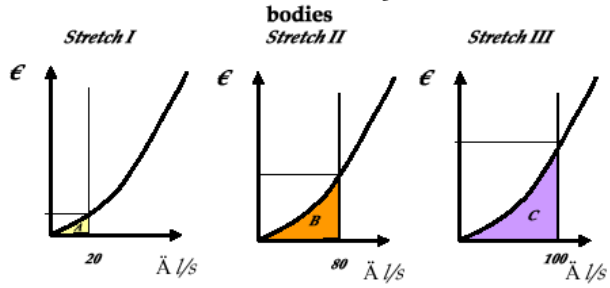
The analysis continues then with these steps being systematically applied for all sub-basins while moving down to the most downstream sub-river basin. Clearly, there is a need to ensure the analysis moves regularly between different scales, i.e. the sub-basin, the basin, the country or group of countries, so measures that are relevant to different scales can be adequately considered and analysed (e.g. assessing the potential role of a tax on pollution discharges may require a direct analysis for all river basins of a given country if taxes are driven by national policies), as shown in *Illustration 4*. One may first investigate measures that apply at large scales to all sub-basins, and then move to measures that apply at lower scales and that can adjust/refine the broader effects of the large-scale measures. It may also be practical to develop separate cost-effectiveness analyses for individual environmental issues.

Illustration 4 – Cidacos (Spain): Investigating river basins and sub-basins

The Cidacos River is 44 km long, and drains a catchment of 500 km². Except for its initial part, the river runs through a plain, which is mainly agricultural (225 km²). Animal farming is associated to farming with a total of 86 production facilities. Agricultural production is supplied with surface water and groundwater. The basin has 14 small population centres, with two small cities (Olite and Tafalla) and 17,000 domestic users. These are served by water from a small dam in the first stretch of the river, and also from two springs and some wells. These have water quality problems, from hard water and nitrates. The main industries are located in Olite and Tafalla, and industrial permits for water have been denied due to a shortage of good quality water supply.

The Cidacos scoping study distinguished between three water sub-basins or reaches: upstream, downstream and a middle stretch. In order to achieve good ecological quality (GEQ) an improvement to the water flow was considered, increasing flows by 20, 80 and 100 litres per second in the upper, middle and lower sub-basins respectively. The total costs of achieving the objective for each sub-basin *independently* can be obtained simply by aggregating the costs of the measures for the three areas (areas A, B and C in the diagram), i.e. the programme would cost € 1.2 million in total.

Optimal Program with three *independent* water bodies

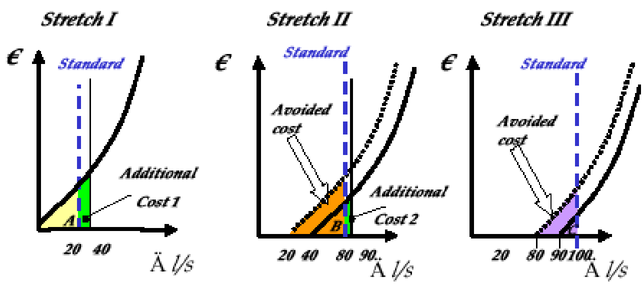


Overall cost: A+B+C

However, because the three sub-basins are connected, the cost of obtaining the GEQ in stretch II depends on the quantity of water it receives from the upstream basin (stretch I) and the cost of GEQ in the downstream basin (stretch III) depends on the ecological status of both stretches I and II. Therefore, the the least cost programme of measures must take into account the externalities involved in the simultaneous improvement of the three interconnected sub-basins, as shown in the diagram below.

By improving the water flow above the minimum standard, it was shown that the marginal cost of achieving the required increase in the water flow in the middle and downstream sub-basins could be avoided. The (avoided) costs of the measures that would have been needed for stretches II and III were shown to be higher than the cost of increasing the water flow in stretch I. In Cidacos, the overall cost of the action plan obtained this way would be €0.56 million (or less than 50 per cent of the total cost of treating the three water bodies as independent).

Least Cost Programme



Overall Cost: A+Addit.Cost 1+B+Addit. Cost 2 +C

Consequently, when considering the scale of the analysis the river basin as a whole must be used. The analysis cannot be done independently for each sub-basin, as it would exclude any shared benefits and costs of the programme of measures.

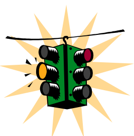
Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. *See **Annex V.***

5. Which basic units should be considered in the cost-effectiveness analysis?

The cost-effectiveness analysis will not be able to deal with all measures targeted to individual users and related environmental impact. Thus, a certain level of aggregation is required for the analysis to remain pragmatic, and also to account for the scale at which some measures apply.

However, one cannot aggregate all information and analysis at the river basin scale as it eliminates the hydrological structure of the river basin and the links between uses, pressures, and water status of specific water bodies. Assessing the basic unit that should be investigated into the cost-effectiveness analysis requires considering:

- The scale of water bodies themselves;
- The scale at which pressures and impacts take place (which areas need to be targeted by measures so as to restore good water status); and
- The scale at which measures will be implemented/will take place (see point below).



Look Out!

Some measures for improving water status have an inherent scale of application/implementation that need to be considered for the cost-effectiveness analysis (e.g. environmental taxes are often national-based instruments). In other cases, the analysis of existing uses, pressures and impacts will lead to the identification of smaller geographical areas (e.g. a given watershed within a river basin), sub-sectors (e.g. a given chemical sector) or sub-uses (e.g. large users of water with swimming pools) that will be targeted by measures (e.g. the restoration of a specific wetland, or a change in water pricing for a specific urban area or irrigation scheme).

6. At which scale should we assess cost-recovery?

Assessing spatial relevance *vis-a-vis* cost recovery appears rather straightforward:

- Information on pollution, uses, financial costs and existing prices are usually collected for water service (or combined water service) areas. This information needs then to be aggregated at the river basin scale that appears as adequate for discussing overall financial flows and recovery issues;
- Environmental and resource costs may relate to the sub-basin or entire river basin (e.g. if a pollution created in the upstream part of a river basin has negative impact in the estuary of the same river). Assessing these costs requires a good assessment of the scale at which environmental impact of existing water services and uses take place. Costs can then be computed for each water service at the scale of the river basin; and
- The assessment of the relative contribution to these costs of key water uses combines both water uses and related services aimed at removing environmental damages caused by these uses. The Water Framework Directive requests a minimum disaggregation into agriculture, households and industry. According to local circumstances and key water uses identified in the analysis of pressures and impacts, this disaggregation may be further refined.

7. At which scale should reporting of information be carried out?

Different aspects need to be considered here:

- Firstly, it is important to identify the geographical scale at which relevant information and expertise is available. The scale at which information is available today is likely to lead to the use of proxies, (statistical) extrapolation or interpolation techniques to obtain robust estimates of key variables at the desired scale. Important will be to ensure assumptions and approximation are made transparent and reported along with results of the analysis;
- Secondly, the scale at which information and results are to be reported for effective information and consultation of the public; and
- Thirdly, the scale for reporting to the EU: in such case, the coverage is clearly the river basin district, with the analysis been presented for key spatial and socio-economic/water uses aggregates.

In addition to the River Basin Management Plans developed for each district, Member States may produce more detailed plans for specific sectors, issues or water types (*Article 13*), providing ample opportunities to focus on specific aggregation levels lower than the river basin. Such detailed plans may be identified in the context of consultation and participation of interested parties or directly result from the analysis of pressures, impacts and significant water management issues.

8. A checklist for a summary

Table 2 summarises spatial and disaggregation scales that can be investigated at the different steps of the economic analysis.

Table 2 - Checklist

Steps	Analysis	Reporting
Characterisation of the river basin	➢ **Economic analysis of water uses** 1. Assessment at the scale of significant water uses as identified by Annex II => assess economic indicators at the same scale 2. Possible further disaggregation if very high socio-economic variability for given uses that are likely to lead to choosing different measures/having different impacts of proposed measures ➢ **Trend analysis and baseline development** 1. Assessment of trends in key drivers/variables at a scale consistent with the economic analysis of water uses ➢ **Assessment of cost-recovery** 1. Identify the scale at which water services (or combined services) take place => assess of cost-recovery at that scale 2. Identify uses that are damaging the environment and cause specific water services to other uses => compare their relative participation to the recovery of the costs of water services at the scale of the water use/services linked to damage caused by water uses	➢ **Economic analysis of water uses** 1. Reporting at the river basin scale 2. Possible reporting for specific water uses ➢ **Trend analysis and baseline development** 1. Reporting at the river basin scale 2. Possible reporting for specific water uses ➢ **Assessment of cost-recovery** 1. Assessment of cost-recovery at the river basin district scale or for national portion of transboundary river basins 2. Assessment of the contribution of water uses to the costs of these services at the river basin scale
Assessing the gap/risk of non-compliance	➢ **Costs of basic measures** 1. Assess total costs of basic measures at the river basin scale ➢ **Likely costs and qualitative impact of potential measures** 1. Assess tentative costs per type of measures considered 2. Assess the impact of potential measures at the scale of the likely-affected water use(s)	➢ **Costs of basic measures** 1. Total costs of basic measures at the river basin scale ➢ **Likely costs and qualitative impact of potential measures** 1. Tentative costs per type of measures 2. Impact of potential measures at the scale of the likely-affected water use
Undertaking the cost-effectiveness analysis	➢ **Costs of measures** 1. For each individual measure proposed – assess costs at the spatial or disaggregation scale at which the measure will apply ➢ **Effectiveness of measures** 1. Assess the effectiveness of measures at the scale at which the concerned environmental issues take place – this depends on the pressures and impacts concerned and the type of measure considered (at which scale is the measure applied, and which part of pressures will be affected) => compute one effectiveness indicator for each measure ➢ **Cost-effectiveness analysis** 1. Cost-effectiveness analysis undertaken at the river basin scale => identify cost-effective programme and total costs 2. If cost-effectiveness undertaken separately for different environmental issues and sub-basins, ensure a logical step-wise approach (from upstream to downstream, from general environmental issues to local	➢ **Costs of measures** 1. For each individual measure proposed – linked to the spatial or disaggregation scale at which the measure will apply ➢ **Effectiveness of measures** 1. Effectiveness for each measure ➢ **Cost-effectiveness analysis** 1. Chosen measures and total costs of cost-effective programme reported at the river basin scale 2. If cost-effectiveness undertaken separately for environmental issues and sub-basins, report on the results (chosen measures,

	environmental issues) and constant feedback loops between analyses 3. Further levels of disaggregation are possible in the analysis linked to the assessment of significant water uses and the potential measures investigated	costs) of each individual analyses and assess qualitatively possible inter-relations between different analyses 3. Possible level of disaggregation possible linked to the assessment of significant water uses and potential measures investigated

ESTIMATING COSTS (AND BENEFITS)

Directive references: *Articles 4, 5* and *9* and *Annex III*
3-Step Approach: this information sheet underlies all key steps of the approach
See other information sheets: *Reporting on Cost Recovery, Cost-effectiveness Analysis* and *Disproportionate Costs*

This information sheet helps you understand how to estimate costs and benefits, which are seen as avoided costs.

1. When to Estimate Costs?

Estimating costs is important for several parts of the economic analysis

- Taking into account the principle of **recovery of costs** of water services, including environmental and resource costs, in order to ensure that an adequate contribution to the recovery of the costs of water services is made by the different water uses, disaggregated into at least industry, households and agriculture (*Article 9, Annex III*);
- Conducting a **cost-effectiveness analysis** of alternative policy measures or projects (*Article 5, Annex III*);
- Assessing the costs of alternative options in the **designation of heavily modified water bodies** (*Article 4*);
- Assessing the need for a derogation based on an economic appraisal of disproportionate costs (such as for the setting of **less stringent objectives or time derogation** - *Article 4*).

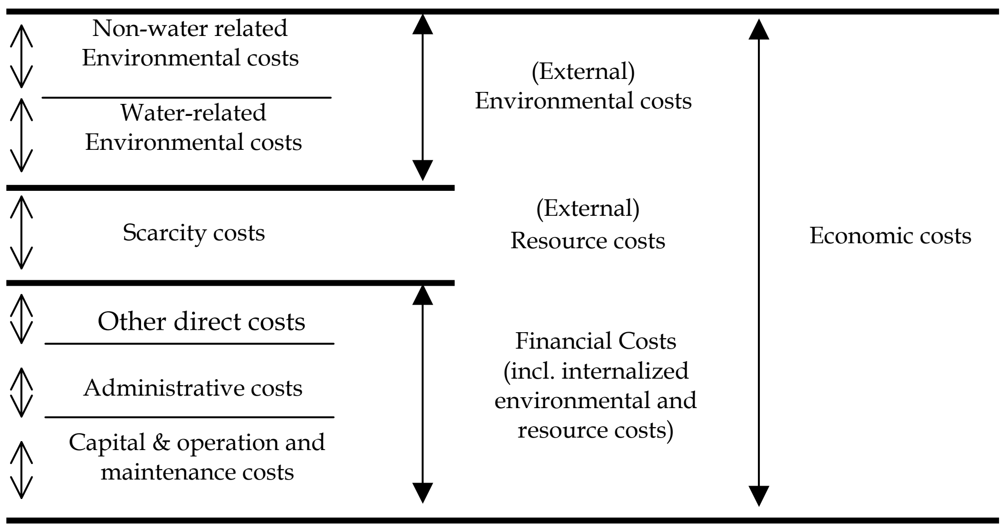
Note that the Directive defines costs as *economic costs*, which are the costs to society as a whole, as opposed to *financial costs*, which are the costs to particular economic agents. In the Directive (*Article 9*), economic costs are made up of three components (see also *Box 1*): financial costs, resource costs and environmental costs. This information sheet helps you analyse and estimate all of these cost categories.

2. Moving from Financial to Economic Costs

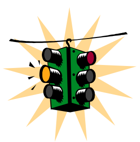
The Table below proposes an approach for moving from financial to economic costs.

Steps	**Rationale**
1. Estimate financial costs	Financial information is often more readily available than estimates of economic costs: as a result, they form a good basis for the analysis.
2. Make transfers (such as taxes and subsidies) explicit	Taxes only represent a transfer from society's point of view and should therefore be excluded from the economic analysis. However, environmentally related taxes might represent internalised environmental costs and should be accounted for as such.
3. In case of distorted markets and scarce resources: replace market prices by opportunity (or resource) costs	Because of distorted markets, market prices may not reflect the opportunity cost of the resource used, and therefore the benefits that could be achieved if the resource was assigned to its best available alternative use.
4. Include all non-priced environmental costs	For non-priced resources (and this is often the case for environmental resources), no price is paid as there is no market. To account for the total effect on welfare, these costs must be estimated and included.

Box 1 – What are the different types of costs mentioned in the Directive?



Source: Rogers et al. (1997)

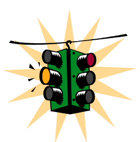


Look Out! Treatment of indirect and induced costs

Direct costs (made up of mainly of financial costs and administrative costs) are included in all components of the economic assessment for the purposes of the Directive. The treatment of indirect and induced costs is likely to vary according to the step of the economic assessment:

- *Indirect costs* are the economic costs for other sectors likely to result from the change in water status, such as a loss in productivity…
- *Induced costs* are the costs resulting from second-order effects, such as the reduction in employment in the service sectors in rural areas resulting from a loss in employment in the agricultural sector due to water degradation.

Indirect costs may be considered when carrying out the cost-effectiveness analysis, but induced costs would only be taken into account (if possible) at the stage of the cost and benefit assessment for justifying derogation.



Look Out! Focus on net costs

When estimating economic costs, you should focus on the *net costs*, including any savings or financial benefits, also known as 'negative costs'. An example of negative costs is income earned from selling sludge (fertiliser), which arises as a by-product of wastewater treatment. Since this activity brings in revenues, it should be subtracted from the costs of wastewater treatment.

Step 1 - Estimating Financial Costs

Financial costs in this context are the costs of providing and administering water services. They can be broken down in a number of cost elements, presented below. The Table gives the definition of each cost element and warns you about potential traps and difficulties.

Cost element	Definition	Look out!
Operating costs	All costs incurred to keep an environmental facility running (e.g. material and staff costs).	*When projecting operating costs, make sure to take into account additional costs linked to new capital investments.*
Maintenance costs	Costs for maintaining existing (or new) assets in good functioning order till the end of their useful life.	*As many water and wastewater assets are long-lived and buried under ground, it will be difficult to estimate the appropriate level of maintenance needed for exploiting the assets without leading to their deterioration.*
Capital costs: ➢ *New investments*	Cost of new investment expenditures and associated costs (e.g. site preparation costs, start-up costs, legal fees)	➢ *Associated costs can be substantial. In the absence of data, it is better to try and estimate them rather than neglect them.* ➢ *For projections, costs of new capital costs should be spread over a number of years. For this, the Annual Equivalent Cost Method is recommended (see Box 2 and Illustration 1)*
➢ *Depreciation*	The depreciation allowance represents an annualised cost of replacing existing assets in future. Estimating depreciation requires defining the value of existing assets and a depreciation methodology.	➢ *Several methods can be used to estimate the value of existing assets, mainly the historical value, the current value and the replacement value methods (see Box 3)* ➢ *Applying existing accounting rules for calculating depreciation may not necessarily lead to the estimation of "economic" depreciation – they may need to be adjusted to reflect economic reality, i.e. that the value of assets declines faster towards the end of their life.*
➢ *Cost of capital*	It is the opportunity cost of capital, i.e. an estimate of the rate of return that can be earned on alternative investments. The cost of capital applied to the asset base (new and existing) gives you the returns that investors are expecting to earn on their investments.	➢ *The expected rate of return is likely to be different for public and private investors but no capital is ever "free", as there are always alternative investments.* ➢ *Estimating the cost of capital is likely to be difficult and contentious, as it depends on the return of alternative investments.* ➢ *Capital subsidies provided to private investors will need to be taken into account when calculating the amount of returns that they are allowed to earn.*
Administrative costs	Administrative costs related to water resource management.	➢ *Examples include: costs of administering a charging system or monitoring costs.*
Other direct costs	This mainly consists of the costs of productivity losses dues to restrictive measures.	➢ *Example: loss of agricultural production resulting from the creation of a retention area.* ➢ *Question: over which horizon should these costs be accounted for?*

Box 2 - The Annual Equivalent Cost (AEC) method

The Annual Equivalent Cost (AEC) method allows you to convert the NPV of a new capital expenditure into an annuity (or rental) which has the same value. This can be done as follows:

1. List all capital expenditures and when they are incurred;
2. Calculate the net present value of expenditures, using the chosen discount rate;
3. Convert this net present value into an "annual equivalent cost" (AEC) based on:

$$AEC = \frac{NPV * DiscountRate}{(1-(1+DiscountRate)^{-lifetime})}$$

AEC = annual equivalent cost
NPV = net present value of investment
Discount rate = chosen discount rate (the same as used to calculate the NPV)
Lifetime = lifetime of the capital equipment

Box 3 - Valuation of capital assets: Current vs. replacement value

Depending on the accounting system in use, it is possible to use various types of valuation methods for existing capital assets:

- The **historical value** is the value of the assets at the price they were originally purchased. Because of inflation, this value often bears no relation with what it would actually cost today to replace those assets – therefore, it is not the best measure for estimating economic costs.

- **The current value** is the historical value multiplied by an inflation index. Calculating this value raises a number of issues: 1. Estimating the inflation index may be open to interpretation (should the general inflation index or the construction (consumer?) price index be used?); 2. This method does not take account of technical progress: a water treatment plant that cost a given amount 10 years ago might cost half today thanks to technical progress. However, this method is relatively easy to apply and is more appropriate than the first one.

- The **replacement value** method estimates the present value of an asset from the current cost of replacing it for an identical service level. The advantage of this method is that it allows taking into account technical progress. However, it might be difficult, costly and time-consuming to apply to all the capital stock. In addition, the water sector being relatively less dynamic than, say, the telecommunications sector, the current value method may be sufficient for the purposes of estimating economic costs.

Illustration 1 - Deriving financial costs for the appraisal of measures in the Cidacos river basin

Cidacos is located in the region of Navarra, in Northern Spain, and is a tributary to the Aragon River. When conducting an economic analysis, deriving financial costs was necessary to determine the costs and benefits of achieving different objectives for water status (good vs. moderate), measures such as demand management, increased efficiency and water imports were considered.

The study calculated the annual equivalent costs (AEC) of each measure considered, assuming a discount rate of 2% and a time horizon of 30 years. This assumes that the costs of measures having a lifetime of more than 30 years have a lower effect on the AEC. The costs considered for the AEC calculation for each measure include:

- Investments costs
- Operation and Maintenance (O&M) costs
- Economic opportunity costs or benefits (when available)
- Environmental costs:
  - External avoided costs of measures (when available).
  - Other environmental benefits associated to the measure (apart from those deriving from the achievement of WFD objectives).

To derive financial costs, capital and O&M costs were expressed in relation to a physical measure, such as per Sq Km, per Ha, per Litre and per m^3. This provided an uniform scale through which different costs and measures could be analysed and compared effectively. An issue that emerged in this exercise was the increasing marginal costs of some measures relative to others over time. As the cost analysis progressed, the increasing marginal costs of some measures emerged, through expanded service coverage or possible marginal efficiency gains, such as those aimed at improving efficiency in water use; or with the constant costs of other measures (e.g., water transfers). This point has important implications for ranking measures and choosing a cost-effective combination of measures. It should also be noted that the cost-effectiveness of a measure is not constant over time in some cases. Some measures have increasing marginal costs as technical efficiency improves (as we reach the maximum potential of the measure). This is relevant since assuming constant costs may lead to an inefficient programme of measures.

Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. *See Annex V.*

Step 2 - Making Transfers Explicit

As mentioned above, taxes and subsidies should usually be treated as transfers within society and should therefore be excluded from the estimation of economic costs. However, it is important to distinguish between general taxes and environmental taxes and subsidies:

- General taxes need to be deducted from financial costs;
- Environmental taxes and subsidies may represent internalised environmental costs and, as such, should not be deducted from financial costs.

Step 3 - Taking Account of Resource Costs

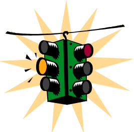
Resource costs represent the costs of foregone opportunities that other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. costs related to groundwater over-abstraction). These users can be either those of today, or those of tomorrow, who will also suffer if water resources are depleted in the future.

If markets function well, the opportunity costs of resources are reflected in the financial costs of resources. However, for environmental resources, these costs are often not included in market prices. Opportunity costs, the scarcity value of under-priced environmental resources like water, should therefore be included when estimating economic costs (see *Box 4*).

Step 4 - Including All Non-priced Environmental Costs

Environmental costs represent the costs of damage that water uses impose on the environment and ecosystems and those who use the environment (for example, a reduction in the ecological quality of aquatic ecosystems or the salinisation and degradation of productive soils). This loss in welfare may encompass lost production or consumption opportunities as well as non-use values (such as the value produced by contemplating a clean lake at dusk), which are harder to quantify. Environmental costs are not commonly estimated – steps and alternative methodologies for carrying out this estimation are therefore highlighted below.

In addition, as environmental costs can be seen as negative benefits and avoided costs (see *Illustration 2*), the following section also discusses the estimation of environmental benefits, which will be useful for the cost and benefit assessment necessary to justifying derogation (see *Disproportionate Costs*).



Look Out! Before estimating environmental costs, it is necessary to know the environmental impacts of the measures used to reach the objectives.

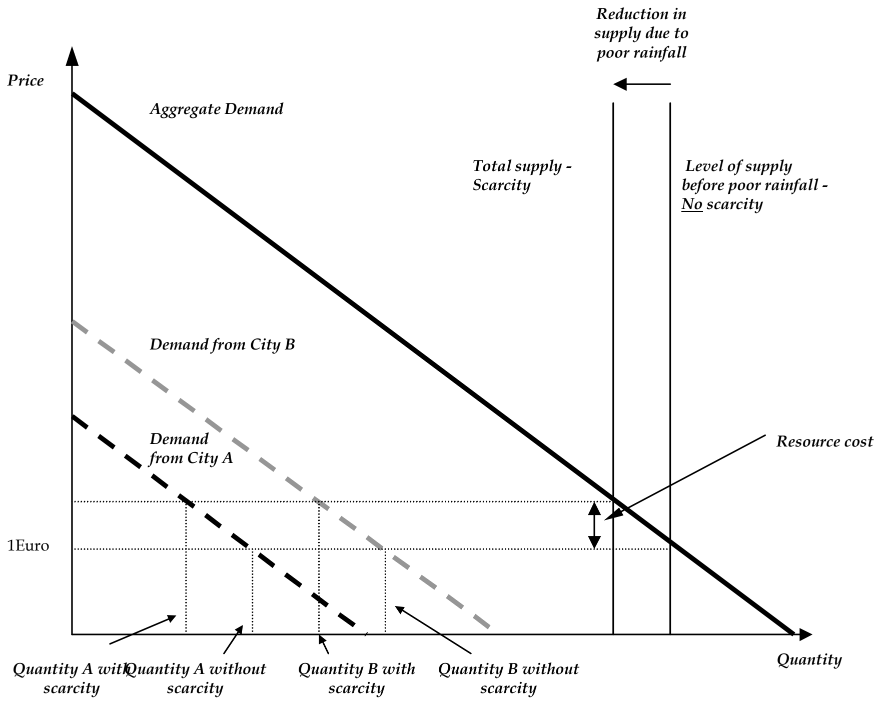
This information will be available from the work carried out by other technical experts (such as experts investigating impacts and pressures - see *Annex I* for contact details) – and environmental modelling might be required. When looking at environmental impacts, it is important to realise that measures taken to reach the objectives in one area will potentially have impacts downstream or on other parts of a river basin. In other words, linkages within a river basin district must be fully understood. Only once the magnitude of change in environmental quality has been measured, is it possible to link it to unitary costs and benefits estimated through different techniques or with the assessment of measures that would be required to prevent and mitigate etc.

Box 4 - Calculating resource costs

There are no well-established methods for estimating resource costs, although some attempts have been made at estimating them. As resource costs are seldom incorporated into market prices, it will be necessarily to rely on estimates of foregone demands and economic values.

The following example illustrates potential methods that would need to be developed:

- Two users (City A and City B) are competing for the use of the same water. It is possible to estimate the demand curve for each of them.
- If there is sufficient water available to satisfy both demands, there is no scarcity and the resource cost of water is zero.
- Suppose that due to poor rainfall in a given season, there is only a limited amount of water available (supply with scarcity). Due to this scarcity, there will be a resource cost, which can be calculated by finding the price for which total demand is exactly to the supply with scarcity. The difference between that price and the normal price is the resource cost, as shown in the Figure below.



What are environmental costs and benefits?

Society derives benefits (or costs, which are foregone benefits) from improved environmental quality in water bodies, which would arise from achieving the environmental objectives contained in the Directive. This value is made up of both 'use' and 'non-use' values (see *Box 5* for examples and below for an explanation). Other and broader benefits may need to be assessed in some instances, such as an assessment of the broader economic benefits for example, for conducting the required analysis for proposed new modifications. These are not explicitly dealt with here, however.

What are use and non-use values/benefits?

Use values/benefits. 'Use values' refers to the fact that economic agents currently use the environmental goods in question, either directly (by sailing on a lake for example) or indirectly (by watching a video of someone else sailing on that lake). Direct use values are the easiest ones to estimate, as they usually stem from products that can be traded in a market as entrants into a production process or final products (for example, water for food processing or fish).

Non-use values/benefits. Some benefits are not associated with any direct use, so called non-use values, but exist because individuals value an ecological resource without using or possibly even intending to use it, for example water quality and biodiversity in a lake.

Box 5 - Types of Environmental Benefits / Avoided costs

Benefit Class	Benefit Category	Types of benefits and examples
Use values	Direct use	Market (Commercial: fishing, navigation, tourism) Non-market (Recreational: water skiing, fishing, swimming, boating, photography)
	Indirect use	Amenity value derived from a nice environment Benefit extracted from someone else using the environmental good (eg. Reading a fishing magazine) General ecosystem support (preserving the food chain to support fishing)
	Option value	Value derived from preserving potential direct or indirect use values in future, which depends on uncertainty over future demand and supply
Non-use values	Existence	Biodiversity, heritage and cultural values
	Bequest	Preservation of water quality for family and future generations

Sources: *OECD (1999) and Timothy M. Swanson and Edward B. Barbier (1992).*

Illustration 2 - Benefits defined as avoided costs: *The Artois-Picardie basin*

Tourism is one the main economic activities in the Artois-Picardie basin in the North of France. In particular, the 'Opal Coast' benefits from beach-oriented tourism, which provides 40 percent of the basin's turnover (around € 1 billion per year). Access to the region's beaches and the sea are critical factors for maintaining tourism. Hence, if the quality of water was 'sufficiently' bad, the beaches of this coastal stretch would have to be closed for bathing activities: users would either go elsewhere, or not take part in bathing activities at all. Two studies were carried out by the Artois-Picardie Water Agency to assess the potential economic loss linked with such a scenario. The studies showed that between 30 to 50 percent of visitors to the area would cancel their trips, leading to economic losses ranging between € 300 million and € 500 million per year. These values can be seen as the benefits of providing bathing and other recreational facilities that are dependent on water quality. As a way of comparison, the money invested in sewage treatment for the basin totalled € 150 million over the 10 last years. The magnitude of the benefits gained from good quality alone provides a compelling reason for continued investment in sewage treatment to avoid the potential cost of pollution.

Source: Agence de l'Eau Artois-Picardie (1997), 'Qualité de l'eau, tourisme et activités récréatives: la recherche d'un développement durable'.

Methodologies for Estimating Environmental Values

Various techniques exist for the valuation of environmental costs and benefits, which are more or less practical, time-consuming and have different cost implications. Below, we outline four possible methodologies for estimating those costs. A rough guide to choosing between these methodologies is presented in *Box 6* and an example of how stakeholders may be involved in the process is gi ven in *Illustration 3*.

Method	Definition	Overall assessment
Market Methods	These methods use values from prevailing prices for goods and services traded in markets. Values of goods in direct markets are revealed by actual market transactions and reflect changes in environmental quality: for example, lower water quality affects the quality of shellfish negatively and hence its price in the market.	***Good method if market data exist but limited to direct use values for goods traded on a market. Since this is often not the case, other methods must be used.***
Cost-based valuation methods	This method is based on the assumption that the cost of maintaining an environmental benefit is a reasonable estimate of its value. References for this type of valuation include the costs of preventative and/or mitigation measures. This assumption is not necessarily correct: all mitigation may not be possible, in which case actual mitigation costs would be an underestimate of true environmental costs. By contrast, mitigation measures might not be cost-effective and those costs might be an over-estimate of the environmental costs. A distinction needs to be made between: ➢ The costs of measures already adopted, which are theoretically already included in financial costs. These costs should be reported as a distinct financial cost category. Counting them as environmental costs would be double counting; and ➢ The costs of measures that would need to be taken to prevent environmental damages up to a certain point, such as the Directive's objectives. These costs can be a good estimate of what society is willing to forego.	***Practical and relatively easy - a good starting point, although the costs of the environmental damage itself tends to be underestimated with this method.***

Method	Definition	Overall assessment
Revealed preference methods	The underlying assumption is that the value of a good in a market reflects a set of environmental costs and benefits and that it is possible to isolate the value of the relevant environmental values. These methods include recreational demand models, hedonic pricing models and averting behaviour models (see *Box 7* for a description).	***This set of techniques tends to be time-consuming and costly to use. The use of such techniques could be reserved to particular environmental issues that raise specific problems***
Stated preference methods	These methods are based on measures of willingness to pay through directly eliciting consumer preferences (i.e. asking them!) on either hypothetical or experimental markets. For hypothetical markets, data are drawn from surveys presenting a hypothetical scenario to the respondents. The respondent makes a hypothetical choice, used to derive consumer preferences and values. Methods include contingent valuation (see *Box 7*) and contingent ranking. It is also possible to construct experimental markets where money changes hand, e.g. using simulated market models. In the questionnaire, it is possible to ask respondents how much they would pay for avoiding an environmental cost or how much they value a given environmental benefit.	***As above***

Box 6 – A Rough Issues To Choosing a Methodology for Estimating Environmental Costs

Checkpoints	**Choice of method**			
	Direct market method	Cost-based valuation	Revealed preferences	Stated preferences
Are you measuring the value of the environmental cost before or after the environmental change?	After	Before or After	Before	Before
Is the market for the environmental value you want to estimate hypothetical or real?	Real	Real	Real	Hypothetical
Are markets directly or indirectly related to the environmental value you want to estimate?	Directly related	Directly Related	Indirectly related	Directly related
Is it important that you can estimate demand/supply elasticity?	Yes	No	Yes	Yes
Are (estimated) non-use values likely to be significant?	No	No	Yes	Yes
Does the method require significant time and financial resources?	No	No	Not necessarily	Yes

Some benefits will not be quantifiable, either because of technical reasons (e.g. all impacts of achieving the environmental objectives cannot be foreseen, it is not possible to quantify all the benefits of improved water quality in a river stretch etc.) or lacking resources (e.g. there is insufficient time to carry out quantitative studies before the RBMP in 2009 or it is too costly). In these situations, benefits should be assessed and described qualitatively.

The Use of Value Transfer

An alternative option to direct valuation of environmental costs is the use of *Value Transfer* (more commonly known as benefit transfer in the case of benefits). This method uses information on environmental costs or benefits from existing studies and uses this information for the analysis in the river basin under consideration. As a result, a data set that has been developed for a unique purpose is being used in an application for a different purpose, i.e. it transfers values from a *study site* to a *policy site,* i.e. from the site where the study has been conducted to the site where the results are used.

Above all, benefit transfer is suitable when technical, financial or time resources are scarce. However, amongst other problems, it is important to note that since benefits have been estimated in a different context they are unlikely to be as accurate as primary research (see also *Look Out!*). A step-wise approach should be developed in order to ensure that the transfer of values derived in other contexts can minimise the potential for estimation errors.

Box 7 – Examples of Revealed and Stated Preference Methods

Revealed Preference Methods

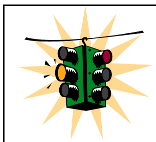
Hedonic Pricing. "Hedonic pricing methods explain variations in price [in the price of goods] using information on [qualitative and quantitative] attributes". They are used in the context of the water to value how environmental attributes and changes affect property prices. In addition to structural features of the property, determinants of property prices may include proximity to, for example, a river or lake. The change in property price corresponding to an environmental degradation, for example the pollution of a river or lake, is the cost of this degradation.

Averting Behaviour. This method derives values from observations of how people change defensive behaviour – adapt coping mechanisms - in response to changes in environmental quality. Defensive behaviour can be defined as measures taken to reduce the risk of suffering environmental damages and actions taken to mitigate the impact of environmental damages. An example of the former is the additional cost of having to filter or boil bad quality water before drinking it. The costs of mitigating the impact may entail expenditures on medical care needed as a consequence of drinking poor quality water. The expenditures produce a value of the risk associated with the environmental damage.

Recreation Demand Models (RDM). Improvements or deterioration in the water quality may enhance or reduce recreation opportunities, for example swimming, in one or more sites in a region. However, markets rarely exist to measure the value of these changes. RDM focus on the choice of trips or visits to sites for recreational purposes and look specifically at the level of satisfaction, time and money spent in relation to the activity. By assuming that the consumer weighs time and money as if he/she were purchasing access to the goods, for example a river stretch, patterns of travel to particular sites can be used to analyse how individuals value the site and, for example, the water quality of the river stretch. Reductions in trips to a river stretch due to a deterioration in water quality, and associated changes in expenditures, reveal the cost of this deterioration.

Stated Preference Methods

Contingent Valuation. Contingent Valuation is based on survey results. A scenario including the good that would be delivered and how it would be paid for (e.g. through an increase of the water bill) is presented to the respondent. Respondents are asked for their willingness to pay (WTP) for the specified good, e.g. improvements to the groundwater status. The mean willingness to pay is calculated to give an estimated value of the good, in this case improved groundwater status, and these means can then be aggregated to establish the value to the relevant population. However, note that one of the difficulties with this approach lies in ensuring that respondents adequately understand the environmental change that is being valued, for example going from poor to good water status.



Look Out! When using Benefit Transfer, you must…

- Assess the quality studies to be used;
- Compare assumptions, baseline conditions, target population and policy measures etc. to ensure that the policy settings are similar; and
- Address uncertainty.

The methods used for transferring benefits include *Meta-analysis, Benefit function, Bayesian techniques* and *Point estimate.* To facilitate benefit transfers during the implementation of the Directive, it might be appropriate to build a trans-European database with references on benefits and costs.

Illustration 3 - Integrating stakeholder analysis in non-market valuation of environmental assets: estimating the value of a wetland area in Kalloni Bay on Lesvos island (Greece)

The study reviewed here sought to investigate the economic values placed on a wetland surrounding Kalloni Bay on the island of Lesvos and employed two types of methodology:

(1) Local people and visitors to the area were surveyed via a questionnaire: each respondent was asked to rate four possible development scenario for the wetland and were asked about their willingness to pay for their preferred scenario;

(2) Opinions from important local stakeholders such as fishermen, elected representatives, construction companies, and hotel owners about their priorities for both conservation and development were gathered through stakeholder focus groups. The stakeholder analysis was designed for: (i) identifying conflicting uses of environmental assets, (ii) conceptualising conflicts on the basis of property right allocations among social groups, regions and nations, and, last but not least, (iii) understanding the institutional mechanisms by which costs and benefits are appropriated.

Dynamics of the stakeholder focus groups
Individual based methods are often criticised for failing to account for institutional structures. As a result, it appeared important to reflect the institutional and social structure of the island through the focus group method. The focus groups revealed important differences in the social constructions made by different stakeholders about the wetlands and its place in the culture and economy of the Kalloni area. The issue of local people having rights over local resources was an important theme, and participants thought that problems and conflicts should be resolved locally. However, different stakeholders were reluctant to enter into discussions with each other. There was, in general, a belief that all of the different activities involving the wetlands such as tourism, agriculture and fishing could co-exist: many local people combine occupations (e.g. being simultaneously farmers and hotel owners). However, the links between the consequences of different activities were not always accepted. For example, farmers refused to make the connection between their use of fertilisers and pesticides and pollution of the bay. The uncertainty over property rights and responsibility was also a major area of concern, and inappropriate uses of land on one property were acknowledged as having detrimental effects on adjacent properties.

Economic valuation of the wetlands
The study yielded interesting results in terms of economic valuation of the wetlands. First, it made clear that the local population is capable of expressing a variety of preferences for extension or reduction of the wetland in terms of economic values, which can be captured by contingent valuation. Further, the stakeholder groups discussed different options for the future based on their needs, hopes and fears as particular interest groups, which informed the development of the scenarios and the choice of payment vehicle. By using these scenarios and from the focus group discussions with relevant stakeholders, a rich diversity in the motivations of different individuals and groups was encountered. For example, the local mayors valued the wetlands as a tourist potential that should be managed as a 'park', with strictly defined boundaries and distinct uses. On the other hand, for construction companies, the wetland was a nuisance that hindered their plans for development. However, the latter recognised that to some extent, they might benefit from an increase in tourism from the well-managed wetlands so their position was not so clear-cut. It resulted that because of the highly complex social constructs, stakeholder participation is essential to address conflicting interests, power-and-equity issues, and the tension between local and more global needs (e.g., tourism).

This study concluded that local people are quite capable of functioning as both citizens and consumers. As citizens, they feel responsible for their environment, though this is often expressed in very different ways, as the stakeholder focus groups demonstrated. However, they also feel responsible to themselves, as consumers of the wetland's economic potential. The conflicting issues that emerged through this study demonstrate the need for stakeholder communications in economic analysis, not only to characterize the social and political issues but also to establish a process through which participation by stakeholders creates ownership and self-determination for meeting environmental and economic objectives.

Source: Skourtos, M.S., Kontogianni, A., Langford I.H., Bateman I.J. and S. Georgiou (2000).

3. Reporting on Cost Issues

The calculation of full economic costs requires that assumptions be made about the lifetime of investments, about discount rates, depreciation methods, costing methods, valuation methods etc. Besides, in adjusting financial cost data for taxes and subsidies and in estimating the environmental and resource costs of ensuring sustainable water use, assumptions will need to be made as well.

To ensure the cost analyses of the member states are comparable, all assumptions and costing methods used should be made explicit, stating clearly how the presented cost information has been derived.

Though different Member States apply different standards for estimating economic costs it would be desirable to resemble as much as possible the methods and standards used in the international guidelines of for example the European Commission or the European Environmental Agency (see *Box 8*), especially when international analyses are performed, for example in case of an international cost-effectiveness analysis. These guidelines may also help decide on issues such as which parameters and methods to include.

The general guideline is that when reporting on economic costs, all assumptions and costing methods should be clearly reported. Depending on the use of economic cost information, other requirements might apply. This is further elaborated in the information sheets *Cost-effectiveness Analysis*, *Reporting on Cost-recovery* and *Disproportionate Costs*.

Box 8- Suggestions for Reporting on Cost Issues

Minimum requirements for the presentation of cost information according to EEA (1999)

1.It is essential that reported costs are properly defined. As a minimum, the total *investment expenditure* and total annual *operating/maintenance costs* should be reported separately.

2. As far as possible, it is recommended that all cost data should be documented in full in the year in which the actual expenditure is incurred, even if the data are subsequently adjusted to take account of time (such as by using *discount rate*s).

3. All costs in should be measured in relation to an alternative. The alternative most commonly employed is a projection of the existing situation, i.e. the situation in which the *environmental protection measure* has not been installed. Therefore, only *additional costs* actually incurred relative to the '*base cas*e' should be included in the reported cost data.

4. Where the costs associated with an *environmental protection measure* have been apportioned between two or more controlled pollutants, the method of apportionment should be described.

5. The reported cost data should only relate to *direct cost*s; *indirect costs* should be excluded from the cost data.

6. Where *environmental protection measures* produce non-environmental benefits, *revenues* or *avoided cost*s, these should be reported separately from *investment expenditures* and *operating and maintenance cost*s.

7. It should be remembered that costs and prices are not fixed for ever. For example, the unit price of a measure often falls as it changes from an experimental measure to a mass-produced measure. Therefore it is recommended to use the most recent valid data available.

8. It should be remembered that old equipment can sometimes have a lower *efficiency* and higher maintenance costs than new equipment.

9. As a minimum, any *discount rate* used should be recorded.

10. If cost data are adjusted for inflation or changes in price through time, then the method used should be recorded and any index used should be recorded and referenced.

11. If determining annual cost data, the approach that has been used to derive the annual costs should be recorded, along with all underlying assumptions.

Note that this does not necessarily apply directly to the economic assessment required for the Directive – these are guidelines from the EEA only. For example, whereas the EEA recommends to only incorporate direct costs (and not indirect costs), the incorporation of indirect costs in the economic assessment for the Directive would depend on the stage of that assessment, as specified above .

REPORTING ON COST RECOVERY

Directive references: *Article 9* and *Annex III*
3-Step Approach: *Step 1.3* and *Step 3.3*
See other information sheets: *Estimating costs, Defining water services and uses, Baseline Scenarios, Pricing as an Economic Instrument*

This Information Sheet helps you understand what and how you should report on the recovery of costs of water services by types of water users.

1. Why is it necessary to report on cost recovery?

Article 9.1 of the Directive states that: "Member states shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis according to Annex III, and in accordance with the Polluter pays principle".

This information sheet is a guide for reporting on cost recovery and is relevant for:

- Implementing the **recovery of costs of water services** and ensuring an **adequate contribution of the different water uses** to the recovery of costs of water services; (*Article 9*);
- Creating **water pricing policies** to provide adequate incentives for users to use the resources efficiently (*Article 9*); and
- Making the relevant calculations necessary for taking into account the principle of cost recovery in the **economic analysis** (*Annex III*) and making a first assessment of whether the cost-recovery objective of the Directive are currently met.

However; the information sheet focuses on the latter point (*Annex III*). A key objective of this initial analysis will be to improve **transparency** in order to understand which water services are actually paid for, to which extent, by whom and how. More specifically, this will entail identifying whether some external subsidies are provided to the water sector, or whether some cross-subsidies paid between categories of water uses.

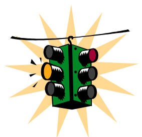
Finally, note that the objective of the Directive is not necessarily to move to "full cost recovery" but to move to a situation where the "polluter pays " principle is adequately applied. The Directive allows Member States to take into account the social, environmental and economic effects of cost recovery. But it is only with maximum transparency that the extent of these secondary effects of cost-recovery can be understood.

2. Approach to Analysing and Reporting on Cost Recovery

The approach that is proposed here for analysing and reporting on cost recovery and assessing the extent to which polluters pay can be broken down into a number of tasks, as shown in *Figure 1*. It is important to stress that this approach may need to be adapted to local and national situations and institutional setup for cost recovery.

Figure 1 – Tasks and Key Questions in Analysing and Reporting on Cost-Recovery

Key Tasks	...And Questions
1. Define the water services	What is the scale for the analysis? What are the differences in scale between water uses and water services? How can they be reconciled? What is the overall scope of the analysis
2. Identify providers, users and polluters	Who generates the costs of the water services? Do they receive a service or are they self-serviced?
3. Calculate financial costs of the water services	What are the financial costs of the water services?
4. Identify and estimate the environmental and resource costs of the water services	What are the environmental and resource costs? Can they be identified and estimated at least in qualitative terms?
5. Identify the cost –recovery mechanism	How are costs currently recovered: through prices, charges or through other institutional mechanisms of cost recovery?
6. Identify the cost –recovery mechanism	What level of costs do water users recover? What is the level of financial costs recovered? What is the amount of external subsidies to the sector? Where do these external subsidies come from and how are they financed?
6. Identify the cost –recovery mechanism	How can costs be allocated to water uses? What proportion of the total costs do water uses cover, and is that in accordance with their actual use?



Look Out!

The suggested steps to report on cost recovery do not include investigating issues dealing with price incentives (Article 9). This is treated as a separate issue in a different information sheet (see *Pricing as an Economic Instrument*).

Task 1 - Define the Water Services

The first task is to define water services (see *Water Uses and Services*) and to determine the scale of the analysis (see *Scale Issues*). Particular attention should be paid to the geographical scope of the analysis (local, regional, river basin, national, international). Subject to data availability, the definition of water services may have to be at the administrative rather than the geographical level. *Illustration 1* demonstrates how data were collated and adapted to RBD level in the Middle Rhine, however, in some cases, for lack of more disaggregated data, cost-recovery might need to be analysed at the national level (see *Illustration 2* for an example).

Illustration 1 – Cost recovery and data availability in the Middle Rhine, Germany

The principal water services in the Middle Rhine are public water supply and local authority sewage disposal, and both types are highly decentralised with a large number of companies. In general, the existence of consistent data may be a problem for the assessment of cost-recovery levels and, potentially, a decentralised structure could complicate data collection further. However, in the Middle Rhine, statistics is collated and categorised so that information based on administrative area defininitions can be related to geographical definitions based on river basins. As a result, the Middle-Rhine scoping study shows that *existing secondary* data can provide enough information for a good first assessment of the level of cost recovery.

In order to assess the level of cost recovery of water services in the Middle Rhine, structural and output data were collated and processed. Essentially, the data collection was carried out in two stages (see Table 1):

Table 1

Type of data	Data sources
Stage 1. Collection and evaluation of generally available data: information on the structure of water uses and water services and related economic characteristics (e.g. charges, subsidies, financial costs of water supply and sewage disposal)	The Federal Statistical Office (censuses of all water supply companies, excluding publicly owned enterprises), regional statistical offices (environmental statistics form censuses of *all* water companies), and data and information from the technical and financial authorities of the Länder.
Stage 2. Collection and evaluation of third party data to supplement Stage 1.	The Federal Gas and Water Management Association, joint authorities/associations surveys on public sewage disposal, and evaluation of special surveys and expert reports.

Surveys to collect *primary* data were planned for a third stage but were not undertaken as *Stages 1* to *2* provided sufficient data to derive the current level of cost recovery. As an example, Table 3 contains a summary of data collected for *public water supply* in the region of Hessen. Table 2 (below) outlines the main results (financial statistics) for public water supply:

Table 2

Water service	Rate of cost recovery
Public water supply Cost recovery from revenue excluding allocations and subsidies Cost recovery from revenue including allocations and subsidies	 83% 90%
Internalised environmental and resource costs (groundwater charge) are approximately DM 52.6 million in total, which significantly exceeds the sum of total subsidies (DM 3.4 million) and the cost recovery shortfall (DM 19.7 million)	

It was found that the ability to adapt official statistics of the Federal Government and the Länder (administrative districts) to river basin district level (as required by the Directive) greatly improved the reliability of the estimates. In addition, to ensure the efficiency of supply, detection and evaluation of data, as well as comparability of the results, a central data pool will be set up to facilitate the availability and access to economic data.

Illustration 1 (Continued)

Table 3

Revenue/Income and Cost/Expenditure	**Amount (DM)**
Number of companies	132
Revenue/income	**280,365,486**
Fees/proceeds from sales	**244,471,830**
Allocations and subsidies for on-going purposes of which:	**3,404,471**
Federal Government	0
State of Hesse	1,073,277
Local Authorities	2,296,070
Other private sectors	35,124
Other operating receipts	12,235,053
Contributions	8,773,279
Investment allocations and subsidies of which:	**10,952,929**
Federal Government	0
State of Hesse	10,538,653
Local Authorities	52,624
Private companies	110,813
Other (private) sectors	250,839
Other income	527,924
Cost/expenditures	**302,370,508**
Personnel expenditures	32,954,151
Imputed costs	78,275,119
Interest	29,383,892
Depreciation	48,891,227
Operating expenditures	149,450,933
Groundwater charges	52,621,451
Other operating expenditures	96,829,482
Aquisition of assets	3,342,563
Structural measures	35,854,654
Other expenditures	2,493,088
Profits/Losses	**-22,005,022**
Public investment allocations and subsidies	**10,702,090**

Illustration 2 – Issue of Data Availability in the Netherlands

- In the Netherlands, data on the costs of wastewater treatment are available at the administrative level of the Regional Water Boards. The information supplied by the Water Boards includes other costs than those for wastewater treatment alone, and assumptions need to be made regarding their share of the total costs.
- Data are available both at the national and regional level. As the regional level does not yet correspond to the geographical level of the river basin, at this moment aggregated national data needs to be used for the analysis of the cost recovery.

In addition, the scale at which the costs of water services are incurred might be different from one category of costs to the other (financial costs would usually be collected at the water service level, whilst environmental and resource costs would be at the level of the river basin, the scale at which water uses can be analysed). Ways to reconcile these different scales and to combine data should therefore be sought during that first task. This might require coordination between different administrations (for example, the economic regulator of water services who would normally have access to data on the financial costs of water services and the environmental regulator, who may have data on the environmental and resource costs in general, although not necessarily allocated to water services).

Task 2 - Identify the Providers, Users and Polluters

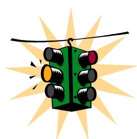
This task involves the identification of the actors involved in the generation of financial, resource and environmental costs. Water services are provided in different ways, e.g. on a communal or individual basis, by a public or a private company. The geographical scope of the analysis is determined by the level at which the responsible authority and the provider of the water service operate and the scale of the market served (see *Illustrations 1* and *2*).

Normally, little information is available for individually provided water services (agricultural groundwater abstraction, industrial waste water treatment, septic tanks of households etc.) - see the *Look Out!* box. Should this be the case, an *estimation* of the extent to which water services are provided on an individual basis, for example the percentage of households with septic tanks or percentage of industry not connected to the sewerage system can be attempted. It is only where there are significant environmental problems linked to self-services (such as mining of an underground aquifer due to too many private wells) that an appropriate estimate of all costs related to self-provided services is key to transparency and better decision-making.

A specific case is that of diffuse pollution, which can be created by agricultural pollution but also industrial or household uses (such as urban run-off). Even though diffuse pollution is not a water service, the costs resulting from diffuse pollution, in so far as they have an impact on the costs of water services (through an increase in water treatment costs for example) should be covered by those who have generated this pollution. With the Water Framework Directive (Article 9) requiring *an adequate contribution of the different water uses … to the recovery of the costs of water services*, it is important to ensure links can be made between water uses and related water services and costs.

Task 3 - Calculate the Financial Costs of the Water Service

To calculate the financial costs (see *Estimating Costs*), extensive information is needed regarding the various cost items involved in providing the water service. Typically, this type of information can be collected from the provider's annual production account or balance sheet or, if there is more than one provider, from their aggregated production accounts or balance sheets (see *Illustration 3*). Depending upon the relevant scale of analysis and the number of providers involved, this can be done at a local, regional, river basin or national level. *Illustration 4* presents an easy-to use methodology for estimating financial costs.



Look Out! Cost-recovery of self-provided water services

Water services can be provided either by third parties (e.g. communal water services) or on an individual basis (e.g. water treatment facilities of industry, agricultural water abstraction, septic tanks of households etc.). For the latter, the financial costs of water services are covered as the *user* will usually have financed these investments. Nevertheless, they can be included in the analysis, in order to fully account for the polluter pays principle. In addition, the environmental and resource costs for these services should also be estimated.

Illustration 3 –Estimating cost-recovery in the Netherlands

Table 1 below shows the aggregated costs water quality (and quantity) management, including both financial, internalised environmental, and remaining environmental costs. This is the case because the costs of mitigation measures to compensate for water pollution (e.g. cleaning of polluted river beds and water soils, monitoring of the water quality) are included in the financial costs and paid for by the users through the wastewater treatment charge. Also, since the wastewater charge paid is related to the pollution caused, the polluter pays principle applies. In total, costs add up EURO 1,030 million.

Total revenues for water quality management amount to EURO 1,035 million. Revenues include financial returns on assets and the revenues received from the wastewater pollution charge. This charge is set to recover the costs of wastewater treatment and mitigation measures. From these revenues, the subsidies received for operating the wastewater treatment installation need to be subtracted, resulting in a total of 1,021 million.

The cost-recovery rate can therefore be estimated as:

$$\frac{\text{Total revenues-subsidies}}{\text{Total costs:}} = \frac{1021}{1030} = 99\%$$

Illustration 3 (continued): Table 1 - Aggregated Balance Sheet of Water Boards in the Netherlands

Costs and revenues *(in million euro)*	**Water quantity management**	**Water quality management**
Total costs	668	1.030
Total revenues		
A received interest	37	85
B received waste water treatment charges		
C received apportionments for water quantity management	514	
D sales, rents and other taxes	14	17
E investment adjustments	9	5
F subsidies	46	14
G other income received from third parties	18	5
H internal adjustments	23	9
Total revenues	661	1035
Net revenues -/-costs	-/-7	5

Illustration 4 – Estimating Financial Cost Recovery in the French West Indies

Two of the main features specific to water supply schemes are: (i) they incorporate assets with service lives of varying lengths, often extending beyond the life of the loans subscribed to finance them; and (ii) corresponding maintenance costs grow over time and are not easy to estimate.

In the French West Indies, a large, multi-purpose water scheme supplying raw water mainly for agriculture (52%) and domestic purposes (40%) provides the basis for a simplified case study on financial cost recovery to illustrate how these features should be taken into account. The scheme is publicly-owned (and as such, investments were funded by various local authorities from 1977 to 2000) but privately managed. From the scheme, 16.8 hm^3 of raw water are sold every year and nearly 10,000 ha are irrigated.

Given the asset lives and a discount rate estimated at 3%, the annual capital costs were calculated to estimate whether the scheme's financial costs are fully recovered. To calculate maintenance costs, an intermediate step in was made to estimate a maintenance rate for each type of asset, taking into account that these costs increase over time, and using lower and upper bound values derived from past experience (see Table 1 below).

Table 1: Capital and maintenance annual costs calculation (€ 2000)

Asset life	Maintenance rate	Total investment per type of asset	Annual capital cost	Total maintenance cost	Annual maintenance cost
100 years	1-2%	504,184	12,092	148,883	4,712
100 years	0.3-1%	11,588,767	298,198	1,311,909	41,518
75 years	0.3-1%	132,573,805	3,586,153	14,776,679	495,893
50 years	1.5-5%	1,640,445	58,292	193,798	7,532
50 years	1.5-5%	210,592	6,124	101,797	3,956
40 years	1.5-5%	7,495,407	244,879	3,264,663	141,237
30 years	1.5-5%	561,173	22,856	234,025	11,940
25 years	1.5-5%	274,366	12,811	105,158	6,039
20 years	1.5-5%	34,811	1,903	11,584	779
10 years	1.5-5%	58,533	4,871	10,111	1,185
Total		173,827,944	4,789,921	20,158,607	714,790

The total financial cost was then calculated by adding this table's intermediate (total) costs to operation costs. These were derived from existing data provided by the private operator.

Table 2: Total financial annual costs and its components per cubic meter (€ 2000)

Type of costs	Total value	Value per m3
Capital costs	4,789,922	0.285
Maintenance costs	714,790	0.043
Operation costs	1,084,522	0.064
TOTAL	6,589,234	0.392

These total costs can be allocated between the different water users (irrigators and others) and compared with the price of water charged to those users. However, there are some clear limits to this approach: average costs calculated over a long period (75 years for some assets) are compared with fees charged in a given year. Thus, a comparison between average annual costs and current prices to estimate cost recovery only gives a rough estimate and should be interpreted with caution. In this case, water used for domestic purposes represented 40% of total volume used and 57% of total fees received, due to the lower price of irrigation water and to a different water pricing structure. For raw water, operation and maintenance costs were fully covered by users through tariffs but a large part of capital costs were covered through subsidies from the public authorities.

Based on several case studies conducted in France, this method for estimating financial costs appears relatively robust as it provides the means to estimate costs with assets of varying asset lifes. It can also be applied to external costs whenever it is possible to identify stakeholders who are affected by externalities and who have incurred expenses to avoid them or to remedy their effects. So far, however, this method has been applied solely to estimating financial costs.

Source: T. Rieu (2002, forthcoming).

Task 4 – Identify and Estimate the Environmental and Resource Costs of Water Services

According to the Directive's definition, environmental and resource costs should also be considered in order to take account of the principle of cost recovery. As mentioned in *Estimating Costs (and Benefits)*, the estimation of environmental costs and resources might be difficult, due to methodology issues. Some environmental and resource costs are already internalised and as such, are included in the financial costs (see *Illustration 5*). Non-internalised environmental costs will prove most difficult to quantify and incorporate in the cost-recovery equation. For those, and for the sake of improving transparency, it might be sufficient to identify the costs and estimate them in a first instance.

Illustration 5 – Introducing a Natural Resource Tax (NRT) in Latvia

The Natural Resource Tax (NRT) was introduced in Latvia in September 1995 as a means to incorporate environmental externalities into the cost of water and wastewater services. Groundwater and surface water abstractions are charged, together with discharges.

The NRT rates vary according to the type of water abstracted and the type of pollutants. The following table shows the NRT rates for both water extraction (ground or surface) and water pollution:

	Unit	**NRT-rate**
Ground water extraction	€ / 1000 m^3	17.7
Surface water extraction	€ / 1000 m^3	3.5
Water pollution with SS	€ / tonne	17.7
Water pollution with COD, P and N	€ / tonne	53.1

Source: Latvian Law on Natural Resource Tax adopted on 14 September 1995.

In the following table, the Latvian NRT rates for groundwater extraction and pollution with P and N are compared with NRT rates in other Central and Eastern European Countries and some EU Member States.

	Ground water extraction (€/1000 m^3)	**Water pollution (P) (€/tonne)**	**Water pollution (N) (€/tonne)**
Latvia	**17.7**	**53.6**	**53.6**
Lithuania	10 – 24	404.3	118.9
Romania	7.3 – 8.4	43.6	43.6
Slovenia	30	5783	694
Estonia	16 – 48	216.6	130.3
Czech Republic	56	1960	1120
Poland	92.3		
The Netherlands	150 (1998)		
Denmark	670 (1998)	14,620	2,660
Germany		46,000	1,900

Source: REC (October, 2001)

This table shows that the NRT rate for groundwater extraction is generally lower in Latvia compared to other Central and Eastern Europe countries, and substantially lower than in EU Member States (it should be noted that GDP per capita in Latvia is only 29% of the average in the EU).

In addition to this relatively low NRT rate, it appears that the tax on water extraction and water pollution does not achieve its intended goal to achieve full cost-recovery while protecting the environment. The rates are relatively low and have remained unchanged since 1996, whilst the inflation between 1996-2001 was 43%. As such, the NRT rates probably do not cover environmental costs, at least from pollution (with respect to abstraction, given abundant groundwater resources and relatively low extraction rates, resource costs are close to zero). In order to prevent social problems, however, and given that water and sewerage tariffs are already relatively high, the NRT rates could only be increased in line with the expected economic growth in Latvia. Many small businesses have difficulties paying even the relatively small NRT and have little incentive to do so given that the monitoring mechanisms are deficient. From this case, it transpires that the NRT currently in place in Latvia largely represents a compromise between social, economic and environmental goals rather than a fully-blown economic instrument for recovering environmental costs.

Source: I. Kirhensteine (2000, forthcoming).

Task 5 - Identify the Cost Recovery Mechanism

This task involves identifying the mechanism currently used for recovering the costs of water services by water users. This would generally involve payment by users (through prices, charges, taxes) or alternative institutional mechanisms for recovering costs. This task should pay specific attention to the institutional mechanisms that are used in order to recover costs going beyond the mere pricing mechanisms. As shown in *Illustration 6* below, water users may sign a specific agreement between themselves in order to share the costs of an improvement in water status, which might reflect more closely the way in which they are sharing the benefits than through relying on an administrative pricing mechanism.

If prices and charges are the main cost-recovery mechanism, it would be important to collect data on the tariff structure, including the price per unit of water service used (for instance, EURO per m^3 or fixed charge per household etc.). If more than one user group is involved, the unit price may be aggregated and averaged across one or more user groups.

Illustration 6 – Institutional mechanisms for cost recovery in Tarragona (Spain)

In Spain, as in other semi-arid regions around the Mediterranean, increasing pressures on available water resources requires improving the efficiency of existing water uses. A water user association in Tarragona came up with an innovative negotiated arrangement in order to increase its available water resources by financing improvements in irrigation water uses.

Background. In Spain, irrigation is a key factor for agricultural production and the Government has played an important role in irrigation development. As a result, irrigated agriculture is by far the largest water consumer. Many irrigators have historical water rights and enjoy large water allotments, but they are faced with low guarantee levels, as allocation rules in times of scarcity give priority to urban uses. To regulate highly variable rainfall patterns, the Government invested in water system regulation infrastructure, with the construction of large water storage reservoirs. Growing water demand together with declining responsibilities for further reservoir building has resulted in increased resource scarcity and mounting competition amongst water users, focusing the debate in the water sector on conservation and reform.

Financing the modernisation of irrigation systems. In some old irrigation districts, technological improvements on the irrigation networks could allow for water savings, especially in areas where possibilities for further reservoir building are limited. Irrigation modernisation programmes can be beneficial for farmers but also for domestic users and the environment, through the resulting water savings. In the region of Tarragona in the Ebro river basin in Spain, where beneficiaries were well defined and third party effects insignificant, private negotiation led to the implementation of irrigation modernisation programmes. A water user society (municipal and urban water users) agreed to pay for modernisation investment in two irrigation districts in the Ebro river basin. In turn, these irrigation districts agreed to reduce their water entitlements (by the amount of water saved through distribution system modernisation) in favour of the water user society. This direct negotiation between water users appears as an alternative to the use of pricing mechanisms for reaching the cost-recovery objectives. In practice, urban users agreed to pay the costs of additional supplies through the financing of irrigation improvements. However, the circumstances in which this kind of institutional solution can be used are relatively limited. In most cases beneficiaries include a large number of downstream users including the environment and public price setting and subsidy transfer would play a key role to give incentives for the adoption of water conservation measures in irrigation districts.

Source: M. Blanco (2002, forthcoming).

Task 6 - Calculate the Recovery Rate of the Economic Costs of Water Services

The next task involves calculating whether, at an aggregated level, the cost of water services is globally recovered via revenues from users of this water service. This will need to be carried out water service by water service. In order to do so, it will be important to assess the revenues received by the water service and to assess whether any external subsidies are paid in order to finance the costs of this water service.

As highlighted in *Box 1* below, subsidies can be paid either directly or indirectly. In addition, they can be paid continuously or have been paid in the past (for example, a capital grant paid in the past to finance investments, or a write-off of capital asset value when transferring some assets in the private sector, as it was done in the United Kingdom at the time of privatisation). Therefore, it will be important to define clearly what is considered to be an external subsidy and when it was granted. An example of cost recovery and identification of subsidies in Hungary is given in *Illustration 7*.

Box 1 – Cost recovery: The issue of subsidies

The polluter pays principle requires that users pay according to the costs they generate. However, subsidies reduce users' contribution to the full cost of water services and disable price incentives to use resources in a sustainable manner – both important objectives of Article 9.

Subsidies are allocated to either providers, users of polluters in different ways. They can be paid **directly** by the (central or local) government:

- to the provider of water services in the form of investment subsidies. *(capital subsidies, lowering fixed costs)*
- to the provider of water services in order to co-finance the operation of the infrastructure *(operational subsidies, lowering variable costs)*
- to water users *(income transfers, lowering the price/charges paid by the user)*

In addition, subsidies can be paid **indirectly** by

- users/polluters paying the costs of other users/polluters. Cross subsidisation may arise between different users (households, agriculture, industry), different regions (dry and wet, populated or less populated) and/or different types of users (rich or poor, small or large users etc.).

When user groups pay only part of the costs of a water service, the rest of the costs will have to be paid or subsidised by others. These others can be the public at large contributing through general taxation (tax revenues being used by the central government to subsidise the supply of water services in ways described above) or other user groups that pay a larger fraction of the total costs (including resource and environmental costs) than they generate.

Once the external subsidies have been identified, the general formula for calculating the cost recovery rate for water services can be calculated as follows:

$$CRR = \frac{TR - Subsidy}{TC} * 100\%,$$

where CRR is the Cost Recovery Rate, TR the total revenues (depending on the cost recovery mechanism this figure could be based on either fixed or variable charges in euros/year), subsidy the total amount of subsidies paid to the water service, and TC the economic costs (in EURO/year) of the water service provided.

If the water service is provided free of charge, the CRR equals zero. The problem with assessing the full extent to which the PPP holds is that external resource and environmental costs must be calculated and added to the financial cost. This may be difficult due to data availability (e.g. cause and effect are not always clear and environmental costs are often incurred at a scale that is larger than the scale of analysis). In such a case, to make an estimation of the extent to which environmental and resource costs are recovered, aggregated data on the quantity of water used by the different sectors and the amount of pollution caused by water services may at least be sufficient to inform a general assessment of the most important pressures and pollutants. In combination with information on environmental charges and levies, they can provide sufficient information to give a qualitative estimation of the extent to which the polluter pays principle has been applied.

In addition, due to the difficulties of identifying and allocating environmental and resource costs, it is important to distinguish between financial cost-recovery and overall cost-recovery. Financial cost-recovery should be analysed in the first instance as a minimum, and then overall cost-recovery could be estimated on top of this, bearing in mind the difficulties of doing so.

Illustration 7 - Cost recovery in Hungary and the need to identify subsidies

To meet EU accession requirements, Hungary must comply with EU regulations concerning wastewater collection and treatment by 2015. As a result of accession negotiations, total wastewater collected must be 79.5%, and the level of treated sewage must be 90% (from 38.5% in 2002). The investment costs for this undertaking will total € 820 millions. Most of the necessary investments will be financed by State and EU subsidies, although the present level of these subsidies is already high with over 1/3 of the water services companies having negative earnings.

An assessment of cost-recovery in Hungary remains difficult: the water services sector is highly fragmented with companies using different accounting systems; data gathering and processing is costly, due to the number of companies and clims of data confidentiality; economic valuation of environmental costs is lacking.

An overhaul of the water services sector in 1990 led to increased decentralisation, with local control transferred to local and regional companies (with public ownership of assets), and the establishment of 5 regional, fully state-owned companies that handle bulk production and some supply. Regulatory responsibilities and ability to set prices for water and sewage were also transferred to local water authorities (except for the regional companies, whose prices are set by the Ministry of Transport, Telecommunication and Water Management – MoTTW). Local control over pricing means varied costs relative to production costs – areas with higher production costs must charge more for water than areas with lower production costs. Along with the transfer and loss of centralized control, the central government also decided to reduce subsidies for operation costs in the water sector, claiming that local water charges should recover the water sector operating costs. However, as illustrated in the following table, this is a difficult task.

Table 1: Characterisation of the Water Services Sector in Hungary

Agriculture	Industry	Household Use
"Free price" system, where control over pricing is exerted via the tender process.	Systematic economic change since 1988 led to declines in industrial production and use of less polluting production.	Water/sewerage pricing a political decision, with responsibility in the hands of local officials.
Prices vary based on use of gravity or pump, distance to carry water, required pressure, economies of scale, whether there is infrastructure to be maintained, etc.	Decrease in demand due to price increases and bankruptcy of production companies.	High prices relative to disposable income, along with unwillingness (or ability) to pay has led to 10% consumer debt to companies. Even if the charges per unit of consumption = the costs per unit, actual revenues from charges will still not fully recover costs.
Prices usually cover operation and maintenance costs only.	Revenues (industry and households combined) cover only operating costs, not depreciation or development. Amortisation isn't used as a practice, so future costs are undervalued.	Revenues (households and industry combined) only cover operating costs, not depreciation or development. Amortisation isn't used as a practice, so future costs are undervalued.

Water use rights by application and last for 3 years, except for a large regional water supply company that also operates irrigation objects in a 25-year concession.	Large industrial users mostly extract water individually. The prices of water purchased are not centrally regulated, which means diverse pricing structures.	Due to legal/technical constraints, it is impossible to shut down water services for non-payment to households.
Prices not available to the public. No official requirement to collect price data; data that is collected is generally considered confidential.	Revenues from industry are used to cross-subsidise household use.	Benefits from cross-subsidy from industrial sector.

The subsidies that are provided by the central government are the responsibility of the MoTTW. Each year, the MoTTW sets threshold values for water and sewage unit costs and municipalities (local governments) with higher costs receive the difference as a subsidy. The charges paid by the household consumers in the subsidised settlements are then equal to the threshold level of costs.

In practice, the Ministry first decides on the aggregate amount of transfers in each year, and then determines threshold values. In 1998, 1999 and 2000, total subsidies amounted t to CHF 3.4, 3.8 and 4.1 billion (at current price) respectively. For 1998, this is less than 0,5% of the total costs of water and sewage services provided for households in the country. More than one third of the settlements in Hungary (usually smaller villages) receive this kind of subsidy.

With a relatively low level of forecasted household incomes, simply raising the water charges will not result in an improved water sector. Further, increased investments from the EU and the state alone will also not result in an improved water sector. Given the state of the sector, and the need for further investments and reform to meet the EU accession goals, a closer look at how the subsidy system operates, how these are implemented, and how they are measured to meet overall policy goals may be necessary. The situation in Hungary may also be relevant to accession countries facing similar challenges, and to some Member States.

Source: P. Krajner (2002, forthcoming).

Task 7 - Identify the Allocation of Costs to Users and Polluters

The allocation of costs to water users will require determining a number of cost drivers, which are proxy indicators for estimating the amount of costs that they generate. These cost drivers are likely to differ according to the type of costs that are at stake. For example, in the case of the provision of a water distribution service, "volume of water used" might be an adequate driver for allocating operating costs whereas "required pipe capacity" may be a more appropriate driver for allocating investment costs. Cost drivers for environmental costs might be linked to the quality of the water discharged into the environment or into the sewer.

Specific attention should be paid to the potential existence of cross-subsidies between users of the water services (see *Box 1*). The availability of data will largely determine to what extend those cross-subsidies can be made explicit. Typically, the allocation of costs to different categories of water users can be a difficult exercise.

3. Reporting on Cost Recovery

It follows from the tasks outlined above that information is needed on the specific water services involved, their costs (including possible environmental and resource costs) and the way they are paid for (or not), providers, users/polluters and possible subsidies/transfers is required to estimate the rate of cost recovery (see *Illustration 8* for an example on how this may be achieved).

This information can usefully be compiled in a matrix, as shown in *Table 1*. This structure makes the interactions between the economic system and the water basin explicit and combines all the necessary information in one general accounting matrix. In this structure, a distinction is made between the different water users (households, industry and agriculture) and providers of water services (communal and individual). A similar structure is currently used by the National Accounting Matrices, Water Accounts (NAMWA)[1].

Illustration 8 – Observatory for household water pricing (France)

Since the middle of the 1990s, increased attention has been paid to water pricing for households in France, with the launching of *observatories* in different Ministries and within the river basin water agencies. Originally, these observatories were developed to determine the average price per cubic meter of water (including water supply and waste water treatment). Already from the beginning, some attemps were made to identify the different components of the price (investment, maintenance, subsidies, etc.). However, the results of these studies were highly variable from one region to the other. In 1999, the Ministry of Environment and the water agencies decided to create a national observatory of domestic water prices at the National Institute for Environmental Statistics (IFEN). This observatory is based on information collected from 5000 municipalities, which are interviewed every three years. A great deal of technical and economic information is collected, such as:

- Price per cubic meter
- Status of infrastructures
- Forecasted investments
- Information on subsidies…

While still in its start-up phase, it is expected that the data from this new national observatory will stimulate more work in the field of cost-recovery for household-related water services that will be of direct use for implementing the economic-related articles of the Water Framework Directive.

Source: A. Courtecuisse – Artois Picardie River Basin Agency – See also: http://www.ifen.fr/pages/4eaulit.htm#65

(1) [1] This structure has been elaborated in the NAMEA (National Accounting Matrices-Environmental Accounts) and NAMWA (National Accounting Matrices- Water Accounts) by the Netherlands Statistical Bureau (CBS), and is now being reproduced in most EU member states and further elaborated by Eurostat.

Table 1 - General structure of information requirements with respect to reporting on cost recovery

Water service	Provider	User/Polluter	Financial costs	Resource costs	Environmental costs	Possible cost recover mechanisms	Possible subsidies/transfers involved
Supply of (drinking) water	communal/ individual (agriculture, industry, household)	Households Agriculture Industry	Annual costs of water infrastructure, maintenance and operation costs	Opportunity costs of alternative water uses	Environmental damages due to abstraction, storage, impoundment etc.	Utility charges, market prices, abstraction taxes/charges paid by households, industry and agriculture etc.	Subsidies to low-income households, capital subsidies on investments in water supply infrastructure
Irrigation	communal/ individual (agriculture)	Agriculture	Annual costs of irrigation system, maintenance and operation costs	Opportunity costs of alternative water uses	Environmental damages due to abstraction, storage, impoundment etc.	Abstraction charges and/or charges paid for the use of the irrigation system by agriculture etc.	Subsidies on agricultural water use, capital subsidies on investments in irrigation system.
Hydro power	communal	Industry Households	Annual costs of investment, maintenance and operation costs	Opportunity costs of alternative water uses	Environmental damages of impoundment, dehydration of nature		Subsidies on industrial electricity use, capital subsidies on hydropower dam construction.
Drainage	communal/ individual (agriculture)	Households Agriculture	Annual costs of investment, maintenance and operation costs	Opportunity costs of loss of wetlands	Environmental damage to wetlands, dehydration of nature	Water management charges paid by households, agriculture, industry	Financing of large scale drainage out of general means, other subsidies
Sewerage	communal/ individual (industry)	Households Agriculture Industry	Annual costs of sewerage system, maintenance and operation costs		Environmental damage of (residual) water pollution	Sewerage and pollution charges paid by households, industry, agriculture	Capital subsidies on investments in the sewerage system, financing of sewerage out of general means
Waste water treatment	communal/ individual	Households Agriculture Industry	Annual costs of waste water treatment, operation and maintenance costs		Environmental damage of (residual) water pollution	Waste water treatment and pollution charges paid for by households, industry, agriculture	Capital subsidies on investments in waste water treatment, subsidies to users of waste water treatment.

BASELINE SCENARIO

Directive references: Article 5, *Article 9* and *Annex III*, also implicit in *Annex II*
3-Step Approach: *Task 1.2*, *Task 2, Task 1.3 and 3.3*.
Information sheets: *Recovery of Costs* and *Cost-effectiveness Analysis*

This information sheet will help you develop one or several alternative baseline scenarios (or "business-as-usual" (BAU) scenarios), and proposes an optional approach to complement the forecasting analysis (to define the BAU scenarios) with prospective analysis.

1. Objective

Article 5 requires that each Member State shall ensure that "an economic analysis of water use is undertaken for each River Basin District" and Annex III further specifies that this analysis should " take account of the long term forecasts of supply and demand for water in the RBD and where necessary: estimates of the volume, prices and costs associated with water services and estimates of relevant investment including forecasts of such investments".

The construction of long-term forecasts (what is referred to as *business-as-usual* scenarios) during *Step 1.2* of the 3-step economic approach is needed for:

- Identifying whether there is a gap in water status between the projected situation and the Directive's objectives by 2015 (*Step 2* – as illustrated in **Figure 1**);
- Identifying potential measures to bridge that gap (if there is one) and construct a cost-effective programme of measures (*Step 3.1 and 3.2*);
- Making the relevant calculations necessary for taking into account the principle of cost recovery of water services, taking into account long-term forecasts of supply and demand for water in the River Basin District (*Step 1.3 and 3.3*).

Note that the *business as usual* scenario will only integrate what would happen in a given river basin district without the Water Framework Directive, due to changes in population, technologies, the implementation of water policies resulting from previous European directives, other sector policies, climate change, etc. During *Step 1.2* of the economic assessment, it will be important to focus on the forecasting of pressures and of key socio-economic drivers that are likely to affect those pressures. It is only during *Step 2* of the overall approach that these forecasts are translated into an assessment of their impact on water status.

2. Key Issues

Given the use of the baseline scenario, it is important to broaden the scope of the forecasting analysis suggested in Annex III in order to:

- Forecast not only investments but other key parameters and drivers influencing water supply and demand (or more generally all significant pressures), since a failure to do so would undermine the definition of the programme of measures;

- Not rely too much on a mere projection of past trends, as such forecasting method tends to produce misleading results: forecasts need to integrate predictable changes in past trends based on a series of assumptions concerning these changes;
- Identify (and distinguish) variables that can be derived with a high degree of confidence and those that are uncertain. This distinction should be made for 'physical' parameters as well as for economic and policy-based drivers; and
- Build a series of alternative scenarios using alternative assumptions, particularly with respect to policy options. This will allow stressing the main (signficant water management) issues in the river basin district, and discussing policy options by simulating their consistency and their long-term significance (e.g. it can be useful to compare two distinct scenarios, one where water prices and charges are kept stable and one where they increase: both assumptions are realistic, but stem from different policy options).

In order to build the baseline scenario, it will be necessary to forecast a set of variables before assessing the impact that these changes will have in terms of pressures and water status. It will be important to distinguish between three types of variables as presented in Table 1 below.

1. Trend variables: underlying (exogenous) trends, on which water policy has no direct influence;
2. Critical uncertainties: variables which are particularly difficult to predict, and might have a significant impact on the final result;
3. Water policy variables (see *Table 1*): variables linked to the underlying water policies, independently from the implementation of the Water Framework Directive (as the focus is on building a "business as usual scenario")

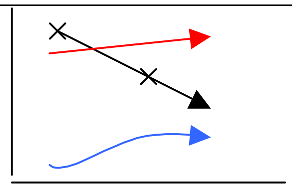
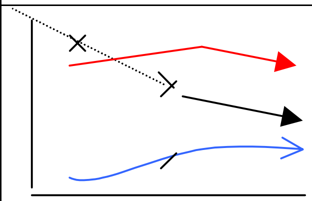
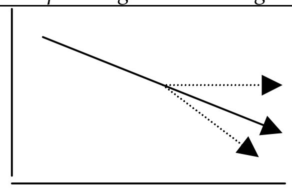
Table 1 – Categories of variables to be examined for the business as usual scenario

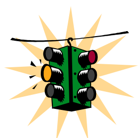
Categories of variables	**Examples**
Trend variables	• Changes in demographic factors, e.g. population growth in specific urban areas; • Economic growth and changes in economic activity composition, e.g. growth of the relative importance of services; • Changes in land planning, e.g. new areas dedicated to specific economic activities, land management in the catchment for reducing erosion.
Critical uncertainties	• Changes in social values and policy drivers (e.g. globalisation / regionalisation; policies relying on economics, technology vs. on values and lifestyles); • Changes in natural conditions, e.g. climate change; • Changes in non-water sector policies, e.g. changes in agricultural policy or industrial policy that will affect economic sectors.
Water policy variables	• Planned investments in the water sector, e.g. for developing water services or for restoring the natural environment/mitigating for damaging caused by given water uses; • Development of new technologies likely to impact on water use for industrial production and related pressures.

3. Practical Tasks for deriving the Baseline (*Business-as-Usual*) Scenario

The proposed approach for developing the Baseline Scenario is outlined in three tasks, as shown in *Box 1*. This box serves as a visual aid throughout the process outlined below.

Box 1 – Illustration of the General Method

Task	Output	Visual illustration
1. Assess current trends in *trend* variables, including physical parameters and socio-economic drivers	Short-term projections of trend variables based on existing trends	 past present 2015 *Variables are projected based on current trends over a short-term horizon*
2. Project certain changes in water policy variables	Longer-term projections of variables incorporating changes in current trends	 past present 2015 *Variables are projected over a longer-term horizon, incorporating certain changes in water policies*
3. Integrate changes in "critical uncertainties" and derive one or several realistic business-as-usual scenarios	Build several baseline or *Business-as-usual* scenarios	 past present 2015 *Alternative BAU scenarios are constructed, out of several combinations of assumptions on trend variables, water policy variables and critical uncertainties*



Look Out! Developing the baseline is an iterative process

The first baseline scenarios developed for supporting the development of river basin management plans are likely to build on existing knowledge of trends in key variables and lack robustness and to incorporate many uncertainties. As the assessment of significant water management issues evolves, it will be possible to identify areas where further work is needed to improve the baseline scenarios. To enable revisions, it would be important to keep a log of:

- The overall reasoning process: assumptions, choices of variables, range of variation, priorities in analysis;
- Calculations made with respect to key variables, physical parameters and formulas (and ideally provide a schematic description of calculations);
- Databases used for calculations; and
- Perceived limitations in the analysis and suggested future work.

Task 1 - Assess current trends in "trend" variables (including physical parameters and socio-economic drivers)

The output of this task is a survey of past observations, historical data and a forecast of ongoing trends over a relatively short-term horizon. This work will be partly based on physical and ecological characterisation of the river basin and will build on technical and data handling/statistical expertise. The analysis of past evolution of water resources and physical parameters will mostly rely on technical expertise and on the analysis of trends in pressures, water uses, water services and impacts. The data to be gathered are summarised in Table 2 below.

The methodology for this task will be based on a comparison between the past and present status of *trend* variables in the river basin (including water uses, water services and physical parameters - as per Annex V of the Directive). This should enable:

- *Pointing to significant changes in the river basin district*: e.g. major degradations and improvements: what quality and quantity parameters have deteriorated or conversely improved, and what were the most apparent causes?
- *Gathering knowledge on the evolution of the human and technical context*: population and its location, economic activity components, equipment and water works;
- *Assessing the rate of policy implementation* and especially, the pace of water investments over the recent period;
- *Evaluating the likelihood of the above trends to be prolonged over the mid-term future*: are there good any reasons for assuming that the worsening /improving parameters will stop worsening / improving?
- *Compiling a first identification of the main pressures likely to cause a future gap* between the Directive's objectives and the possible future situations, and thus help identifying key driving forces and drivers linked to these pressures.

Table 2: Data to be gathered in Task 1

TASK 1	Key points	Output
Identify Trends in Physical parameters	Map evolution of: • Trends in water status over the past relevant period (e.g. evolution of pollution and ecological quality)	Overview of general trends in the hydrological system in the RBD.
Identify Trends in socio-economic drivers influencing water uses and, water services and impacts	Map evolution of: • Equipment (e.g. water distribution and sewage, rates of households and industries connected to public network) • Pricing (e.g. pricing policies, average prices) • Uses (e.g. hydropower, navigation, angling, etc.) and related impacts (e.g. power produced, transportation volumes, number of angling people, etc.)	Overview of general trends in water uses and services in the RBD.

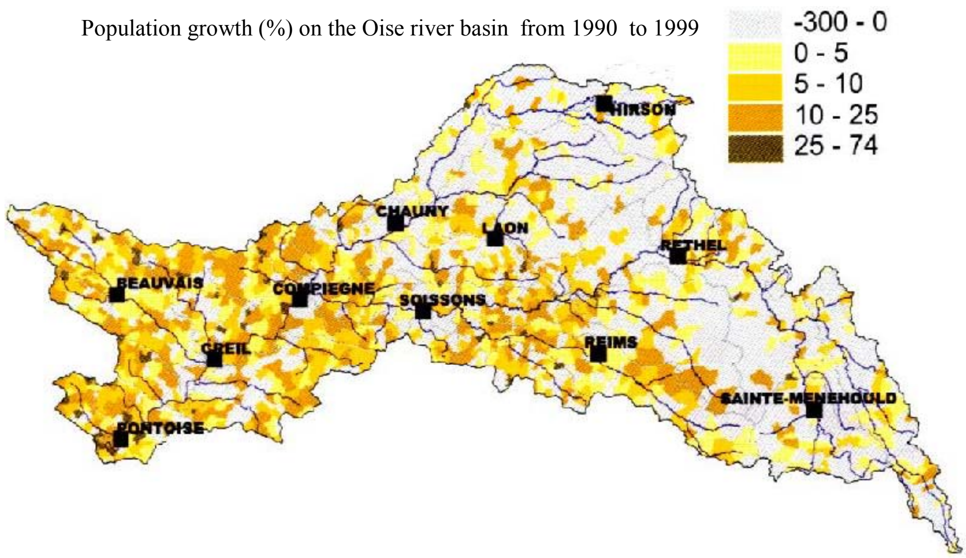
Identify Trends in Water Policies and Regulations	• List past and existing national water policies • State the level of compliance with water-related environmental directives (e.g. habitats directive) and describe past investments and efforts • Describe trends in rates of a. Equipment in water distribution treatment and in sewage treatment capacities; b. Agri-environmental policies implementation; c. Industrial compliance.	Overview of general trends in the implementation of present water policies and regulations.

Illustration 1 - Oise river basin (France): case study of deriving a baseline scenario

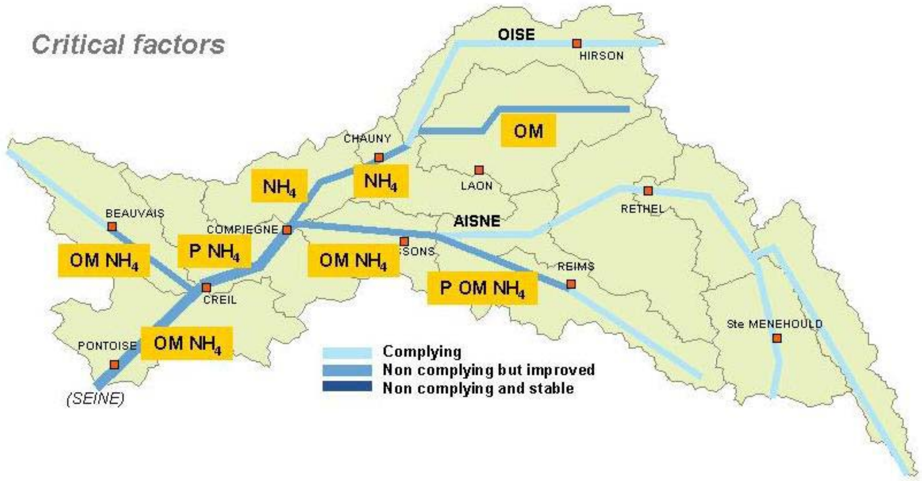
As part of the Seine River District in France, the Oise River Basin suffers from high diffuse pollution from agricultural runoff, high urban water intensity, dense industrial concentration on main and smaller rivers, and overall poor water quality in the main river and some of its smaller tributaries. By identifying past trends and the present state of water policy, surface water quality and pollution (including sewage equipment and discharges), a baseline scenario was formulated to provide insight to policy makers for addressing present and future water resources management. The following maps highlight some of the study's results:

Task 1 - Evaluation of major past trends
Evolution of polluting activities 1990-1999:
+2,7% population increase (+0,3%/year)
+11% industry production growth (+1,3%/year)

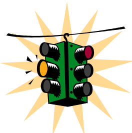
Population growth (%) on the Oise river basin from 1990 to 1999



Task 2 - Baseline projections
In a second phase, the effects of the development of future activities and planned policies and programmes (sewage works) in the Oise river basin were simulated and critical factors that limit compliance with good quality (chemical) status were identified. The baseline scenario highlighted major difficulties for achieving surface water quality objectives, including durable nitrate pollution involving groundwater and incompatibility between the "good" status definition and some natural processes (e.g., suspended matter standards versus erosion). While the baseline scenario has a useful purpose, there is an extreme uncertainty about the future level of economic activities in the region, particularly for industry and agriculture. The availability of data for this study was a great asset that allowed for scenario building, and the study provided useful results about the risk of non-compliance with the good status objectives of 2015, and allowed for a wider vision than recent planning preparation (up to 2006).



Source: Agence de l'Eau Seine-Normandie, 2002 (provisional assessment).



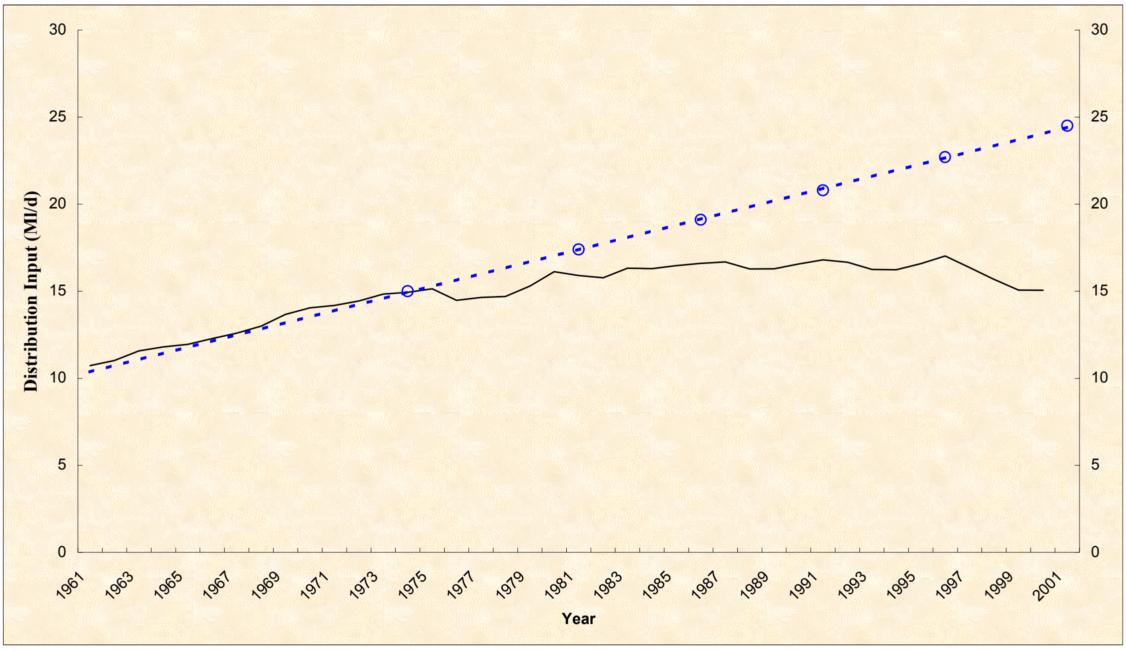
Look Out! Do not rely too much on past projections and examine alternative scenarios, rather than an unique one

Reviews of existing past projections have shown that long-term projections in the water sector usually proved false when evaluated afterwards. Accordingly, it would be dangerous to suggest that an adequate image of the future can be the result of a mere projection of past trends. In addition, it will be important to avoid presenting one "image of the future" as a baseline scenario. A plurality of images, from a series of combination of variables, will be preferred.

Illustration 2 – Issues with trend extrapolation: "The past is not necessarily a good indicator of the future" (England and Wales)

In England and Wales, water demand rose steadily from 1960 to 1975. Applying an assumption that "the past is a good indicator of the future", it would have been logical to apply a simple linear relationship to demand from 1975 onwards. However, a simple non-causal relationship ignores the real drivers affecting water use. It is therefore not surprising that this extrapolation technique often fails, as it would have done in this hypothetical example (see Figure 1).

Figure 1 Water supply in England and Wales, 1961-2000



For short-term forecasting a more refined approach using a multiple linear regression form of extrapolation of trends might be suitable. This might be dependent on variables such as temperature and rainfall but it is likely to be more effective if applied to specific elements of water demand rather than *total* water demand. Indeed, the problem with overall trend forecasting is that it fails to analyse causal relationships and as a result, lacks transparency. Therefore, a more disaggregated approach to demand forecasting might be preferable (see *Illustration 3*).

Using simple trend projections might have benefits, as it is a low cost method and that it is quick and simple to derive a trend line. However such method has also many disadvantages, in the sense that it produces low quality forecasts and that it is reliant on good quality time series from which to derive statistical relationships. In sum, the past is not a reliable indicator of the future for anything other than possibly short-term forecasting.

Illustration 3 – A disaggregated approach to demand forecasting (England and Wales)

A preferred approach to trend projection and an important building block of any demand forecasting exercise requires adopting a disaggregated approach to demand forecasting, in order to identify the key drivers of demand and in particular, the key sectors having an impact on demand. This illustration draws on water demand forecasting activity undertaken to develop a water resources strategy for England and Wales. Its purpose is to demonstrate the level of detail necessary to reasonably apply assumptions about future water use brought about by changes to the key drivers of demand. The approach is valid for different sized areas although in small river basins there may be local issues relating to robustness of sample sizes and data availability

The causalities of short-term changes in water demand are likely to be different to those affecting the longer-term. In the case of the former, it may be sufficient to examine recent history to establish how existing pressures are likely to translate into total water demand. Since water demand within a river basin will fluctuate over the longer-term (+5 years) as individual water uses grow and/or decline, it is logical to estimate how total water demand may change by examining the drivers of demand and the consequences for *each use*. Table 1 summarises the breakdown of total water demand used in the case study referred to above.

Table 1 Elements of water use by sector

Sector of demand	**Component of demand**	**Micro-components of demand**
4 no. sectors:		
• Household	8 no. components eg Toilet use, personal washing, clothes and dish washing, garden watering	14 no. micro-components eg various WC, bath, shower, hand basin, washing machine, washing by hand, garden sprinkler
• Industrial and commercial	18 no. components eg Chemicals, food & drink, textiles, retail, hotels	Not applicable.
• Agricultural spray irrigation	23 no. crop types relating to three different soil types and seven agro-climatic zones	Not applicable
• Leakage	Reported and unreported leakage on trunk / distribution mains and on service connections to customers.	Not applicable

A similar level of disaggregation to that described is recommended as good practice in order to introduce sufficient confidence into the supply-demand balance assessments that are key to establishing a baseline water use estimation.

The benefits of such detailed disaggregation include:

- Improved robustness of forecasts by reducing the uncertainty inherent in use of generic assumptions.
- Transparent forecasts of total water demand where the key sectors for growth / decline can be described explicitly – provides a clear platform on which to engage stakeholder debate.
- Application of specific assumptions can be restricted to just the relevant sectors.
- Facilitates development of sector-based scenarios of political, economic, social and environmental futures.
- Facilitates application of "*what if …?*" tests to forecasts, such as impacts of water management policies, technology etc.

The disadvantages of such disaggregation include:

- Availability and costs of obtaining econometric and water use data at such a detailed level.
- Cost effectiveness may be questionable for very short-term forecasting (year on year) particularly in regions where there are considerable surplus resources and robustness of forecast is less critical.

Source: UK Water Industry Research Ltd / Environment Agency (1997). For enquiries relating to demand forecasting email: rob.westcott@environment-agency.gov.uk

Summary of the key drivers of demand for each sector

Drivers \ Sectors	Household demand	Leakage	Industrial and commercial demand	Spray irrigation demand
1.1 Economic drivers				
• personal affluence	✔		✔	✔
• level of production/output		✔	✔	✔
• level of employment	✔		✔	
Water policy drivers				
• abstraction licensing		✔	✔	✔
• water price	✔	✔	✔	✔
• Water Regulations/Regulatory framework	✔	✔		
• metering	✔			
• leakage targets		✔		✔
• levels of service	✔	✔	✔	
• water efficiency duty	✔		✔	
Technology drivers				
• white goods	✔			
• power showers	✔			
• acoustic loggers		✔		
• industrial reuse and recycling equipment			✔	
• irrigation scheduling systems				✔
• trickle irrigation				✔
Sector-specific drivers				
• Common Agricultural Policy (CAP)				✔
• supermarket produce quality criteria				✔
• organic production				✔
• drought tolerant crop varieties				✔
• personal water use preferences/behaviour, eg washing and garden watering	✔			
• resource stress		✔		
• rate of uptake of water-use minimisation measures by industry and commerce			✔	

Task 2 – Project certain changes in water policy variables and derive longer-term projections

Based on the previous task, key driving forces and drivers related to water and water policy (be they hydrological, socio-economic or policy/regulatory related) should be identified and analysed. In this task, it is proposed to concentrate on changes that are more certain and for these certain changes:

- To make reasonable assumptions about the future dynamics of the analysed drivers;
- To assess the impact of changes in these drivers on pressures; and
- To estimate the resulting impacts and thus water status.

Above all, this task is intended to assess the outcomes that can be awaited from the implementation of other water and environmental Directives, and notably their results in terms of water pollution abatement investments, taking into account the future capacities that are effectively planned for the next years.

Task 1 will have given an estimation of the future increase in raw pollution from human activities (pressures analysis). This task will try to answer the following questions:

- What additional quantities of pollution will be abated in the future (e.g. following the construction of additional sewage treatment works)?
- What will be the effects of planned policies on water availability for the water services and uses (e.g. regulation policies, storage equipment policies…)?

This task is central to the Water Framework Directive process and thus has to be steered by the district authority at high decision-making level. A "strategic co-ordination group" will probably be needed to incorporate all expertise and interdisciplinary inputs in the process. Again, on these matters, it is recommended not to strive for describing one unique image of the future if not possible. When choices among different values are necessary for some variables (e.g. activities growth rates, technological changes, policy implementation rates…), a series of alternative baseline scenarios can be prepared. The Table below summarises the approach in Task 2.

TASK 2	**Key Points**	**Output**
Make assumptions about the future dynamics of trend variables identified in Task 1	• Determine whether parameters have stabilised (e.g. household connections to public networks, tax levels) • Determine the supposed effect of proposed future policy measures on the water status (e.g. new investment programmes, new national regulations, already planned institutional changes and public equipment policies such as energy, transportation, etc.: what possible effect on water quality and availability?)	Assumptions on the future dynamics of trends
Make projections based on certain trends	• Derive the projected values of the different parameters for 2015 • Check the general consistency of the different trends, explain the apparent inconsistencies (e.g. how can we explain a forecast of growing investments along with a supposed decrease in river quality? Because of a rise in general pollution flows out from economic growth), Propose one or several combinations of assumptions on trends	Baseline or Business-as-usual projections of the RBD in 2015

Illustration 4 - A methodology for scenario building developed for the region of Sfax (Tunisia)

Relevant experiences of scenario-building used in the policy debate are few and far between, which is why it is interesting to introduce an approach developed in Tunisia, in the context of acute water pressures. While Tunisia may not be representative of European contexts at large, the approach taken was usefully applied despite the lack of means and data, and it proposed some simple tools to build scenarios, based on "re-using" the technical forecasts that generally exist in water planning institutions.

In Tunisia, the scenario-building exercise was conducted to feed the debate on strategies related to water demand management, as the approach still tends to focus on supply-side solutions without examining the links between water resource management, land use planning and economic development. For instance, irrigation demands are often considered as an input into the projections rather than something that can be acted upon independently.

As such, the scenario-building exercise followed a four-step process:

Step 1: Use technical planning forecasts as a foundation, and analyse the underlying assumptions in detail;
Step 2: Build scenarios using basic assumptions combined into contrasted scenarios, and make an explicit representation of the water uses/resource system to quantify the water balance with the assumptions;
Step 3: Choose a range of combinations for the assumptions (e.g., one combination is the backbone of one scenario), and then calculate the water balance over time that corresponds to the combination;
Step 4: Based on these elements, imagine a plot that tells the story of the system from now until 2030, giving consistency to the assumptions and water balance curves.

The region of Sfax's demographic projections demonstrates this four-step process.

For **Step 1**, three alternative choices were considered to forecast the region's demography:

- The first considered three possibilities of evolution for the agglomeration of Sfax's population;
- The second concerned two possibilities of evolution for the demography of other cities in the region;
- The third considered two possible evolutions of the rural population.

Data was technical and derived use per use. For every use, more or less simple trends analyses of past evolutions were used to derive projections of, for example, population, unitary domestic consumption, or irrigated area (see Fig.1). This simple framework was used as a basic representation of the water uses/water resources system.

Figure 1: Example of assumptions formulation on the demographic evolution of the Sfax region

	2000	2005	2010	2015	2020	2025	2030	
Population du Grand Sfax								
x 1000 hab								
- hypothèse de désaffection D1a	492,0	548,6	611,6	675,3	745,5	823,1	908,8	(+2,2% jusqu'à 2010, et +2% après)
- hypothèse de mise en valeur progressive D1b	492	543,2	599,7	678,6	767,7	868,6	982,8	(+2% jusqu'à 2010, puis +2,5% après)
- hypothèse de non migration D1c	492	556,7	629,8	712,6	806,2	912,1	1032,0	(+2,5% sur toute la période)
								Hypothèses du PAC de Sfax

Population Communale hors Grand Sfax

Taux de croissance annuel de 1984 à 1994 : 10,65 %/an Incertitude sur ces données indirectes

Taux de croissance annuel de 1994 à 2000 : 16,58 %/an Incertitude sur ces données indirectes

	2000	2005	2010	2015	2020	2025	2030
- hypothèse de développement d'autres centres urbains D2a : +5%/an							
x 1000 hab	58,0	74,0	94,5	120,6	153,9	196,4	250,7
- hypothèse de non développement des autres villes D2b: +4%/an jusqu'à 2010, +2% après							
x 1000 hab	58	70,6	85,9	94,8	104,7	115,5	127,6

Population rurale du gouvernorat

Taux de croissance annuel de 1984 à 1994 : 1,58 %/an Incertitude sur ces données indirectes

Taux de croissance annuel de 1994 à 2000 : 2,06 %/an Incertitude sur ces données indirectes

	2000	2005	2010	2015	2020	2025	2030
- hypothèse de maintien de l'activité rurale D3a : +2%/an	315,4	348,2	384,5	424,5	468,7	517,4	571,3
- hypothèse d'exode rural D3b: +1%/an jusqu'à 2010, puis +0,5%/an après	315,4	331,5	348,4	357,2	366,2	375,5	384,9

Step 2 requires a check on the global consistency of a combination of assumptions. In the Sfax region, the following critical queries were posed: (i) what are the underlying assumptions for each growth curve (population, leakages)? Is it an exponential, linear or logistic curve? What is the growth rate?; and (ii) What is the statute of the variable: is this a trend that can be extrapolated, a critical uncertainty (depending on external uncertainties) or is it a project variable (which is subject to decisions by stakeholders)? (iii) What is the anticipated water resources supply/demand balance and is the sum of water uses below the maximum available resources? Also, the political and social context of the scenarios must be considered in conjunction with the technical assumptions that form their foundation.

Step 3 requires combining basic assumptions to develop alternative scenarios by reducing a set of basic assumptions, explaining qualitatively the process of evolution and quantifying the assumptions on future evolutions. In Sfax, the alternatives developed were land use planning, spontaneous development, and the baseline scenario. To represent the scenarios, it was important that they were consistent in format with a structured list of assumptions to ensure transparency (for discussion with stakeholders); a quantitative evaluation of the resources/demand balance; a narrative illustrating the causal paths, major issues, and transitions that could occur; and, if possible, a geographic representation of the spatial distribution of resources and uses. It is important to stress that *transparency of the scenario construction*, methods and use of the data sources is *as important as the reliability of the data* underlying the assumptions.

The water resource/uses water balance, modeled in Step 2, combined with the set of assumptions for the land use planning scenario resulted in a situation where the forecasted solicitation of the deep aquifer from planned development became greater than the threshold for aquifer renewal. It was therefore necessary to imagine other ways to generate water supply, particularly concerning agricultural use of groundwater.

Step 4 requires imagining a plot and a narrative. The following was imagined for the land-use planning scenario:

"A very dynamic land use planning policy is being implemented. Local development stakeholders are negotiating subsidies and some autonomy from the state in a way that natural water resources limitation cannot be taken into account. Finally, the development model for which a lot of money has been invested is put into question because of excessive water use."

Then, this scenario was imagined for the spontaneous development scenario:

"The city of Sfax continues growing without implementation of land use planning policies. Because of water scarcity and of the Euro Mediterranean free trade zone, agricultural employment in the region decreases drastically. Sfax must incorporate this new population and labour force, which accelerates water supply problems in the city. Thanks to its political weight, the city manages to have a bigger allocation from the national water resources network, but national solidarity and water resources sharing becomes a problematic national political issue."

This last example shows why social and political elements must be added to the technical forms of the baseline scenario. While the techical plans indicate a growing and intensifying irrigation sector, the sector's future is in fact more uncertain. Both for regional and national policies, the impact of external factors on water scarcity are important to at least acknowledge, even if they are not quantifiable.

The scenario approach presented here is possible to implement without important efforts and even with little data. It exemplifies that the baseline scenario necessitated by the Water Framework Directive can be built as one particular combination of assumptions, for instance the one based on land use planning and other existing plans. The other possible combinations are also plausible and are necessary counter examples to the baseline scenario. It is therefore necessary to put into discussion the scenarios that are built, and to ensure that the construction method is transparent enough for any stakeholder to be able to participate in the discussion.

Source: Treyer, S. (2002, forthcoming).

Illustration 5 - Example output from a scenario building exercise in the Ribble (England)

The case study identified seven pressures on the water status of the Ribble basin, of which water industry discharges (STW), the presence of dangerous substances, agricultural and diffuse pollution and abstraction were found to be significant. The Table below illustrates how the outputs of a characterisation and risk assessment can be presented, drawing on experience in the Ribble river basin. Though the Ribble case study analysed pressures quantitatively and qualitatively, the results below are presented in a qualitative form: the arrows denote whether the pressures are likely to fall, rise or remain at current levels whilst H, M and L describe the likely magnitude of risk of failure to achieve a given water status (good, moderate or poor). The Table shows that there is a high risk of failing to achieve good status in 2015, 2021 and 2027 on account of STW discharges and diffuse pollution from agriculture and that abstraction could contribute significantly to the risks of failing to achieve good water status in 2027.

		Likely Development in Pressure			**Likelihood of limiting achievement of quality states in future plan periods**								
Ribble	Significant?	2000 to 2015	2015 to 2021	2021 to 2027	2015			2021			2027		
					G	M	B	G	M	B	G	M	B
Water Industry STW discharges	Yes	↓	→	→	H	M	L	H	M	L	H	M	L
Landfill	No	↓	↓	↓	L	L	L	L	L	L	L	L	L
Land drainage	No	→	↓	↓	M	L	L	L	L	L	L	L	L
Dangerous substances	Yes	→	→	→	L	L	L	M	M	L	M	M	L
Agricultural diffuse pollution	Yes	↑	↑	↑	H	H	L	H	H	L	H	H	L
Abstraction	Yes	→	→	↑	L	L	L	L	L	L	H	M	L
Overall (inc. synergies/cumulative effects)					H	H	L	H	H	L	H	H	L

G-Good, M-Moderate, B-Poor Status. H-High (75%), M-Medium (50%), L-Low (25%) risk of failure

Source: Integrated appraisal for river basin management plans. Environment Agency, Andrews et alii, extract: the Ribble case.

Task 3 - Integrate Changes in Uncertain Parameters (integration of critical uncertainties)

In this task, more uncertain changes that are likely to have significant impacts on the pressures and water status are integrated into the analysis for developing the final business-as-usual scenarios to be used for identifying the gap in water status.

At this stage, the possibility of uncertain events or "what-if scenarios" will therefore be integrated into the "business-as-usual" scenario with questions such as:

- What if the river basin district goes through a technology or water consumption shift?
- What if a series of severe droughts or flooding events occur during the next 10 years?
- What if agriculture common policy is radically changed? Etc.

Of course, possibilities for such variations are infinite. However the first two tasks will have helped designating the key parameters on which uncertainty analysis is necessary (e.g. if diffuse pollution appear as a major issue in a district, analysis of uncertainty in that field is worthwhile, through the analysis of alternative agricultural policies for example). The Table below summarises the key issues that could be examined during that Task. Taking into account such changes will produce the Baseline scenarios for the district.

Task 3	Key points	Output
Identify changes to the parameters that are uncertain and could have significant impacts on the water policy	Pay special attention to: • Increase in magnitude and frequency of uncertain events (policy and technological shifts, meteorological events such as floods and droughts occurrence) • Possible reactions and feedbacks from the environment: acceleration of water quality improvement due to enhancing of auto-purification by the water environment; apparition of new quality parameters previously hidden (again recommended use of modelling) • Possible social changes having significant impacts on the water system: consumption habits (housing, land planning, …), institutional design of water policy • Possible economic changes having significant impacts on the water system: economic growth cycles, investment flows, employment, economic policy, taxing system, etc. • Associate and merge analyses of "demand" and of "supply" of water. Baseline scenarios are particularly necessary for preventing the dissociation of supply policies and demand-side management, "putting offer and demand in the same image".	Alternative baseline scenarios

Illustration 6– The incorporation of critical uncertainties in the development of a Water Resources Strategy (England and Wales)

The only certainty surrounding long-term forecasts is that they are likely to be wrong! Any best estimate forecast contains uncertainties. One way of dealing with some of these uncertainties is to define scenarios, or story lines, within which the key drivers of demand evolve on a justified basis. The use of scenarios enables us to test not only "*what if…?*" scenarios but it also provides an indication of the sensitivity of components to particular assumptions.

The Agency's case study referred to above (see *Illustration 3*) used a demand-forecasting approach based on the projection of disaggregated demands. In order to assess the key uncertainties related to these forecasts, the possible impacts of different socio-economic and political pressures on the key drivers of demand were examined using the *Foresight* tool, developed by the UK Government to project alternative Environmental Futures scenarios over a period of several years. Note that the process used in developing this Foresight generic tool involved drawing on national and global future scenarios for the state of the environment as a whole (without focusing particularly on water), which were then developed and reviewed by business, government and academia. This produced a tool that others can use to explore possible futures.

Scenario development

In the study, four future scenarios for water use were developed for the period 2010 and 2025, which reflected different permutations of regionalisation versus globalisation and communitarian versus individualistic traits.

Key lessons

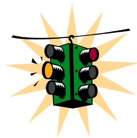
The areas of greatest residual uncertainty in this process were in relation to the pace at which policies might be applied and their relative success. Expert advice drawn from stakeholders in business, trade associations, economists, government and the water industry helped to minimise such concerns. Wherever possible these judgements were reinforced by practical examples and real experiences. One weakness that emerged from the use of scenarios, however, is if the forecast relies on unsubstantiated key judgements about demand changes.

The benefit of this approach is to acknowledge that the future cannot be reliably predicted, however, it is possible to identify the circumstances under which significant demand changes might realistically occur. As well as facilitating a means of testing combinations of assumptions and their relative effects / sensitivity, this method permits an examination of the robustness of management options to a range of demands. Also it facilitates debate on the potential acceptability of various options under certain socio-economic conditions.

Source: Environment Agency for England and Wales (August, 2001).

4. The role of public participation in scenario-building

The choice of assumptions made while developing a *business as usual* scenario will require discussions with the public and stakeholders, and input from economists and technical experts.



Look Out! Participation in scenario building can take many forms

Participation in scenario building can take many forms. Most past experiences demonstrate that public participation should be placed as much "upstream" in the process as possible. At least 3 modes of participation are possible:

- *Participation by collective building of scenarios*: involve the public in the process in the choice of assumptions and their values;
- *Participation by checking coherence of the proposed scenarios*: check consistency of assumptions and of scenarios with the various visions that are shared or distributed among social groups;
- *Participation by asking the public to question the main "statements" in water policy*: scenarios illustrate and somehow caricaturise the most common policy statements, helping the public to input into decision-making and fostering transparency in the process.

The use of scenario building for public participation

One particular method of involving the public is to use scenario building (or foresight methodologies). This may usefully complement forecasting (i.e. the derivation of the business-as-usual scenarios) in order to structure policy discussion and public participation, and identifying key water management issues. Scenario building as an exercise is not so much carried out to produce one single image of the future, but it intends to foster the debate on present and immediate future policy options by exploring their possible future consequences. Prospective scenarios can provide colourful illustrations of the main issues for water management, give extended view of the ongoing policy debate on water (e.g. supply- or demand- management), illustrate the *pros* and *cons* of the possible solutions, reveal possible factors of change, and offer a possibility of a wide but formalised interdisciplinary discussion. Prospective scenario building is proved to be much less "data-demanding" than forecasting a baseline.

Optional additional task	Key points	Output
Combine various combinations of possible changes in parameters, using futures studies methodology	Design several contrasted scenarios in order to allow for uncertainties surrounding the key parameters Organise and give effective result of stakeholders and public participation	Exploratory scenarios

Methods and practical tasks in this field are very diverse, with respect to:

- The spatial scale: world perspective, river basin / regional scale, local scale.
- The time horizon: preferably long-term horizons (25 to 100 years);
- The type of "input variables": either in qualitative or quantitative terms;
- The type of output: contrasted "visions", possible statements on water status, qualitative and/or quantitative scenarios, …

The role of public participation in scenario building at river basin district level: A summary

Task	Role of public participation	Output
Task 1	System analysis and choice of determinant assumptions In-depth interviews with main stakeholders, experts and institutions of the district, aimed at: • Defining the key variables that determinate the water system in the district according to the interlocutors; • Proposing a hierarchy for these variables (more or less determinant); • Describing their range of variation	Overview of general trends in key variables – Short-term projections
Task 2	Scenario building based on task 1 inputs and participation from stakeholders, experts, representatives, scientists through working groups, thematic workshops, etc …	Baseline scenario without uncertainty
Task 3	Large-scale debate on the proposed scenarios: presentation at various policy levels, large communication, and collection of opinions from the public. The list of assumptions that underlie the scenarios should be delivered as clearly as possible to allow transparency and possibilities for criticism and reformulating, etc.	Alternative baseline scenarios incorporating uncertainty
Task 4 (optional)	Amendment of scenarios, and quantification refinement: based on previous tasks, derive and calculate the precise significance of scenarios for their systems and instruments: investment and subsidising system, pricing, technical actions, policy organisation, etc. Organisation of large scale publication and participative discussions.	Exploratory scenarios

Illustration 7- The role of participation in four long-term thinking exercises in the field of water

	World Water Vision	**Globesight**	**WaterGAP**	**WEAP**
Approach	Participatory Vision Development based on reference scenarios	Human in the Loop Systems Dynamics Simulations	Simulation of Resources Dynamics	Policy analysis
Spatial scale	World, Region (river basin, socio-economic region, or territorial region), and Sector	River basin	World/region on a 0.5-0.5° scale, using river basins as smallest output entity. 4000 river basins in total.	Municipal, agricultural systems, single sub-basins or complex river systems. GIS based.
Time scale	Up to 2025	Calibrated on historical data. Time horizon flexible.	Up to 2100 (historical data is used for calibration)	Time horizon flexible.
Inputs	Demography Economy Technology Society Governance Environment Hydrology (through the use of quantitative models)	Demography Energy Economy Agriculture Hydrology	Land cover Climate Population Income Technology	policies costs demand factors pollution supply hydrology
Nature of inputs	Qualitative	Quantitative	Quantitative	Semi-quantitative
Output	Visions and scenarios, which have become independent. The overall synthesis is largely built on the preferences elaborated in the scenarios.	Water balance between water demand and water supply	Water availability Water Withdrawals Water stress indication	Water sufficiency costs and benefits Compatibility with environmental targets Sensitivity to key variables
Nature of output	Qualitative, with quantification	Quantitative	Quantitative	Quantitative
Socio-economic driving forces	Demography Technology Society Governance Economy Environment	Demography Energy Economy (GDP) Agriculture	Population Income Electricity Water Intensity Agricultural intensity Water use efficiency	Policies Costs Demand factors Pollution Supply
Scenario use	Value-laden reference scenarios being used to fuel debates and visioning exercises, as well as direct input to the final vision.	Different scenarios can be run, either through data changes or through different interventions by the human element.	Scenarios are used as input for the model. Water use scenarios (technological change and structural change) and climate scenarios are used.	What-if policy scenarios
Participation	Large scale consultations among stakeholders through contributions and feedback to intermediate versions of documents and through workshops. Decentralisation of the exercise in order to foster appropriation and legitimisation.	Cybernetical view of participation. Human beings are seen as submodel. The goal-seeking behaviour of algorithms is replaced by the goal-seeking behaviour of human 'models'.	Scientists-based model which does not include participation. However, WaterGAP can handle participation upstream (in defining socio-economic scenarios) and downstream.	Decision support system in which the (individual) user can assess different scenario possibilities. No citizen participation is included in the concept.

Source: Van der Helm, R. & Kroll, A (2002, forthcoming).

5. Summary

The development of baseline or *business-as-usual* scenarios require a range of economic and technical expertise to account for, and investigate, trends and evolutions of a wide range of hydrological, technical, socio-economic and regulatory parameters. Methods that need to be mobilised include:

- Statistical analysis of past data;
- Economic and environmental modelling, e.g. to asses the impact of changes in sectoral policy drivers on key pressures;
- Review of existing planning documents that develop scenarios for key socio-economic sectors; and
- Interaction with, or participation of, key stakeholders.

The development of the baseline scenarios investigates drivers and parameters at different scales:

- For parameters and drivers linked to **local changes**, input into the analysis of potential changes in these parameters and validation of key assumptions with stakeholders and the public is likely to enhance acceptance of results of the analysis and the selected baseline; and
- For **global changes** (e.g. climate change) and EU/national sector policies, interaction and feedback will be required between river basins and between countries to ensure coherent assumptions are made for foreseen changes in key drivers.

COST-EFFECTIVENESS ANALYSIS

Directive references: *Articles 4* & *5* and *Annex III*
3-Step Approach: *Step 3.2*
See other information sheets: *Baseline Scenario*, *Estimating Costs* and *Disproportionate Costs*

This information sheet will help you carrying out a Cost-effectiveness Analysis (CEA). The CEA is used for assessing the cost-effectiveness of potential measures for achieving the environmental objectives set out by the Directive and construct a cost-effective Programme of Measures.

1. Objective

Cost-effectiveness analysis (CEA) is an appraisal technique that provides a ranking of alternative measures on the basis of their costs and effectiveness, where the most cost-effective has the highest ranking. The CEA proposed here takes an *economic* view of cost-effectiveness (see *Estimating Costs* for a definition of the term).

The CEA is used for assessing the cost-effectiveness of potential measures for achieving the environmental objectives set out in the Directive, and in particular for:

- Making judgements about the most cost effective **programme of measures** which could be implemented in order to bridge a potential gap in water status between the baseline scenario and the Directive's objectives (*Annex III*) (see also *Baseline Scenario*); and

- Assessing the cost-effectiveness of **alternative measures** in order to estimate whether those programmes of measures are disproportionately costly or expensive (*Article 4*) (see also *Disproportionate Costs*).

The focus of this information sheet is on the first component of this analysis. The sheet outlines issues relevant to estimating the effectiveness, costs and economic impacts of water improvement measures as well as the key tasks of the CEA.

2. What are the Key Issues?

Key issues to look out for when conducting the cost-effectiveness analysis include:

- Provide value added information to aid decision-makers;
- Be practical and proportionate, allowing for the costs of carrying out the analysis and the availability of data and the importance of the effects and costs in question;
- Cover fully the costs and economic impacts of measures for the different sectors, whilst avoiding double counting;
- Be applicable to a wide range of measures in a RBMP (see *Box 1*), including specific control and abatement measures for both water quality and water resources (e.g. abstractions);
- Be able to cover measures that incur costs and achieve effectiveness in different periods;
- Be readily applicable in practice and capable of generating summary cost estimates in and across basins, sectors and measures in order to aid decision-making on measures that could be taken at national level and subsequently included in the RBMPs.

Box 1 Possible measures for implementing the Water Framework Directive

Possible Measure/sector	Decision-making body	Level of decision	Level of Implementation
1. Requirements for water industry to implement measures to reduce abstraction	National Relevant Ministry	National	River Basin District
2. Controls on other Direct dischargers	Environment Agency National ministries re control measures for other sectors	RBMP & also In line with National/Agency policy on sector	River Basin District
3. Controls on other abstractors	Environment Agency	RBMP	River Basin District
4 Best practice controls on pollution and abstraction at farms	Agency in charge of environment (but, in a clear national policy context)	RBMP & also In line with National/Agency policy on sector	River Basin District
5. Controls on other indirect dischargers (e.g. run off from traffic on roads)	National Ministry	Highways Agency, Local Authorities	Highways Agency, Local Authorities/basins
6. Agri-Environment programmes (financial and technical assistance and advice to go beyond good practice)	National agriculture + finance ministries in response to Ministry submissions	National	Regional/basins
7. Economic instruments	National agriculture + finance ministries In response to Ministry submissions	National	National taxes (but pollution charges and tradable permits are local)
8. Morphological measures	River Basin Agency	RBMP	River Basin District

3. What are the Practical Tasks?

The key components of the CEA are the costs and effects on water of the measures. These and other tasks are outlined below. At times, this will save you doing the job twice, since most of the cost analysis for the cost and benefit assessment will have already been performed for the cost-effectiveness analysis. Some other key points to consider throughout the process include:

- The cost-effectiveness analysis should be used to refine the programme of measures by focusing on the largest cost components and the major determinants of the effectiveness of measures. The analysis should then be used to develop packages of the most cost-effective measures for achieving alternative water status.
- Some measures have differing uncertainties concerning their effectiveness and costs. To allow for this, it would be desirable to use ranges of costs instead of point estimates.
- It is costly to undertake a CEA. Therefore, the focus of the analysis should be on the limited number of water bodies requiring actions to achieve good status. Consider only those measures that are likely to be worthwhile for achieving this aim.

The analysis of cost-effectiveness can be broken down in five basic tasks and one optional (see *Figure 1*).

Figure 1 – Tasks and Key Questions in Analysing and Reporting on Cost-Recovery

Key Tasks	…And Questions
1. Define Scale of the Analysis	Where are the most significant pressures causing the failures located? At which scale do the measures under consideration for addressing the gap have an impact?
2. Define Time Horizons	What measures can be implemented in the first RBMP (2009-2015) period? If the objectives cannot be met by 2015, which measures can be implemented in later periods? What are the major cost elements that could be reduced by an extended deadline?
3. Determine the Effects of Measures on Water	What is the technical feasibility and applicability of specific control measures? How should the effectiveness of measures be assessed and on the basis of which parameters? How do the measures affect the risk of an incident taking place?
4. Estimate the Costs of Proposed Measures	What are the direct costs of measures and environmental costs (or benefits) non linked to water? How are these costs allocated between different sectors and who pay for the measures? Are any of these costs likely to be disproportionate for a particular group?
5. Assess Cost Effectiveness	What is the cost-effectiveness of each measure? How can the most cost-effective programme of measure be constructed? How can alternative programmes of measures to meet an objective be compared?
6. Optional – Assess wider economic impacts	What is the overall cost impact of the programme of measures particularly on the Exchequer costs? What are the wider economic impacts of the cost-effective programme of measures?

Task 1 - Define the Scale of the Analysis

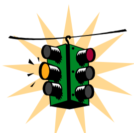
Sub-task	Key points	Look Out! 
Define the spatial scale	• Define the spatial scale according to the level identified by the IMPRESS Working Group for the location of the significant pressures that cause the failures (see *Illustration 1*). • Extend the scope of the cost-effectiveness analysis depending on the scope of the environmental and economic impacts of the main measures under consideration.	Data can be aggregated to identify key environmental and sectoral problems and appraise the cost-effectiveness of measures at RBD level.

Illustration 1 – Determination of scale based on information in Cidacos (Spain)

The analysis of pressures in the Cidacos river has played three roles for the cost-effectiveness analysis:

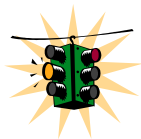
1. To define water bodies for the analysis on the basis of homogeneity of pressures/human activities;
2. To design programmes of measures that help to reduce key pressures;
3. To understand factors behind existing pressures and their likely evolution in order to make projections about the likely status of water quality in 2009 and 2015.

In Cidacos, information about emissions exists (for point pollution) or in some cases it is possible to rely on estimates (for diffuse pollution). For example, estimates of leachate of nutrients from farms are based on estimates empirically tested elsewhere (elaborated by the National Plan of Irrigation) applied to the existing information for Cidacos. This depends on the types of soil, types of crops and productivity, irrigated areas, use of water and monthly distribution, irrigation techniques and efficiency of irrigation systems. This information exists in the Cidacos river ordered by irrigation cooperative and by total number of hectares.

The identification of the water bodies for the analysis was done on the basis of types of pressures and in such a way that it would be possible to monitor improvements of water status resulting from the programme of measures. Control stations helped defining the limits of the water bodies used for the Cidacos study.

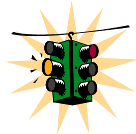
Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. See ***Annex V.***

Task 2 - Define Time Horizons

Sub-task	**Key points**	**Look Out!** 
Identify the relevant time periods for the analysis	• Focus, firstly, on measures to be implemented in the first RBMP period 2009 – 2015. • Look at later RBMP periods (2015 – 2021 and 2021 – 2027) if the measures cannot achieve cost-effectively good status by 2015. • Look at later RBMP periods if there are uncertainties about the costs and effectiveness of the measures applicable in the first RBMP and scope for increasing effectiveness and reducing costs. • Identify the major cost elements that could be reduced by an extended deadline and an actual start in developing and applying more efficient control measures (started in the period 2009 - 2015 although the measures would come into effect in a later period). This will require a clear signal to the sectors concerned so as to prompt such an actual start to the development and application of more efficient control measures. In addition, it is necessary to examine scope for this increasing the effectiveness of measures (especially in respect of development and application of technological changes).	Distinguish between • Long run ongoing costs in 2027. (opportunity costs of the resources used for achieving good status instead of alternative uses); • Short run dislocation costs and economic impacts of measures to achieve good water status by 2015 and 2021.

Task 3 - Determine the Effects of Measures on Water

CEA requires comparable and if possible, quantitative information on the effects of measures.

Sub-tasks	Key points	Look Out! 
Assess technical feasibility and applicability of specific control measures for each RBD	Base the analysis on: • Analysis of the current and future pressures on water in the basin, which should characterise these pressures into main segments of the key sectors that cause most of the problems to identify and develop measures effectively targeted at them • Views of stakeholders involved in the practical implementation of the measures to address the specific pressures (e.g. water industry, non-water industry, agriculture). • Studies and reviews of available technologies (e.g. BREF notes, BAT reviews) and prospects for the development and application of technical changes.	
Assess effectiveness (see Illustration 2 for an example).	• Clarify how (risks of) failure to achieve the good status target will be defined and interpreted in practice • Effectiveness needs to be assessed in terms of reductions in the risks of pollution incidents arising (e.g. slurry run off, leaks) as well as reductions in continuous discharges and abstractions. • How to assess the likely effects on discharges and abstractions and correspondingly the effects on biological water quality of specific measures, especially where measures focus on achieving behavioural and more qualitative changes (e.g. changes in farm practices) • How to assess and allow for any time lags before a measure could become fully effective? Would this extend over a number of planning periods? The problem of time lags may be addressed by setting interim targets and periodic reviews of their achievement. • How to allow for the complex synergistic effects of policy measures that may have a nation or region-wide scope and serve multiple objectives or have multiple effects. • Prospects for the development and application of technical changes that could increase the effectiveness of measures for achieving good quality if such changes were embarked upon over an extended deadline.	Multi Criteria Analysis based on scientific advice may serve to combines these various effects into a weighted composite index so that the relative effectiveness of the measure can be assessed on a consistent basis. Consider how long before a measure can be • in place and operational; • fully effective; • will impact on the water body so that it recovers to a higher status

Key issues to address include:

- How to choose and combine criteria for determining the relevant effects? Effects on water are diverse (e.g. effects on emissions of dangerous substances; water flows; water pollution levels, biological quality of the water body; and groundwater etc); and
- Should failing one criteria mean failing to meet the objective (fail one fail all) or should the fact that different measures may have different effects on different metrics be taken into account?

To make it easier, it would be important to identify the effect of the measures on each parameter as clearly as possible (see *Illustration 3*).

Illustration 2 demonstrates how the effectiveness of measures was assessed for the Ribble basin.

Illustration 2 – Assessing the effectiveness of measures in the Ribble (UK)

This example illustrates how effectiveness of measures was assessed in the Ribble basin. It is assumed that an aggregate 50 percent reduction in nutrient levels would be needed to achieve the necessary reduction in the risks of not achieving good water status. However, it should be noted that, depending on the outcome of other research on the appropriate compliance assessment model, different formats for presenting risk reduction information might be more appropriate. In addition, precise estimates of the risk reduction may not be the most appropriate format for presentation. Broader categories of risk reduction (High-Medium-Low, or ranges) may be better. However, in order to make the analysis tractable, point estimates are used here..

The table presents estimates of the effectiveness of number of measures for the River Ribble. For example, STW optimisation may be judged to deliver a 20% risk reduction (+/- 5%, i.e. 15% to 25%). The measure can become operational immediately (i.e. no specific time lag). This might be contrasted to the agricultural general binding rule measure, which might deliver the risk reduction, but entails considerable uncertainty about its effectiveness and would require a significant lead time. Full effectiveness of this measure would not be expected until the 2021 planning date. In addition, this measure is not currently available, as it would need to be negotiated at a national level.

Aggregate risk reduction required			Risk reduction delivered			Feasibility	Expected km delivered in 2015		
2021	2027	Measures	2015	2021	2027	Uncertainty range	2015	2021	2027
Elevated Nutrient Levels									
50%	50%	STW Management optimisation	20%	20%	20%	5%	5	5	5
		STW Opex scheme	50%	50%	50%	10%	14	14	14
		STW Capex scheme	50%	50%	50%	10%	14	14	14
		Agri surveillance/enforcement	2%	2%	2%	1%	1	1	1
		Agri General binding rule	10%	50%	70%	25%	3	14	19
		Agri Nutrient surplus charge	15%	30%	50%	25%	4	8	14
Land drainage									
0%	0%	Risk acceptable, do nothing	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Dangerous substances									
25%	25%	Monitor + R&D	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Abstraction									
0%	50%	Monitor + R&D	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: J. Fisher. Integrated appraisal for river basin management plans. See Annex V.

Illustration 3 – Issues in conducting the cost-effectiveness analysis in Cidacos (Spain)

In Cidacos, information for determining water quality status was drawn from the control stations in the river that measure a number of quality parameters and other stations that measure quantity of water, pluviometry and estimate runoff. There are also two stations that monitor biological indexes along the river all year long, allowing for the identification of the current status of key parameters in winter and in summer.

Selecting quality parameters
From an initial assessment, a few key parameters were selected for the Cost Effectiveness Analysis, including water quality and hydromorphological parameters that need to improve to achieve the objectives (as defined in the existing quality plan).

The criteria for selecting those parameters were the following:

- Those parameters where there is a gap or which are closer to thresholds;
- Those parameters that may be sensitive to further expected pressures;
- Those parameters that may be sensitive to the introduction of measures aimed at improving other parameters.

The hydromorphological parameters chosen were: water flow, and improvements of river borders and river vegetation. Others such as the existence of barriers, bridges, etc., were not considered for the purpose of this study since it was difficult to assess the effectiveness of the measures when the inter-relations between physico-chemical and hydromorphological parameters with the biological parameters have not been characterized.

Examining the effects of measures on combined sets of parameters
From the study, it became clear that it is important to identify and characterize the inter-relations between the different "selected" parameters in order to assess with some accuracy the effectiveness of measures. Some simple examples are: an improvement of water flow affects dilution of pollutants and hence has a positive effect on physico-chemical parameters. However the objective of water flow is not affected by the water quality parameters. By contrast, water flow would be negatively affected by the improvements of river border vegetation (that demands water). It is important also because it helps identify those parameters (often those with key synergies) on which it could be most effective to intervene.

Analysing the effectiveness of measures
The analysis of the effectiveness of the measures for the Cidacos river were based on:

- Empirical information on the impact of measures on pollution emissions;
- Empirical information about the water saving potential of measures and how this translates into increased water flow;
- Expert judgement about how these will lead to an improvement in the specific parameters.

The effectiveness of the measures was estimated on the basis of actual data for the Cidacos River. For example, the estimation of the effectiveness of measures aimed at improving water flow (such as improvement of irrigation, canals, substitution of pipes, or changes to low pressure water distribution systems) varies according to water use and density of irrigation networks. This information applied to the real data on the Cidacos (on density and number of hectares with different water applications) leading to estimates of ***total maximum water saving potential for each individual measure***.

In the case of agriculture, 27 measures were analysed in terms of their maximum potential for water savings or reduction of Nitrites, Nitrates, and BOD5. These have been expressed in absolute numbers or expressed either as a percentage reduction of pollution or percentage increases in water savings in relation to the base line indicators. The main problem was how to measure the improvement of water quality resulting from a certain reduction in pollution. Another problem was to identify how much each user contributes to the water status of the river.

This information used in relation to agriculture had been collected to prepare the National Irrigation Plan. The available information for urban areas came from empirical evidence of demand management programmes, management of urban water, inspection reports to companies and commercial water uses and the reports on measurements on pollution from wastewater treatment plant outlets.

*Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. S**ee Annex V.***

Task 4 - Estimate the Costs of Proposed Measures

Analysing the costs and economic impacts consistently for distinctly different sectors is a major challenge. All costs should be measured in comparison with the business as usual situation that would arise in the absence of the option. Also, who pays for measures that have significant effects on particular parties (e.g. water customers in respect of water bills) and the scale of any such payments should be identified. Therefore the allocation of costs of the proposed measures is a key element of the analysis.

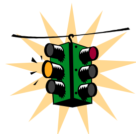
Sub-tasks	**Key points**	**Look Out!** 
Determine costs of measures	• Estimate costs of measures (including direct costs, financial and administrative) and environmental costs not linked to water (see below). *Illustration 5* and *Annex I* give an example of such costs from the Ribble basin. • Examine how to review and validate the cost estimates (and note that costs are dynamic – they change as a result of developments in sectors) • The links between costs and the business-as-usual case need to be considered as implementation of current legislation will affect additional measures needed and also change the prevailing prices and incentives structures for agriculture • Allocate the costs of measures to water users (see *Illustration 4*), and identify winners and losers, in order to potentially feed into the analysis of disproportionate costs to justify derogation – This would also determine the institutional viability of proposed measures.	Formats should be developed for different types of sectors and measures. These need to build on the existing costing conventions currently used in each sector (see *Annex I*).
Determine costs of other policy measures	• Estimate the costs of control measures such as economic instruments, water pricing measures, cost recovery charging levels and technical and financial assistance measures (e.g. agri-environment measures, waste minimisation programmes) to encourage behavioural changes (eg changes in farm practices)	
Estimate non-water environmental impacts from the control measures	• Focus only on the external elements and determine the scale and significance of such external impacts (materiality) as any direct costs of measures are included in the financial costs, e.g. impacts on natural habitats of particular measures; environmental impacts from combustion and extraction of the energy and raw materials used in some control measures, nuisance from sewage treatment works and impacts from transport of sewage sludge.	The CEA does not value the water related benefits of measures. Benefits are included in the appraisal of derogations, see *Disproportionate Costs*.

Illustration 4 – Allocating costs of measures to water users in Cidacos (Spain)

In the Cidacos case study, the most cost-effective measures require many actions in the irrigation communities located upstream of the river and no action in those located downstream. The cost reduction gains that result from this approach far outweigh other more symmetric alternatives. However, the drawback is that measures must be funded and the target farmers' cannot finance the programmes of measures by themselves. Therefore, they must rely on other farmers' contributions, especially those whose irrigation districts will not be modernised or rehabilitated.

The consideration of institutional issues means that the costs and benefits for the six irrigation communities of the Cidacos River would have the following effects:

Stretch Irrigation community	Net margins variation (in % with respect to the present situation)
Stretch I	
▪ **CR Barasoain**	27.4
▪ **CR Pueyo**	11.5
Stretch II	
▪ **CR Olite**	-18.8
▪ **CR Tafalla**	-12.4
Stretch III	
▪ **CR Pitillas**	-34.5
▪ **CR Beire**	-29.8

The numbers in the Table gives an idea of the winners and losers from the proposed programme of measures, which may stir conflicts amongst usually quite united stakeholders. Thus, measures will need to be taken to enhance the persuasiveness to gain the support for a cost- effective set of measures. While in the Cidacos project, it is assumed that all irrigators will be charged equal water rates, the net margins variation found in the study might support the option to implement differential rate schemes.

Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. *See* ***Annex V.***

Task 5 – Assess Cost-effectiveness

The unit-cost effectiveness estimates from above analyses should form the main element of the appraisal of costs of measures. Cost-effectiveness can be presented in two ways: (i) costs divided by the effect, or (ii) effect divided by costs. For the selection of measures in the framework of the Directive, the former is used:

Costs per effect:

KEm = Km/BEm

KEm - cost-effectiveness of measure m (Euro/m3)
Km - economic costs of measure m (Euro)
BEm - the water quality improvement (= the effect) of the measure (say in km or m3 of improved water body)

The cost-effectiveness analysis itself can be broken down into a number of tasks:

- Analyse the costs of individual measures;
- Produce ranking of measures based on their cost-effectiveness (see *Illustration 5*);
- Produce proposed programme of measures to achieve given objective; and
- Rank alternative programme of measures to achieve a given objective based on their overall effectiveness.

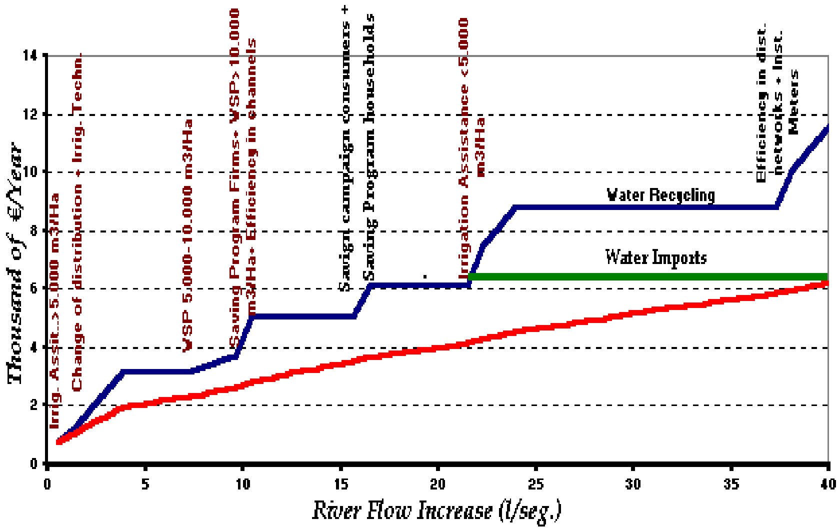
A summary of the cost-effectiveness analysis in the Ribble is given in *Illustration 6*.

Illustration 5 – Ranking measures based on their cost-effectiveness

Different measures can be implemented to achieve an improvement in the water status for a specific parameter. In order to select an appropriate set of measures, these can be ranked according to technical efficiency (ability to obtain an X reduction of pollutants or increase in river flow) and associated costs.

In the Cidacos scoping study, a total of 26 policy measures for improving the water flow were identified initially. These measures involved reducing pressures on water abstraction by reducing the water demand, increasing the efficiency of the water distribution networks in urban and the rural areas, and importing water from another basin through existing infrastructure, and each of them was appraised according to effectiveness and cost. As shown in the diagram below, the cost and efficiency of each measure can be represented by marginal cost curves (see blue and green curves), indicating the cost in euro per unit of achieved flow increase (litre per second) and so provide a ranking. (The red curve shows the average cost of the resulting policy package.)

In the Cidacos river, an increase in the water flow of 50 litres per second is required to meet the objectives of the Directive. Following the ranking of measures (as shown in the diagram), it was shown that the most effective measure (i.e. the measure that could achieve the greatest increase in water flow at the lowest cost) was the implementation of a water saving programmes (WSP) in the agricultural sector (achieving 20% of the requirement, or 10 litres per second), mainly by reducing the demand and changing irrigation techniques for farms using more than 6.000 m³ per Ha, followed by WSP designed to reduce the demand in households and firms (urban uses), which achieved another 15 percent (or 7.5 litres per second) of the required flow increase.



However, note that the cost effectiveness (and ranking) of a measure is not always constant. For some measures, the marginal cost increases with the level of efficiency (see water recycling, blue curve). It is therefore important to carefully look into the behaviour of costs: assuming that costs are constant may lead to an inefficient selection of measures.

Illustration 6 – Estimating the cost-effectiveness of proposed measures in the Ribble (UK)

This illustration demonstrates how costs of measures were reported and used to calculate the cost-effectiveness of measures in the Ribble river basin.

Annex I (to this information sheet) illustrates a worked example of proformas for recording and presenting the ranges of costs of individual measures. The example used is that of the Ribble STW Capex scheme. Capital and operating costs were recorded separately. In capital costs, a distinction is made between the costs of the pollution control equipment and installation. In operating costs, a distinction was made between changes in operating costs and changes in revenues or receivables. These were then used with information on the economic life of the investment (30 years in this example) and the discount rate (6%) to estimate the present value of costs and the equivalent annual value of costs. Recorded costs were reported in a common unit – Annual Equivalent Cost (AEC).

The reported (financial) costs (see Annex I) were used together with the appraisal of the other impacts and the assessment of the effectiveness of the option to calculate cost-effectiveness. Table 1 below presents an illustrative assessment of the costs and effectiveness of options for the Ribble. Cost-effectiveness is measured here in terms of the annual equivalent costs of the measures divided by the km of river delivered to good status. This is a fairly simplistic statistic, which may not be appropriate in all circumstances. It is of great importance that the calculated CE variable should show explicitly the uncertainties, regarding both the costs as well as the effectiveness of some measures. This can only be resolved through the judicious use of ranges of cost and CE calculations.

The key points in Table 1 are highlighted in bold. This shows that Sewage Treatment Works (STW) optimisation is most cost-effective (EAV= Euros1,852/km/yr) but is insufficient alone to achieve the target status. It would achieve 20% of the required 50% risk reduction.

For 2015, the STW Capex scheme is the next most cost-effective measure, followed by the General Binding Rule (GBR) with agriculture and the STW opex scheme. The GBR measure, however, is more cost-effective in the long run because of the long time-to-effect lag due to the lags in implementation of the measure and the slow environmental response to this measure.

Once the cost effectiveness is assessed, strategies involving packages of options can be defined on the basis of meeting the different targets at different points in time. If the objective is G2015, the best strategy would be STW optimisation, GBR + opex scheme; then monitor to see how effective the GBR is and turn off the op ex scheme, if/once the full effect is felt. This flexibility would not be possible if the initially cheaper Capex solution was chosen. If target is moderate status in 2015, followed by achieving good status in 2021, however, the op ex scheme would not be necessary and this would reduce significantly the costs.

Source: J. Fisher, 'Integrated appraisal for river basin management plans'. See Annex V.

Illustration 6 (continued): Table 1 - Illustrative results for the option appraisal (costs and cost effectiveness) – Ribble

Aggregate risk reduction required				Risk reduction delivered			Feasibility	Expected km delivered in 2015			Cost (Euros)	Cost per km delivered (Euros)			
2015	2021	2027	Measures	2015	2021	2027	Uncertainty range	2015	2021	2027	EAV of future costs	2015	2021	2027	Other relevant (measures specific) ancillary impacts
Elevated Nutrient Levels															
50%	**50%**	**50%**	**STW Management optimisation**	**20%**	**20%**	**20%**	**5%**	5	5	5	10,000	**1,852**	1,852	1,852	Impacts on water prices; Environmental impacts of energy consumed at STW
			STW Opex scheme	50%	50%	50%	10%	14	14	14	300,000	22,222	22,222	22,222	
			STW Capex scheme	50%	50%	50%	10%	14	14	14	200,000	**14,815**	**14,815**	**14,815**	
			Agri: tight specific surveillance/enforcement	2%	2%	2%	1%	0.6	0.6	0.6	100,000	185,185	185,185	185,185	Economic impacts on agriculture; Wildlife + natural habitat + soil protection benefits of buffer strips
			Agri General binding rule	**10%**	**50%**	**70%**	**25%**	3	14	19	60,000	22,222	**4,444**	**3,175**	
			Agri Nutrient surplus charge	15%	30%	50%	25%	4	8	14	250,000	61,728	30,864	18,519	
Land drainage															
0%	0%	0%	Risk acceptable, do nothing	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
Dangerous substances															
0%	25%	25%	Monitor + R&D	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
Abstraction															
0%	0%	50%	Monitor + R&D	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	

A key element will be to take into account uncertainty in all elements of the analysis, as it can significantly affect the results (see *Illustration 7*).

Illustration 7 - Addressing uncertainty in cost-effectiveness analysis: an example from the Scheldt estuary

A cost-effective analysis of the Scheldt estuary's morphological measures involved three different types of uncertainty: The effectiveness of the measures; the costs of the measures; and the assumptions made in the baseline scenario.

To address the first uncertainty, experts were asked to estimate the probability of measures reaching their ecological objective. If the probability was below 100%, additional measures were defined until the ecological objectives were reached. This means to address the measures' effectiveness within the CEA was then formulated by summing the probability of reaching the ecological objective times the costs of the additional measures to reach the objective.

The cost of the measures was accounted for by including ranges of costs instead of point estimates. The uncertainty surrounding the loss of added value through reduced navigation in the Scheldt estuary was considered especially large, and for the calculation of these costs large assumptions were made. This uncertainty was expressed in the CEA by including the probability of the actual costs being lower, and using expected cost figures instead of point estimates in the analysis.

To address the uncertainty surrounding assumptions made in the baseline scenario, experts were asked to judge the probability that the assumptions were correct. This involved asking experts whether they thought the baseline would succeed in maintaining the natural dynamics of the estuary. Experts judged the probability of this being true as 80%, leaving a 20% change that additional measures would be required. As this finding revealed major savings for the first alternative and major costs for the second, including the uncertainty of assumptions in the baseline scenario made quite a difference.

In average annual costs (million EUR/YR)	Option 1 De-poldering	Option 2 No further deepening
Uncertainty not included	7,3	38
Most extreme, with uncertainty	11	- 45,4
Expected outcome, with uncertainty	8,4	11,9

By including uncertainty into the expected costs of measures in the cost-effectiveness analysis, the outcome of the assessment changed considerably. Besides, it made the range of costs explicit, a range that turned out to be much larger for the one option then it was for the other. As this is important information for decision makers, uncertainty should always be included when performing a cost-effectiveness analysis.

Task 6 (Optional) – Estimate the Economic Impact of Measures

In addition to this process, it may be useful to estimate the economic impact of the proposed measures, although this would go strictly outside of the cost-effectiveness exercise. In addition to direct costs, such an analysis would account for induced costs (i.e. the costs on other economic sectors) and the environmental costs not linked to water (see *Illustration 8* for an example).

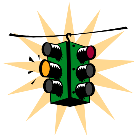
Sub-tasks	Key points	Look Out! 
Estimate the exchequer (net) costs	The net impacts on public expenditures and revenues may be important because of the impacts on the economy of a change in net exchequer costs. This primarily includes the impacts of expenditures for agri-environment schemes and net impacts on revenues of economic instruments and, in countries with publicly owned water services, the impacts of changes in the prices charged for water services.	Includes primarily the impacts on expenditures for agri-environment schemes, revenues of economic instruments and impacts of changes in the prices charged for publicly owned water services.
Estimating wider economic and social impacts	• Include, for example, significant changes in patterns of employment, economic impacts on upstream suppliers or downstream customer industries and impacts on local economic development from changes in the price of water supply and discharges and changes in water quality. • Include effects of changes in water bills on the retail price index (RPI) and inflation.	Consider these only where there are particular concerns about economic and social impacts, e.g. dislocation costs and frictional unemployment impacts in a sector.

Illustration 8 – Impact of the incorporation of the economic impact of measures on the ranking of measures in Cidacos river basin (Spain)

Any change in the economic conditions affecting irrigated farms can potentially have other direct costs and also indirect costs. Costs that would need to be taken into account are those that affect land dedicated to agriculture and water consumption. "Other direct costs" are likely to be small if farmers keep the same practices or cropping patterns that they used prior to the implementation of a given measure. But if farmers' consumption is expected to fall, their output will change and their labour demand will also fall.

The Cidacos study considered (as in the Spanish Ministry Agriculture National Irrigation Plan) that 1 € of output produces 0.319 € of further added value. This is one measure of other direct costs (or benefits). The other is the impact in the labour market. The Cidacos case study makes the assumption that the loss of one hectare of irrigated land eliminates about 40 € of wages in addition to the losses of farmers' income.

An application is shown for the measure "restoration of the riverine forest".

	Net margin (including subsidies, €)	Subsidies €	Lost wages €	Indirect economic effects, €	Flow increases in litres/s
1 Ha in CR – A	775	189	26	255	0.06
1 Ha in CR- B	1096	153	54	360	0.07
Average	935	171	40	308	0.06
15 Ha	14,029	2,567	593	4,616	0.96

In addition, wider costs in the irrigation sector may be associated with those costs that are borne by stakeholders beyond the gates of the farms. In the Cidacos case study, it was assumed that attention should be given to those sectors linked to the agricultural sector, such as farm input suppliers and food processors. In addition, irrigated agriculture hires workers to perform various tasks, generating labour rents that are important in many agricultural areas. Impacts on the rural economy are thus integrated to the study, evaluating the other direct costs and labour market effects.

The Table below reports the selected programme of measures' costs in terms of Euros per increased unit of river flow. The reported evaluations indicate that incorporating wider costs in the analyses provides a different picture than excluding them. These differences are amplified when the costs reported in the table are brought to the basin-wide analysis, where other sectors and the spatial dimensions of the measures are fully integrated. For instance, if a measure applied in a non-agricultural sector has a cost of 5000 Euros for each litre/second of additional flow, many measures will not be desirable if all costs are included, and others would be more cost-effective if those costs are not included.

Measures' costs (expressed in Euros per increased flow of 1 litre per second)

	Indirect and labour effects included			*Only direct effects included*		
Measures	*Water body I*	*Water body II*	*Water body III*	*Water body I*	*Water body II*	*Water body III*
A	672	2846	2522	672	2356	2522
B	2576	6466	5892	2103	4865	4433
C	3567	6366	7652	2684	4790	5758
D	4301	6845	9667	3236	5151	7274
E	5552	12624	12320	4177	9499	9270
F	6440	12887	15828	4846	9697	11910

Water body I = upstream; Water body II = middle stream; Water body III = downstream

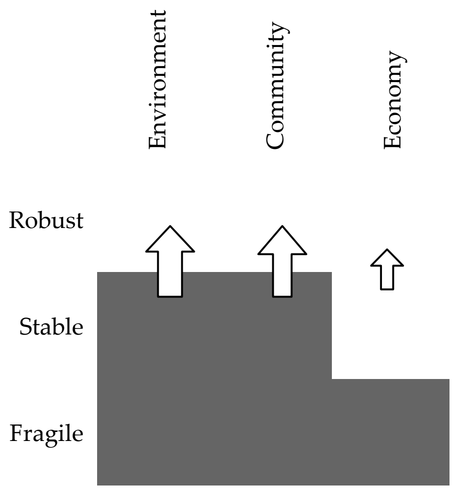
As a general rule, if cost differences are not very significant, an evaluation focused on direct costs may provide a valid starting point. However, if wider costs are thought to be important and sensitive to the regional or local economies, then they should be taken into account at least in the sensitivity analysis.

Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. See Annex V.

Illustration 9 – Analysis of Alternative Agricultural Measures: the Wise Use of Floodplains Project in the Erne Catchment (Ireland)

In order to engage stakeholders in thinking about local sustainability and the effectiveness of alternative measures to reach quality objectives, the Wise Use of Floodplains project in the Erne Catchment in Ireland used a simple model for public participation entitled the Local Sustainability Model (LSM).
The basic model can be supported with more detailed analysis or sub-models on specific issues. The participative process of establishing the baseline and discussing predicted impacts is as valuable as the result itself. The model is a simple three by three matrix. The columns represent three aspects of local sustainability: the natural environment, the community and its culture, and the economy. These are ranked as being Robust, Stable or Fragile. Communities can use this framework to assess how their area performs, shading in the model to provide a "picture" that local people can recognise.

THE LOCAL SUSTAINABILITY MODEL



Example of the local sustainability models use. Newtonbutler, Erne Catchment, February 2001.

1. Baseline conditions in the Catchment are represented by the shaded boxes.

2. Arrows show the predicted impacts of the measure being considered: a proposal to establish a single integrated cross-border Erne catchment management body.

The process of establishing the model leads a community through discussions on these three aspects using local knowledge and professional expertise. The example on the right shows an area which has a stable natural environment and community, but where the local economy is fragile. For potential catchment management options, or measures, arrows are drawn on the matrix reflecting the expected impacts. The model allows locals and professionals to share this qualitative impact assessment without the domination of one or the other.

Based on participatory work using tools such as the LSM, the Erne Wise Use of Floodplains Project developed options to restore water quality in the Erne catchment. An impact assessment study enabled comparison of their cost-effectiveness. Participatory work by the Erne project identified land management options and environmental impact criteria that were key to water quality in the catchment. These options included co-ordinated catchment-level changes to agricultural practices in the Erne, such as:

- Whole-scale buy-in to agri-environment schemes;
- Whole-scale adoption of mixed/organic farming methods; and
- Introduction of buffer strips on the most polluted rivers.

The economic, social and environmental impacts of these measures where analysed in a consultant's study that used a set of financial indicators, and ten weighted environmental and social criteria. The effectiveness scores were inevitably subjective, and encountered problems of double counting. Practitioners can be wary of these issues, and should develop and verify effectiveness scores with as wide a range of stakeholders as possible.

The management option's socio-environmental scores were compared to their predicted additional costs to taxpayers. The study revealed the current financial support for agriculture in the Erne catchment, and could be used to design more cost-effective policy modifications. The methodology developed in this project is interesting in the sense that it allows identification of cost-effective policies in relation to social and environmental objectives.

Source: I. Dickie (2002, forthcoming). See also the Royal Society for the Protection of Birds, www.rspb.org/economics/water

4. What are the Requirements for the Cost-effectiveness Analysis?

A broad-brush qualitative assessment provides a good foundation for the CEA. It can be used to identify the relevant costs, economic impacts and non-water environmental impacts of measures (see *Tasks 4* and *5* – see also the illustration on the methodology used in the Erne catchment in Ireland). However, a quantitative analysis is necessary on top of this, looking at (ranges of) estimates for the effects on water quality, and the financial costs of the main measures.

Where relevant, there should be a qualitative description of impacts over and above the direct costs already estimated. They may include:

- The nature, scale and significance of other considerations such as any wider economic and social impacts;
- Any distributional issues regarding who pays the costs;
- The ability of the sector to pay (or likelihood to pass on) the costs;
- Non-water environmental impacts of the measures; and
- The (administrative) costs of designing and implementing the measures.

As an option, the analysis can be taken further through the inclusion of the following actions:

- ***Developing nation-wide guidelines to assess cost-effectiveness.*** These guidelines should be developed in collaboration with the other regulators and representatives of the major stakeholders;

- ***Developing guidance, drawing on practical experiences of the effectiveness of main measures***. This would again probably be at national level and based on commonly applicable measures;

- ***Developing tailored formats for the estimation and presentation of cost estimates for the main types of measures for the major sectors.*** Costs should be presented in terms of changes in the cost elements arising from the proposed measures as compared with a business as usual baseline scenario. The appropriate expert and regulatory bodies should review carefully the estimates in relation to (ranges for) benchmark cost estimates for standard cost items[1]. These benchmark estimates could be based on expert review of available estimates for each standard cost item. Ranges for the cost estimates should be presented, clearly and explicitly so that these can form the basis for discussions with the main stakeholders concerned. The segments of the sector to which the estimates relate, and key assumptions and factors behind uncertainties surrounding the estimates should be set out. This would allow subsequent improvements, as better information is obtained through increasing experience in applying the control measures;

- ***In the middle of the following RBMP period (i.e. around 2013), there should be an evaluation to check the costs and effectiveness of the measures in the first agreed RBMP.*** This will provide a better basis for assessing the cost effectiveness of measures for the next RBMP. It will also offer opportunities for increased feedback and system learning.

Annex I – Illustration of Format for Presenting Costs

1. CAPITAL COSTS			
Cost component	Cost (euro)		
	Low estimate	Medium estimate	High estimate
Pollution control equipment costs			
Primary pollution control equipment	450,000	600,000	750,000
Auxiliary equipment	112,500	150,000	187,500
Instrumentation	150,000	200,000	250,000
Modifications to existing equipment	157,500	210,000	262,500
Other (please specify)			
Total pollution control equipment costs	870,000	1,160,000	1,450,000
Installation costs			
Land costs	37,500	50,000	62,500
General site preparation	15,000	20,000	25,000
Buildings and civil works (eg foundations/ supports, electrical, piping, insulation etc)	225,000	300,000	375,000
Labour and materials (engineering, construction and field expenses)	157,500	210,000	262,500
Other (please specify)			
Total Installation costs	435,000	580,000	725,000
Other capital costs			
Project definition, design and planning	75,000	100,000	125,000
Testing and start-up costs	15,000	20,000	25,000
Contingency	22,500	30,000	37,500
Working capital	15,000	20,000	25,000
End of life clean up costs	30,000	40,000	50,000
Miscellaneous	37,500	50,000	62,500
Total other capital costs	195,000	260,000	325,000
Total capital costs	1,500,000	2,000,000	2,500,000

*Note: Present Value of costs =Capex + (opex * discount multiplier). Equivalent annual cost = NPV/discount rate multiplier. Discount multiplier = 14.59 for a 30 year investment at 6%.*

2. CHANGE IN OPERATING COSTS (INC. REVENUE CHANGES)			
Cost component	Annual costs (Euro p.a.)		
	Low estimate	Medium estimate	High estimate
Change in operating costs			
Additional labour for operation and maintenance	15,000	20,000	25,000
Water/sewerage			
Fuel/energy costs	12,000	12,000	12,000
(specify energy/fuel type)	Grid	Grid	Grid
Reagent costs			
Waste treatment and disposal	22,190	32,920	43,650
Other materials and parts			
Change in operating costs of any additional pollution abatement equipment operation			
Insurance			
Taxes on property			
Environmental tax/charge			
Other general overheads (please specify)			
Total additional operating costs	49,190	64,920	80,650
Change in revenues			
By-products recovered/sold	2,000	2,000	2,000
Other (please specify)			
Total revenues			
Net change in operating costs	47,190	62,920	78,650

3. TOTAL COSTS – PRESENT VALUE or EQUIVALENT ANNUAL COST (Euro)			
Cost component	Low estimate	Medium estimate	High estimate
Total capital costs	1,500,000	2,000,000	2,500,000
Net change in operating costs	47,19(	62,92(	78,65(
Economic assumptions			
Economic life of equipment			
Discount rate			
Net present value	2,188,500	2,918,000	3,647,500
Equivalent annual cost	150,000	200,000	250,000

Source: Fisher, JCD, Holt, A, (2001).

PRICING AS AN ECONOMIC INSTRUMENT

Directive references: *Article 9*
3-Step Approach: *Step 1.3 and 3.1*, and potentially *Step 3.2*
See other information sheets: *Estimating Costs, Reporting on Cost Recovery*

This information sheet helps you assess the effectiveness of pricing as a measure to achieve the environmental objectives of the Directive.

1. Objective

The Directive recognises water charges and prices as basic measures for achieving its environmental objectives. This information sheet proposes and illustrates a range of methods for assessing whether pricing policies (actual or proposed) provide appropriate incentives for users to reduce their water uses and pollution. This is particularly relevant for two main purposes:

- Assessing the incentive properties of current pricing policies (*Step 1.3*) and preparing the basis for the introduction of pricing policies that provide adequate incentives for users to use water resources efficiently (*Step 3.4* and *Article 9*);
- Reporting on the tasks and measures proposed for ensuring that pricing plays its due role in enhancing the protection of water resources (*Articles 9 & 13 and Annex VII*).

2. How does pricing impact water consumption and discharge?

The price of water is an important variable that influences the amount of water used by users or the amount of pollution they discharge. As such, it can be a useful measure to introduce (amongst others) in order to meet the objectives of the Directive:

- Pricing policies can help make users more efficient in their use of water resources by giving them financial incentives to shift to technologies and practices that ensure a better use of available resources or act to reduce leakage; and
- Similarly, on the dirty water side, pricing can incentivise users to shift to less polluting input or processes, eliminate highly polluting production lines and practices, or install treatment facilities to treat polluted water before discharging it into the environment.

To yield such effects, however, pricing policies must be designed so that a reduction in the quantity of water used or pollution discharged would lead to a simultaneous reduction in the total bill for the particular user. ***This means that the price of water should be proportional to the quantity of water used or the pollution generated*** (see *Box 1).*

Incentive-based pricing can be more or less effective depending on its design…

- **Seasonal tariff variations** can be very effective to provide higher incentives for saving water in periods with high scarcity only (e.g. increase *a* - see *Box 1* - in the summer);
- **Increasing-block tariffs,** with dissuasive charges above a certain level, can be an effective way of reducing demand from users with very high demands;

- **High fixed charges** (F in *Box 1*) and low volumetric charges might reduce tariffs' incentive properties on demand.

Box 1 – Tariffs with a volumetric element are key to introducing incentives

To introduce incentives, tariffs should incorporate a volumetric element, such as:

$P = F + a.Q + b.Y,$ *where,*

P = total price for water services (e.g. supply of water, treatment);
F = a component of the price related to fixed costs (e.g. overheads);
a = the charge per unit of water extracted from the environment and used, linked to variable costs (e.g. pumping costs);
Q = the total quantity of water used;
b = the charge per unit of pollution produced and emitted to the environment, linked to variable costs (e.g. variables costs of treatment, emission charges etc; and
Y = the total volume of pollution emitted.

… and on user demand characteristics – for example, the impact of volumetric tariffs on demand might be negligible:

- If the total bill represents a small portion of a user's production costs or income;
- If the water user has no alternative (due to technical, social or economic constraints).

An important measure of whether or not pricing policies are likely to have an impact on water demand is the price elasticity of demand (see *Box 2*).

Box 2 – Estimating the Price Elasticity of Demand

How responsive the demand for water is to a change in price is usually captured by the notion of "price elasticity of demand". This parameter is defined as the percentage change in quantity demanded when the price changes, divided by the percentage change in price (see Box 3 for an illustration). For example, suppose that a 10 percent increase in price reduces the water demand by 5 percent, then the price elasticity of demand is -5/10 = -0.5. The higher the price elasticity in absolute terms, the more responsive the demand will be to changes in prices. The price elasticity of pollution discharge can be computed in a similar way.

- ***It is important to note that elasticity can vary through time as well as across different levels of consumption along the demand curve.***

To develop efficient incentive pricing policies and to assess the impact of these policies on water uses and pollution and on the state of the environment, it is important to answer the following questions:

1. Are prices paid proportional to water used or amount of pollution discharged (see *Illustration 1* for an example of water pricing structures)?
2. How do changes in prices (for different starting points) lead to changes in the demand for water or the pollution discharged, i.e. depending on the price elasticity of demand?
3. How do changes in demand affect water status, in order to understand the effectiveness of pricing as a measure for reaching the environmental objectives of the Directive?

In addition, it is important to take into account other policies than those strictly related to water might affect demand (see *Illustration 3*). The second point represents the main challenge from an economic point of view and is illustrated in *Box 3*.

Illustration 1 – Current water pricing in the Vouga river basin (Portugal)

In the Vouga River Basin, information on water pricing was sought during a scoping exercise for the implementation of the WFD. It was found that this information was available for only 18 out of 32 municipalities and for the two existing public irrigation facilities. The outstanding feature of the data was the wide disparity both in tariff structures and in actual tariff levels.

For the irrigation facilities, the users' payments are unrelated to actual water consumption (in one case there are per ha charges and in another case per hour) so pricing has no incentive impact whatsoever.

As with municipal systems, all require a monthly fixed payment (which varies with the requested capacity) as well as a variable (per m^3) charge. However, there are great disparities in the rates and in the structure of the variable part.

- For similar capacity, the monthly fixed payment can be very different; for instance, for 30 mm it varies between 1.05€ and 9.5€.
- Only three municipalities have seasonal rates (higher in the summer, mainly for larger consumption) .
- The majority of municipalities charge different rates for domestic, industrial, agricultural, and other users; only two apply the same rates to all users.
- Some municipalities charge a constant price per m^3 for the industrial and commercial sectors. Otherwise, increasing block rates are applied but in two distinctive ways: for one group (e.g Mira) the price charged on all water consumed is defined by the block where total consumption falls (average price equals the block rate), whereas in the other group (e.g. Castro Daire) the price charged for each m^3 is the price of the block where that m^3 is (average price equals a weighted average of block rates). The first scheme is meant to discourage excessive consumption, although it implies highly irregular marginal prices as shown below:

Municipality	**Block structure and prices**				**Marginal Price for 5th m^3**	**Marginal Price for 6th m^3**	**Marginal Price for 7th m^3**
Mira	**Block**	**0-5 m^3**	**0-10 m^3**	**0-15 m^3**			
	€/m^3	0.22	0.30	0.37	0.22	0.70	0.30
Castro Daire	**Block**	**0-5 m^3**	**6-10 m^3**	**11-20m^3**			
	€/m^3	0.17	0.30	0.55	0.17	0.30	0.30

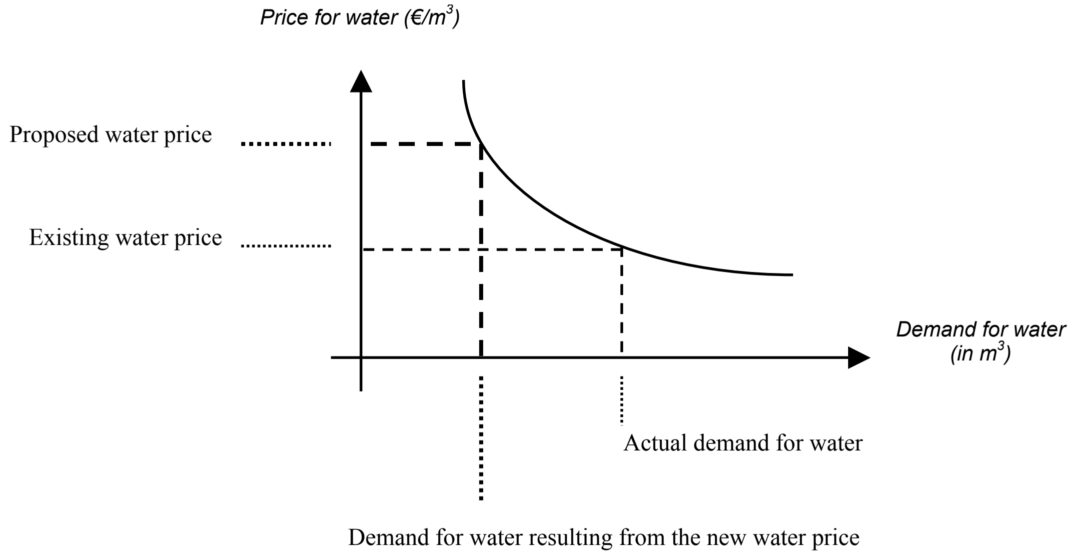
Such disparity is especially odd considering that many municipalities are connected to the same bulk supplier, who charges all municipalities the same price per m^3. Moreover, there are a few cases where the rates charged by municipalities are lower than this bulk rate.

Source: P. Mendes. Scoping key elements of the economic analysis in the Vouga River Basin. See Annex V.

Box 3 – The impact of price on demand

The approach promoted by the Directive in the use of pricing as an instrument (or as a measure) consists of defining an environmental goal and calculating the total amount to be paid by users (the tariff), by category of user, in order to achieve this goal. However, given that pricing is only one measure amongst a package of measures, this might be difficult.

Box 3 (continued)



3. Possible Approaches for Assessing the Relation Water Prices/Water Demands

Several approaches can be used to assess the relation between water prices and water demand/pollution discharged, as follows:

Interviewing key experts/stakeholders: ask people "what if?" questions in order to assess how they would react to a proposed change in the tariff structure or level.

Reviewing existing literature. Several types of literature reviews can be performed:

- Review of analysis already carried out in the river basin of interest. If this analysis is not out-dated and no significant changes in key variables and policies have taken place since it was carried out, then it can potentially provide useful information.
- Review of analysis carried out for the same uses under the same hydrological and socio-economic conditions.
- General literature review, although this is likely to yield only very general results (such as agriculture is more responsive to price changes than households) that have no direct practical use in performing economic analysis for the Directive.

Developing statistical models for specific sectors. Two types of statistical models can be developed:

- *Cross-sectional models* can be developed for comparing responses to price changes of user groups that face different price regimes at a given point in time; and
- *Time-series models* can be developed for comparing responses to price changes of a user group across a period of time.

The simplest statistical approach may consist of comparing two (or more) groups of users that face two (or more) different price regimes (e.g. an irrigation district paying a flat rate for its water versus an irrigation district where volumetric charges are applied). However, extrapolating the results of such comparisons to other situations is very delicate.

Such models have mostly been developed for analysing price incentive issues for the household sector, as information on the volumes used and prices tends to be more readily available (see *Illustration 2*).

Developing behavioural models for specific sectors. Optimisation models can be developed for the various economic sectors to estimate the relationship between the price for water and the water demand/pollution discharged. Such models are formed by combinations of mathematical equations that attempt to reproduce real decision-making processes that aim at achieving given objectives (e.g. maximising the total income of a firm) taking account of key technical, legal and economic constraints faced by given economic sectors. Key tasks for carrying out behavioural modelling are outlined in *Box 4*, and an application is shown in *Illustration 4*.

Behavioural models can be built for an entire sector, i.e. accounting for all farmers of a given irrigation scheme, if the different users of this sector are homogeneous in terms of objectives, constraints, conditions. However, if different users in the sector face a wide variety of strategies and constraints, it is more appropriate to identify key types of users and develop models for each user type.

Illustration 2 – An application of time series modelling: Did water pricing play a role in reducing household water consumption in Athens, Greece?

Severe droughts at the end of the 1980s and beginning of the 1990s have resulted in significant changes in the price of water in the region of Athens. Such price changes have taken place in a policy context where the need for demand management beside efforts to discover and tap additional water resources is increasingly recognised.

To assess the role water pricing can play to reduce the water consumption in the domestic and small commercial sector supplied by the Athens Water Utility Company (EYDAP), a statistical analysis of past price and water consumption information was undertaken to estimate the price elasticity of water demand. The information used for this statistical analysis included (i) the quarterly water consumption (in m^3) for an eleven-year period (1989 to 1999) for a sample of 1000 consumers, and (ii) price levels for the same period.

It is to be expected that consumers with different levels of water consumption will react differently to water price changes. Therefore, a statistical cluster analysis has been performed to identify five groups of consumers based on their quarterly consumption levels: (i) lower than 15 m^3; (ii) between 15 and 30 m^3; (iii) between 30 and 45 m^3; (iv) between 45 and 60 m^3; (v) above 60 m^3.

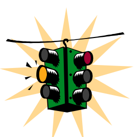
The analysis of the consumption information showed that the dramatic price increase that took place in the third quarter of 1992 led to a significant reduction in the demand for water. This was the case for all the groups of consumers except for the group with the lowest water consumption (lower than 15 m^3), which did not alter its consumption.

On the basis of the quarterly water consumption and (deflated/constant) price levels, a statistical time series model was developed to estimate the long-term price elasticity of the water consumption for each consumer group. To validate the model, all variables were tested and found to be statistically significant.

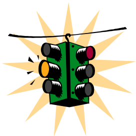
The results show that the long-term price elasticity of demand for the different consumer groups range from -0.58 for the low consumption group (i.e. quarterly consumption lower than 15 m^3) to -0.87 for the very large consumption group (i.e. quarterly consumption above 60 m^3). These elasticity values show that water pricing (combined with active information and awareness campaign) can be used as a major measure for controlling water consumption in the Athens area, and that price changes are likely to have a greater impact on the water consumption of large water consumers as compared to small water consumers.

Box 4 - Key Tasks for developing behavioural models

1. Define key relationships between input and output variables and basic assumptions. Make sure you characterise the relationships between price and demand for water;
2. Using a first set of information from a real-life situation, estimate the parameters of these relationships through calibration of the model to ensure that the model adequately reproduces the conditions of this real life situation;
3. Using a second set of information from a real-life a situation (e.g. a different year), validate the model by ensuring that it can also predict adequately the second situation;
4. Run simulations with the validated model, e.g. change the parameter 'water price' in the model and run the model so that it estimates the related demand for water, and repeat this operation as many times as required;
5. Use the results from several simulations, to build the water demand curve and estimate the price elasticity of demand for different price levels.



Look Out! Models can be useful tools to organise participation
Models can be very useful tools to support discussion between experts and stakeholders about various water pricing measures. This element of assistance to the discussion is sometimes more important than its exact predictions.



Look Out! Reality is often more complicated than simple models

Many countries in Central and Eastern Europe have witnessed significant changes in water consumptions since the early 1990s. Such changes were as much related to changes in water prices (following a cut in subsidies to the water sector) than to overall economic changes, which resulted in a drop in economic activity. Therefore, to account for changes in non-water related variables in time series models would be particularly important when analysing changes in water demand and tariffs in Central & Eastern Europe.

Illustration 3 – Taking account of broader policies to estimate the incentive properties of pricing policies: the impact of the CAP in Cidacos (Spain)

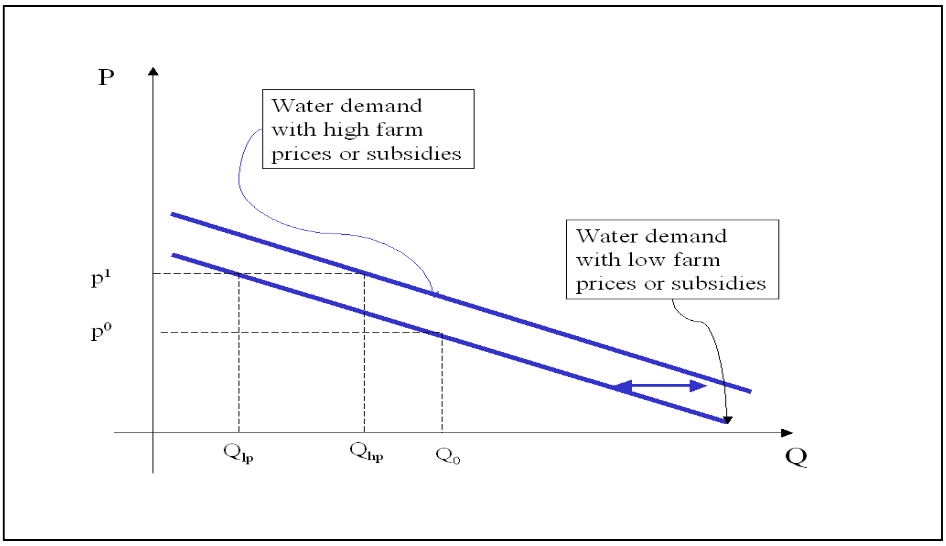
That the Common Agricultural Policy (CAP) programmes affect farmers' water demand has been thoroughly documented across many European countries and regions. This implies that water-pricing policies will, in principle, have different effects depending on the Agricultural policy scenario considered.

In general, those CAP programmes that provide measures of income support decoupled from production would not affect irrigators' water demand. By contrast, those other programmes based on production subsidies will have a significant impact on farmers' water demand. In the latter case, farmers' responses to pricing policies will be sensitive to the agricultural policy scenario. The way to ascertain the effects of a change of policy in farmers' water demand is to simulate farmers' behaviour. In the absence of calibrated models, relevant to the area of study, one can formulate several policy scenarios and carry out simple sensitivity analysis.

In the Cidacos case study, the following scenarios were proposed:

A key implication of assuming one or another CAP scenario is that irrigation water demand will shift as the economic conditions improve or get worse. This implies that farmers' demand response to water pricing will change as agricultural prices or product subsidies change. This is reflected in the following graph:

		Correcting factors	
Scenario	***Costs***	***Prices***	***CAP - subsidies***
Business-as-usual	1	1	1
Agrarian	0.9	1.2	1
WTO - liberalisation	1	0.8	0.7



*Source: Ministerio de Medio Ambiente, Gobierno de Navarra, 'Virtual Scoping Study of the Cost Effectiveness Analysis in the Cidacos River'. **See Annex V.***

Illustration 4 – An application of behavioural modelling: Demand for irrigation water in Tarquinia (Lazio, Italy)

Water uses in the Marta River are characterised by a high number of users and a high degree of pollution. Keeping the river water flow above a minimum vital level is seen as a key target for both water management and sanitary authorities. However, this requires lower demand from some economic sectors during periods of significant water shortages. Therefore, to assess the role water pricing could play to reduce water demand from agriculture, an economic linear programming model was developed for the entire irrigation system.

Following a detailed analysis of the irrigation and farming systems, the model was developed as an aggregation of sub-models representative of the conditions faced by different farm types (facing a variety of land, labour, financial constraints) and for different districts of the irrigation systems with different water availability and distribution systems. The objective of the linear programming model was to maximise the gross income from agricultural activities, taking account of the key constraints faced by farmers in terms of labour availability, access to hired labour, land constraints, crop rotation constraints, and water availability. Built with a series of equations (equalities or inequalities) that link input (fertiliser, labour, water) and output (yield, gross margin) variables, and for a variety of crops, the model identifies the combination of crops that yields the highest farm income within the limits of the constraints set. By comparing the cropping pattern estimated by the model with real cropping pattern information for two different years, the model was calibrated and validated.

The model was then used to assess the changes in cropping patterns, farm income and water consumption that would result from changes in the price of irrigation water. The model was run several times with different price levels, and the water consumption resulting from each price level and computed by the model were recorded.

The results obtained from different model simulations, i.e. the water demand and the price elasticity of the water demand for different price levels, are presented in the table.

	Actual water demand	Proposed water price increase			
		+5%	**+15%**	**+25%**	**+50%**
Water demand (1000 m³)	9,212	8,851	8,733	8,479	8,116
Price elasticity of demand		-0.78	-0.35	-0.32	-0.24

Note that the estimated values of water demand and elasticity are valid for conditions close to actual agricultural policies. Significant changes in these policies, for example a change in subsidies and agricultural product price support, would change the opportunities and constraints faced by farmers, and therefore also their responses to changes in the price level.

4. What is the most appropriate approach, depending on circumstances?

Each approach set out above has its strengths and weaknesses and is more or less suitable according to circumstances, as presented in the Table below.

Approach	*Strengths*	*Weaknesses*	*When is it suited?*
Interviewing experts and key stakeholders	➢ Fits participatory approaches to water management	➢ Rough estimates ➢ Difficult to evaluate robustness of the information	➢ Local level with a limited number of users (e.g. one specific industrial plant in a sub-basin) ➢ Comparing limited number of very significant tariff changes
Reviewing existing literature	➢ Can be useful as a first proxy ➢ Potentially less costly than other approaches	➢ Limited amounts of literature available (mostly on household uses – little on pollution)	➢ Analysis in the first instance to define the type of measures
Developing statistical models	➢ Can have strong predictive powers in a given area	➢ Difficult to extrapolate the results	➢ More complex, multi-variate models might sometimes be needed
Developing behavioural models	➢ Attempts to reproduce real-decision making processes on the part of users	➢ Mostly accurate for ranges of parameters not too far from real life conditions	➢ To model behaviour for an entire sector, particularly if users are rather homogeneous in terms of strategies and constraints

The approach chosen to assess the relationship between the price and water use will also depend on the information, human and time resources available. For example, undertaking a literature review and discussing pricing policy changes with key stakeholders may be the only short-term possibility. However, in the long run, it is important to ensure that more robust and accurate results are achieved. It is also important to ensure that the analysis and level of details are appropriate for the issues of the river basin considered.

Clearly, the incentive dimension of pricing policies is key, but not the only measure to achieve the WFD objectives. The definition of new pricing policies also needs to consider cost recovery issues, as specified in Article 9 (see *Reporting on Cost Recovery*). In addition, other social, environmental and economic effects of proposed changes in water pricing policies must be taken into account when designing these new policies.

DISPROPORTIONATE COSTS

Directive references: *Article 4* (Paragraphs 3-5 and 7)
3-Step Approach: *Step 3.3*
See other information sheets: *Estimating Costs*, *Cost-effectiveness Analysis*

This information sheet will help you assess whether the costs of the Programme of Measures are disproportionate and whether derogation from the Directive's objectives could be justified following an assessment of costs and benefits.

1. When is it Necessary to Assess Disproportionate Costs?

This information sheet presents an approach for determining whether the total costs of the programme of measures are disproportionately costly or expensive and is relevant for justifying derogation. In particular, this approach is relevant for:

- **Designating heavily modified water bodies (HMWB)** when the beneficial objectives served by the artificial or modified characteristics of the water body cannot, for reasons including **disproportionate costs**, reasonably be achieved by other means, which are a significantly better environmental option (*Article 4.3*, see *Illustration 1* for further explanation);

- **Time derogation** when completing the improvements in the status of water bodies within the time scale would be **disproportionately expensive** (*Article 4.4*, see *Illustration 2* for further explanation);

- **Less stringent environmental objectives** when the achievement of these objectives would be infeasible or **disproportionately expensive** and the environmental and socio-economic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing **disproportionate costs** (*Article 4.5*); and

- Failure to achieve good status or failure to prevent deterioration as a result of **new modifications** to the water body when the beneficial objectives served by those modifications or alterations of the water body cannot for reasons including **disproportionate costs** be achieved by other means, which are a significantly better environmental option (*Article 4.7*).

The analysis of whether costs are disproportionate or not will need to be initiated relatively early in the process, around 2006, in order to ensure that the public can be consulted on such a key element of the economic assessment (by 2008) and that work can be coordinated with other expertise, as this process will require a combination of technical and economic expertise. The precise tasks of the analysis are described in *Box 5* at the end of this information sheet. If achievement of good quality status is only possible after 2015, an interim lower objective can be set for 2015 and a time derogation be registered in the RBMP. If in 2009 it is considered that good status cannot be achieved by 2027, less stringent objectives should be registered in the plan.

Illustration 1 - Disproportionate costs in the designation of Heavily Modified Water Bodies: An example from the Netherlands

For the designation of Heavily Modified Water Bodies (according to *Article 4.3*), alternatives for the beneficial objectives of a water body must be presented. These alternatives must be: 1) technically feasible, 2) a better environmental option and 3) not cause disproportionate costs. In the EU Heavily Modified Waters working group, four typical Dutch water bodies* were tested for designation as HMWB. A summary of the alternatives to maintain the beneficial objectives and the costs involved is presented in the table below.

This table shows that although the absolute costs (A) may seem high for the 1st case (1000 millions €), the relative costs as expressed per km² of restored water body (B) show a different picture. There, the costs are still the highest for the first case (6000 €/km²), but they are much more of a similar order of magnitude than in the other cases. Another criteria presented is to scale the costs to the size of the catchment (C), which in this example reverses the conclusion drawn from approach A: now the costs for case 1 are the lowest (5 €/km²). The exercise presented illustrates how such 'benchmarking' can present a framework to assess the disproportionality of costs. It should be kept in mind that in the final conclusion, issues such as the ability to pay and the (intrinsic) value of the type of ecosystem restored should also be considered.

Designation task	Dammed estuary (1)	Lowland brook (2)	Shallow lakes (3)
Measures to achieve GES	Destruction of dam	Land reclamation for restoration of stream morphology	Land reclamation for restoration lake hydrology
Define beneficial objectives?	Safety, fresh water supply	Safety, agriculture	Safety, fresh water supply, recreation
Define alternative for beneficial objective?	Higher dikes to maintain safety and relocate fresh water intake points	Create retention areas; buy alternative land for agriculture; mitigate costs of yield losses	Displace the present habitation (no cost estimate); use surface water for drinking water
A: Costs of alternative	1000 millions €	1.5 million € + 2.5 million € /y	PM + 9.24 million €/year
B: Costs per km² (restored) water body	6000 K€/km²	3600 K€/km²	PM+3900 K€/km²
C: Costs per km² catchment	5 K€/km²	500 K€/km²	PM+2000 K€/km²

* *The waterbodies studied were: The Haringvliet Estuary (Dammed estuary; 1); the Hagmolenbeek (Lowland brook ; 2) and the Veluwerandmeren & Loosdrechtse Plassen (Shallow lakes; 3)*

Source: M. van Wijngaarden (2002, forthcoming).

Illustration 2 - Considerations for time derogation in the Alsace (France)

In the Southwestern part of the Alsace region (France), the potash mining activity has generated an intense pollution of the Rhine valley alluvial aquifer. The pollution originates from huge waste dumps containing salt (sodium chloride) that have accumulated since the early 1900s and have been leached by rainfall. The polluted water has progressively extended over time following the aquifer's flow lines. Different measures aimed at reducing the salt emission, increasing salt elimination and accelerating dilution through artificial aquifer recharge have been implemented, resulting in a significant reduction of pressure over the last 10 years. However, these measures are unlikely to be sufficient to restore the quality of the aquifer by 2015.

A hydrodynamic model was used to test current measures' effectiveness. The results indicate that if the measures already implemented are maintained from 2002-2027, the salt concentration of water will fall below 250 mg/l in the whole aquifer (to drinking standard) and approximately 96% of the salt present in the aquifer in 2002 will be removed. From this model it can be concluded that the current measures are sufficient to achieve the objective of good status in 2027, and that a time derogation can be defined if the more intensive, alternative programs of measures are disproportionately expensive. This scenario corresponds to the "third best" option in the Figures 1 and 2 below.

Two more intensive alternatives were defined to meet the 2015 objective. The first (or "second best") option consists of constructing more lines of pumping wells to prevent migration of the pollution plume, to meet the environmental objective in 2021. The "first best" option consists of constructing hydraulic barriers plus a line of pumping wells and a pipeline to evacuate the pumped water, and will meet the environmental objectives by 2015. Costs for these options are still being studied. The following charts show the three options according to their ability to meet the quality and time objectives.

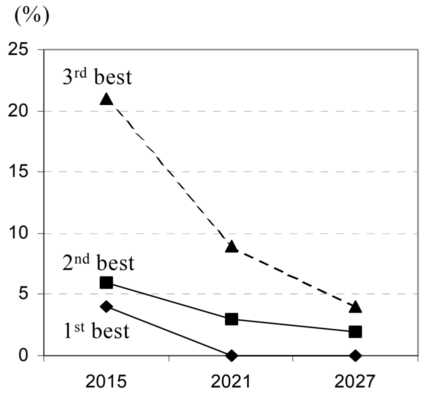


Figure 1: Quantity of salt remaining in the aquifer as a percentage of the initial stock

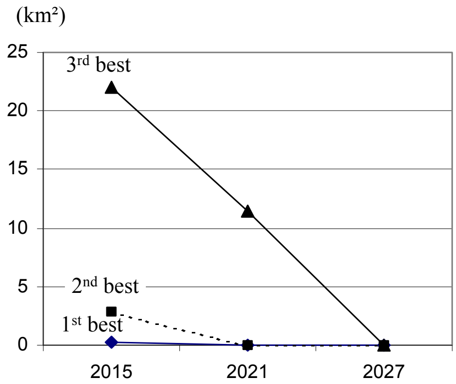


Figure 2: Area where the salt concentration is higher than 250 mg/l for the three scenario (in

A preliminary analysis shows that the benefits of the first best option likely to accrue to direct uses (agriculture, industry, drinking water) are not likely to be significant in either monetary value or through employment or economic development. However, the benefits for *future* uses (avoided costs of treating polluted drinking water; gains from future industrial/economic development; etc.) may be more significant.

The work presented is ongoing and does not yet answer the question of the type of derogation needed for the Alsace aquifer. Part of the discussion concerns the choice of simulation model to determine the effectiveness of the alternative programmes of measures. In this case, the comparison of technical effectiveness of various programmes of measures has been undertaken using a simple hydrodynamic model. The major difficulty here was choosing the level of detail for the model, which determines the accuracy of results and the confidence stakeholders may have in the analysis. The choice of model also raises the question about how uncertainty should be considered in the logical argument to justify a derogation. Should the Member State petition for a derogation when the models say that the gap between the simulated quality of water and the objectives is expected to be close to 20% with a possible error of plus or minus 25%? Or should the error be expressed in number of years (the objective will be reached in 2015 plus or minus 5 years)?

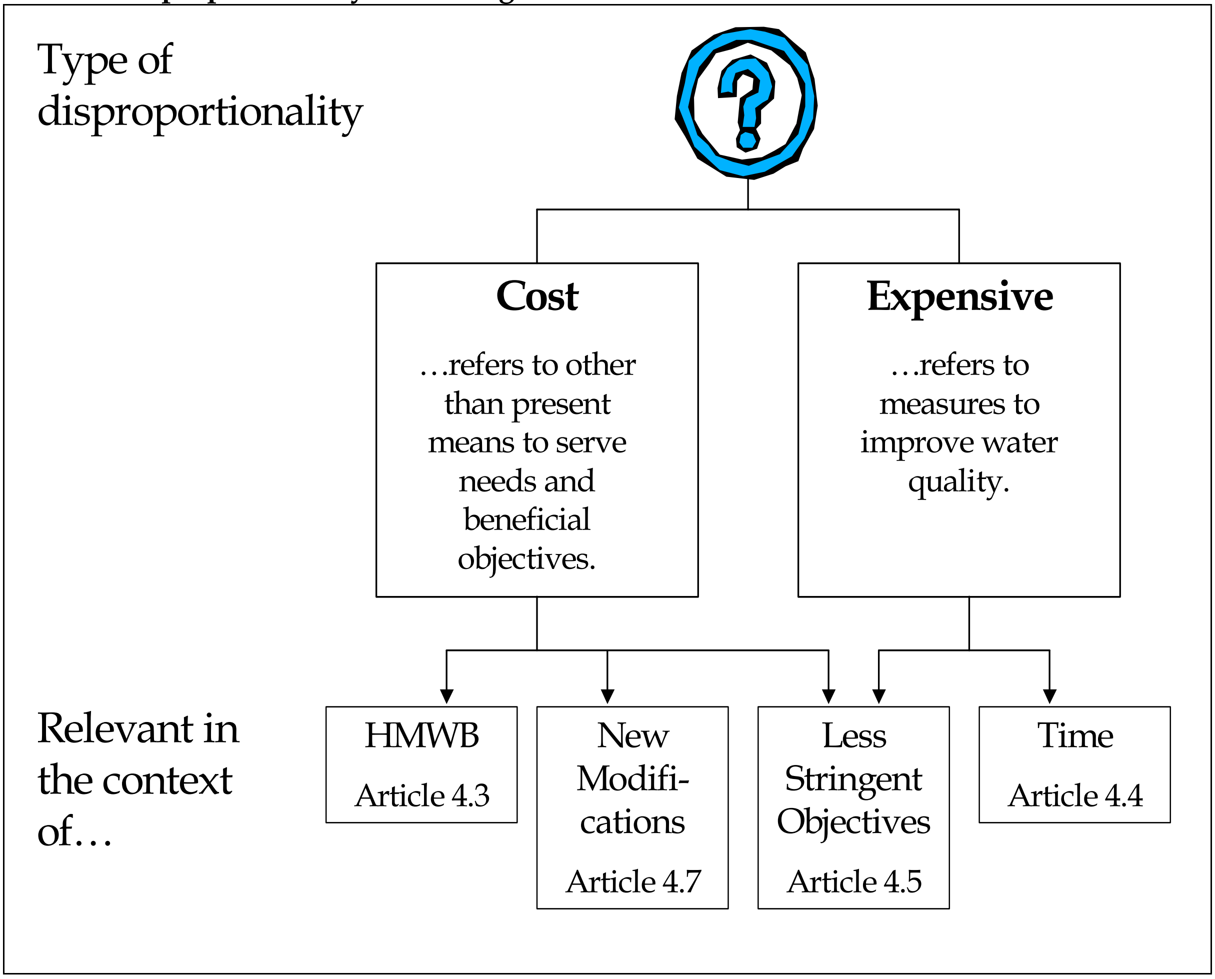
Source: J.D. Rinaudo and C. Pelouin. Assessing disproportionate costs in the Alscae aquifer. See Annex V.

2. What are the Key Issues?

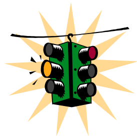
'Disproportionate cost' refers to 'beneficial objectives being achieved by other means' in the context of designations, derogations and new modifications. 'Disproportionately expensive' refers to measures for improving water quality (see *Box 1*). This has two implications:

- Extended time or less stringent objectives can be justified on the grounds of **disproportionately expensive** measures (Articles 4.4 and 4.5); and
- Designation of heavily modified water bodies, new modifications and (again) less stringent objectives can be justified when the current needs and socio-economic benefits accruing from this activity cannot be achieved by other means not entailing **disproportionate costs**.

Box 1 – Disproportionality and Derogation



Note that Annex IV.II of this Guidance document goes into more details for explaining the procedure to follow for designating Heavily Modified Water Bodies (Article 4.3) and justifying a derogation based on Article 4.7 following new modification/activity.



Look Out! Estimating all benefits to society…
One source of identification of impacts of qualitative benefits is the consultation required under *Article 14.1* of the Directive. However, note that benefits that may accrue to 'interested parties' are not the only source of benefits. The analysis should attempt to fully incorporate all possible impacts so that the total economic value to society as a whole is established.

How Should Alternatives be Compared?

When derogation relates to heavily modified water bodies, new modifications or less stringent environmental objectives, it must be ensured that the human activity affecting these waters, and the environmental and socio-economic benefits accruing from this activity cannot be achieved by other means not entailing disproportionate costs. If there is an alternative option to achieving the objectives, its costs must be assessed so that they are not disproportionate. Importantly, alternative means should be a significantly better environmental option, not restricted simply to water quality. 'Significant' implies that the benefits from the alternative means should be appreciable compared to the original means.

What is Disproportionate?

Illustration 3 demonstrates in a simplified way what 'disproportionate cost' means. Whether an improvement is found to be disproportionately expensive or 'other means' disproportionately costly will be decided by individual Member States on a case-by-case basis (see *Illustration 4* for an example on decision making). Ultimately, disproportionality is a political judgement informed by economic information. Given the uncertainty around estimates of costs and benefits, bear in mind that:

- Disproportionality should not begin at the point where measured costs simply exceed quantifiable benefits;
- The assessment of costs and benefits will have to include qualitative costs and benefits as well as quantitative;
- The margin by which costs exceed benefits should be appreciable and have a high level of confidence;
- In the context of disproportionality the decision maker may also want to take into consideration the ability to pay of those affected by the measures and some information on this may be required. This analysis might need to be disaggregated to the level of separate socio-economic groups and sectors, especially if ability-to-pay is an issue for a particular group within the basin. Whether and where this information is available depends on the scale or geographical area for which costs and benefits are considered (see *Box 2*).

Illustration 3 – The interpretation of the Directive on disproportionate costs

A sewage treatment works is discharging effluents into a watercourse (a small stream), which is a tributary and flows 1km down from the discharge into a much larger water body (a large river). The water quality of the tributary is of moderate status whilst the river is of good status. The tributary runs under roads and through an industrial estate.

The costs of possible measures, modifications to the works and a higher level of treatment for the effluent are high. The quantifiable benefits of improving the water quality on the tributary are appraised using benefits transfer techniques and a check is made to see if there would be any regeneration benefits. The measured benefits are low; in addition there are qualitative benefits from improving the ecology but there is little possibility of improved recreational use or angling. It is decided for the 2009-2015 River Basin Management Plan that the costs of reaching the environmental objectives of the tributary significantly exceed the benefits and the measures are judged to be disproportionately expensive. A lower quality objective, moderate, is recorded in the RBMP for this particular water body.

For the less stringent objectives to be set, the 'environmental and socio-economic needs served by such human activity cannot be achieved by other means which are a significantly better environmental option not entailing *disproportionate costs*'. The need served by the human activity is the disposal of sewage effluent.

In accordance with the Directive, an alternative option to higher levels of treatment, which meets the need, is explored with the water company. It is possible to build a pipeline from the treatment plant directly to the river and thus bypassing the tributary. Due to large dilution factors, this measure would have no negative impact on the water quality status of the river and is a better environmental option because the tributary is cleaner than under the first option.

The cost and benefits of each of each option are compared but it is found that the pipeline option would be disproportionately costly, as it would entail much higher costs but only a slight increase in benefits. Having explored other means of meeting the needs of achieving the human activity and rejected them, the less stringent objective for the water body is set.

Source: J. Fisher. Integrated appraisal for river basin management plans. See Annex V.

Illustration 4 - Using an expert panel to assess disproportionate costs in the Scheldt estuary

The Scheldt estuary, located in part in the Netherlands and Belgium, is an important source of economic land use and navigation. However, increased socio-economic pressure has directly affected the estuary's morphology, and resulted in a reduction of the system's natural dynamics. After developing a base case scenario and trend line to project future impacts, an expert panel representing both countries was convened to assess whether the costs of measures to reach the desired ecological objectives were disproportionate.

The panel first assessed the broader socio-economic effects of two alternative scenarios: either reducing the navigation channel by not allowing further deepening, or to reduce economic land use by de-poldering agricultural land. For these, a distinction was made between significant effects with associated costs, non-significant effects and effects that were significant but not quantifiable. The first category of effects was introduced to the cost-effectiveness analysis, and included increased salinity, yielding extra drinking water costs; increased scarcity of land, impacting land prices; and effects on recreation in the region, yielding either a loss or gain of added value. Because these broader effects were included, the outcome of the original cost-effectiveness analysis changed, and the option for no further deepening became the most cost-effective.

Non-significant effects were then disregarded, while the third category of effects was left for the final stage of preparing the river basin management plan, the assessment of the financial implication, organisation and instrumentation of the plan. These included the effect of the chosen option on political relations between the Netherlands and Belgium, societal support for the option, and the effect on regional employment.

To judge whether the no further deepening option posed disproportionate costs, the panel used the following criteria:

- Ability to pay
- Cost comparison
- Cost-benefit assessment

Because public funds are sufficient to finance the proposed measures and the relative costs for private sector are relatively low (maximum 38 million Eur/yr, with an added value of 16 billion Eur/yr), ability to pay was not deemed disproportionate. A more extensive analysis would include the use of indicators, the effect on the sector's competitiveness, or on the financial solvability of the private sector company.

Cost comparison was also not considered disproportionate. A similar project in the Netherlands was sited as having relatively higher costs to reach comparable ecological gains. For a more extensive cost comparison, the panel proposed to use the indicator of costs per ha of comparable nature quality created in another domestic project.

An analysis of functional impacts demonstrated a difficulty in quantifying ecological objectives and societal benefits for the purposes of a cost-benefit assessment. As the other criteria showed that the costs of reaching ecological objectives in the Scheldt estuary were not disproportionate, the panel decided not to assess the relative value of costs and benefits.

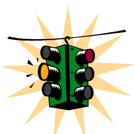
Source: Beckers et al., Scheldt International River Basin: Testing elements of the 3-step approach. *See Annex V.*

Box 2 – Issues to consider when assessing ability to pay

- Do we consider ability to pay of certain sectors separately, i.e. households, agriculture and industry? Are cross subsidies possible for the financing of measures, say between agriculture and industry?
- At what administrative level do we consider ability to pay? At the level of the river basin, at regional or national levels?
- Are state subsidies possible?
- How do ability to pay and cost recovery levels interact?
- How far do we look for costs and benefits accruing from a measure? Only within the river basin?
- How do we treat costs and benefits of a measure that occur upstream or downstream and affect other water bodies?

3. What are the Practical Tasks for Assessing Disproportionality?

The analysis required for justifying derogation from the environmental objectives of the Directive is directly related to methodologies used for carrying out cost and benefit assessments. However, the approach proposed here is substantially different and reflects the requirements of the Directive.



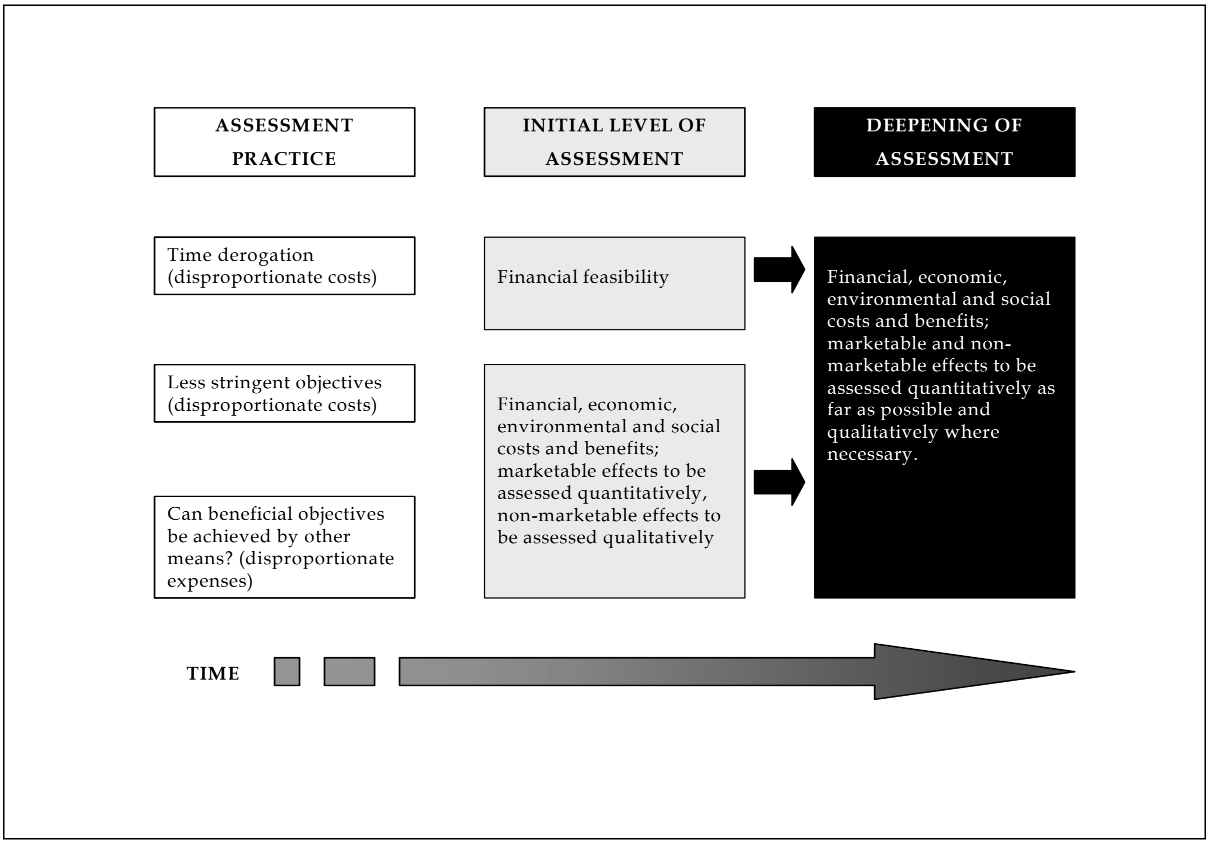
Look Out! Traditional cost-benefit analysis

The traditional Cost Benefit *Analysis* (CBA) estimates the *net benefit* (or cost) of an activity, policy or project in monetary terms (often for a country). The valuations are based on "the willingness to pay of the potential gainers for the benefits they will receive as a result of the [activities], and on the willingness of potential losers to accept compensation for the losses they will incur."(1) In layman terms, this means comparing variations of quantifiable costs and benefits, caused by the activities, for people affected by the policy under consideration.

(1) The Department for Transport, Local Government and the Regions (DTLR) in the UK (2001), 'Multi Criteria Analysis: A Manual'

The overall process for assessing disproportionality is presented in *Box 3*, showing a gradual deepening in the level of assessment.

Box 3 – Assessing Disproportionality



Assessing disproportionality

As shown in *Box 3*, the assessment may be largely qualitative at the initial stages. Costs and benefits of the alternative programmes of measures for achieving different water quality states should be identified and listed, though not necessarily fully valued. The extent to which costs and benefits are valued will depend on the type of derogation:

- For derogation on the basis of less stringent objectives and for the assessment of 'other means' (HMWB and new modifications), a fully quantified valuation may be undertaken for market costs and benefits and described in qualitative terms for non-market cost and benefit items (see *Box 4* for an example of a checklist).

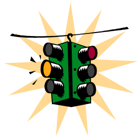
- For time derogations, simple financial criteria may suffice to prove disproportionality as this is only a temporary measure. Over time, and as more robust quantitative data are collected, a deepening of the assessment could include a more extensive identification and quantification of costs and benefits, including financial, economic, environmental and social costs and benefits.

Box4 – Example of AST Checklist

Option Definition and description

		Option Description	Problem	EAV of costs £/yr
Option **Ribble nutrient strategy** **BUC:** B2015-->M2021-->M2027 **Option** G2015-->G2021-->G2027		Undertake STW optimization, operational P removal and negotiated agreement with Dairy farmers	Excessive input of nutrient which limits the achievement of good status	370,000
Objectives, criteria and impacts				
Environment				
Ecology of waterbody		**Qualitative measure**	**Quantitative measure**	**Assessment**
Diverse Ecology	a	Adequate reduction in the risk of meeting good status so that good status should be achieved by 2015	Risk of not meeting good status reduced from 55% to 5% delivering 27km of water to good status	+ve
River bank habitat	a	Factors not limiting at present, but improved structure of riparian zone	No quantitative measure	*[BT value = £8,000/yr]*
Water quality	a	Water quality (nutrient status limiting) this limit is removed.	Reduction in nutrient loading from 150% of capacity to 80%	+ve
Local Air Quality	b	No impact	No quantitative measure	n.a.
Regional Air Quality	c	No impact	No quantitative measure	n.a.
Global Air Quality	d	Reduced methane emissions from dairy farming	Reduction of approximately 300 tonnes of CO2 equivalents	BT value = £1,500/yr
Landscape	e	No impact	No quantitative measure	n.a.
Townscape	e	No impact	No quantitative measure	n.a.
Heritage of historic resources	e	No impact	No quantitative measure	n.a.
Economic value of water (priced) uses	f			
Public water supply		No impact	No quantitative measure	n.a.
Industrial water use		No impact	No quantitative measure	n.a.
Agricultural water use		No impact	No quantitative measure	n.a.
Commercial fisheries/shellfisheries		No impact	No quantitative measure	n.a.
Economic value of water (unpriced) uses	g			
Informal recreation		Improved recreation opportunities from moderate to good	15km of improved bankside habitat involving 1000 visits per year	BT value = 25,000/yr
Angling		Improved fishery quality from T2 to T1	Delivers 8km of improved fishery involving 250 angling visits per year	BT value = 40,000/yr
Other in-stream uses		None	No quantitative measure	n.a.
Residential amenity		No impact	No quantitative measure	n.a.
Commercial amenity		No impact	No quantitative measure	n.a.
Wider economic impacts	h			
Employment		No impact	No quantitative measure	n.a.
Regeneration		Rural economic diversification	No quantitative measure	+ve
Competitiveness		No impact	No quantitative measure	n.a.
Social	I			
Social inclusion/cohesion		No impact	No quantitative measure	n.a.
Distribution of costs and benefits		Improvement	Index of cost recovery improves from 0.90 to 0.95	+ve
Policy Integration	j			
Land-use policy		Consistent with land use policies	No quantitative measure	+ve
Other government policies		Generally supportive of other government policies	No quantitative measure	+ve

However, it is often very difficult to obtain (reliable) quantitative estimates for all costs and benefits, which are necessary for conducting a CBA. Therefore, the proposed disproportionality assessment should use quantified costs and benefits where possible, **but it strongly emphasises the need to incorporate qualitative measures where quantitative ones are unavailable.** The final output should look at developing a table where qualitative, quantitative and monetary information is presented so that trade-offs are transparent, e.g. when justifying derogation for a specific water body (see *Illustration 5*).



Look Out! There is a link between the disproportionate cost analysis and the cost-effectiveness analysis: don't do it twice!

In terms of process, it is important to bear in mind that the evaluation of costs and benefits for the purpose of the disproportionality assessment will take place after having conducted a cost-effectiveness analysis for the construction of a programme of measures. As a result, it will not be necessary to estimate again the costs (and potentially, benefits) that will have been estimated for the cost-effectiveness analysis. For the measures that are part of the programme of measures, the cost-effectiveness analysis will have estimated:

- The direct or financial costs (including administrative costs);
- The non-water related environmental costs;
- The resource costs;
- The indirect costs (i.e. related losses in economic production).

In addition to this, and for the measures in the Programme, the disproportionality assessment will require estimating the induced costs (i.e. costs for other sectors of the economy) and the water-related environmental costs. However, in some cases, the induced costs might have been estimated as part as a follow-up to the cost For measures outside of the programme, all these cost categories will need to be estimated. A fully quantified cost benefit analysis is not required for each assessment, however costs and benefits should be quantified wherever possible – in particular where markets exist.

Illustration 5 – Assessing disproportionate costs in the Ribble (United Kingdom)

This illustration outlines the procedure carried out for assessing disproportionate costs of measures in the Ribble basin. Drawing on potential impacts (identified by the stakeholder consultation processes at the earlier Objective specification stage), a matrix of costs and benefits for two identified measures was developed (see tables). The first (high cost) Option 1 achieves good status by 2015. The second (lower cost) Option 2 achieves good status by 2021. An important prior consideration here is the extent to which costs can be reduced by extending the time scales for the measures.

Given the potentially large number of water bodies for which more detailed assessments may be needed, it will not be possible to carry out original research and surveys in each and every case. Consequently, some form of 'benefits transfer' (BT) analysis may be needed, which would apply valuations derived from other studies of similar cases.

The results of the application of the BT exercise are shown in the tables, where monetarised benefits of £74,500/yr (Option 1) and £51,000/yr (Option 2) are estimated.

Given the high incremental cost of Option 1 (£300,000/yr), the results of the benefits transfer exercise are taken as evidence that a timing derogation, allowing good status in 2021 (Option 2) to be the objective, may be an appropriate strategy. In this case, however, it is assumed that there is sufficient uncertainty about whether the BT exercise fully captures the important differences between the options – particularly in terms of the incremental ecological improvements, which are not measured well in the existing benefits transfer information, and the rural economic diversification benefits. It is decided, therefore, that this water body should be passed on for further stakeholder consultation.

However, in-depth stakeholder consultation can only cover a small number of people. In addition, the consultation raises the issue of how to value some types of benefits – those that accrue to relatively affluent sections of the population, who may not reside within the basin but may bring in tourist revenues. These are issues that require a more broad-based assessment, using a more representative sample of affected people. Consequently, the conclusion of the assessment is, that this water body should be one of those, on which further stated preference analysis would be undertaken.

Analysis of the data (through modelling) reveals an implicit valuation of the benefits of Option 1 at £40,000/yr.

This information would then be incorporated into the revised AST to facilitate the overall decision making by DEFRA (Department of Environment, Food and Rural Affairs). This final decision-making would be done on the basis of all the evidence – quantitative, qualitative and indicator (monetary and non-monetary). In this case, the implication would be that the goal of good water status in 2015 would involve disproportionate costs.

Source: J. Fisher. Integrated appraisal for river basin management plans. See Annex V.

Option 1 – Undertaking STW Optimisation, Operational P Removal and Negotiated Agreement with Dairy Farmers

Option Definition and description

Option	**Ribble nutrient strategy**			**Option Description**	**Problem**	**EAV of costs £/yr**
BUC:	B2015-->M2021-->M2027					370,000
Option	G2015-->G2021-->G2027			Undertake STW optimization, operational P removal and negotiated agreement with Dairy farmers	Excessive input of nutrient which limits the achievement of good status	
Objectives, criteria and impacts						
Environment						
	Ecology of Wate-body		Note	**Qualitative measure**	**Quantitative measure**	**Assessment**
		Diverse Ecology	a	Adequate reduction in the risk of meeting good status so that good status should be achieved by 2015	Risk of not meeting good status reduced from 55% to 5% delivering 27km of water to good status	+ve
		River bank habitat	a	Factors not limiting at present, but improved structure of riparian zone	No quantitative measure	*[BT value = £8,000/yr]*
		Water quality	a	Water quality (nutrient status limiting) this limit is removed.	Reduction in nutrient loading from 150% of capacity to 80%	+ve
	Local Air Quality		b	No impact	No quantitative measure	n.a.
	Regional Air Quality		c	No impact	No quantitative measure	n.a.
	Greenhouse gasses/climate change		d	Reduced methane emissions from dairy farming	Reduction of approximately 300 tonnes of CO_2 equivalents	BT value = £1,500/yr
	Landscape		e	No impact	No quantitative measure	n.a.
	Townscape		e	No impact	No quantitative measure	n.a.
	Heritage of historic resources		e	No impact	No quantitative measure	n.a.
Economic value of water (priced) uses			f			
	Public water supply			No impact	No quantitative measure	n.a.
	Industrial water use			No impact	No quantitative measure	n.a.
	Agricultural water use			No impact	No quantitative measure	n.a.
	Commercial fisheries/shellfisheries			No impact	No quantitative measure	n.a.
Economic value of water (unpriced) uses			g			
	Informal recreation			Improved recreation opportunities from moderate to good	15km of improved bankside habitat involving 1000 visits per year	BT value = 25,000/yr
	Angling			Improved fishery quality from T2 to T1	Delivers 8km of improved fishery involving 250 angling visits per year	BT value = 40,000/yr
	Other in-stream uses			None	No quantitative measure	n.a.
	Residential amenity			No impact	No quantitative measure	n.a.
	Commercial amenity			No impact	No quantitative measure	n.a.
Wider economic impacts			h			
	Employment			No impact	No quantitative measure	n.a.
	Regeneration			Rural economic diversification	No quantitative measure	+ve
	Competitiveness			No impact	No quantitative measure	n.a.
Social			I			
	Social inclusion/cohesion			No impact	No quantitative measure	n.a.
	Distribution of costs and benefits			Improvement	Index of cost recovery improves from 0.90 to 0.95	+ve
Policy Integration			j			
	Land-use policy			Consistent with land use policies	No quantitative measure	+ve
	Other government policies			Generally supportive of other government policies	No quantitative measure	+ve

Option 2 – Undertaking Operational P Removal and Negotiated Agreement with Dairy Farmers

Option Definition and description

Option **BUC:** Option	**Ribble nutrient strategy** B2015-->M2021-->M2027 M2015-->G2021-->G2027		**Option Description** Operational P removal and negotiated agreement with Dairy farmers	**Problem** Excessive input of nutrient which limits the achievement of good status	**EAV of costs £/yr** 70,000
Objectives, criteria and impacts					
Environment					
	Ecology of waterbody	Note	**Qualitative measure**	**Quantitative measure**	**Assessment**
	Diverse Ecology	a	Adequate reduction in the risk of meeting good status so that good status should be achieved by 2021	Risk of not meeting good status reduced from 55% to 5% delivering 27km of water to good status in 2021	+ve
	River bank habitat	a	Factors not limiting at present, but improved structure of riparian zone	No quantitative measure	*[BT value = 5,000/yr]*
	Water quality	a	Water quality (nutrient status limiting) this limit is removed.	Reduction in nutrient loading from 150% of capacity to 80%	+ve
	Local Air Quality	b	No impact	No quantitative measure	n.a.
	Regional Air Quality	c	No impact	No quantitative measure	n.a.
	Greenhouse gasses/climate change	d	Reduced methane emissions from dairy farming	Reduction of approximately 300 tonnes of CO2 equivalents	BT value = £1,000/yr
	Landscape	e	No impact	No quantitative measure	n.a.
	Townscape	e	No impact	No quantitative measure	n.a.
	Heritage of historic resources	e	No impact	No quantitative measure	n.a.
Economic value of water (priced) uses		f			
	Public water supply		No impact	No quantitative measure	n.a.
	Industrial water use		No impact	No quantitative measure	n.a.
	Agricultural water use		No impact	No quantitative measure	n.a.
	Commercial fisheries/shellfisheries		No impact	No quantitative measure	n.a.
Economic value of water (unpriced) uses		g			
	Informal recreation		Improved recreation opportunities from moderate to good	15km of improved bankside habitat involving 1000 visits per year	BT value = 15,000/yr
	Angling		Improved fishery quality from T2 to T1	Delivers 8km of improved fishery involving 250 angling visits per year	BT value = 30,000/yr
	Other in-stream uses		None	No quantitative measure	n.a.
	Residential amenity		No impact	No quantitative measure	n.a.
	Commercial amenity		No impact	No quantitative measure	n.a.
Wider economic impacts		h			
	Employment		No impact	No quantitative measure	n.a.
	Regeneration		Rural economic diversification	No quantitative measure	+ve
	Competitiveness		No impact	No quantitative measure	n.a.
Social		I			
	Social inclusion/cohesion		No impact	No quantitative measure	n.a.
	Distribution of costs and benefits		Improvement	Index of cost recovery improves from 0.90 to 0.95	+ve
Policy Integration		j			
	Land-use policy		Consistent with land use policies	No quantitative measure	+ve
	Other government policies		Generally supportive of other government policies	No quantitative measure	+ve

3. What are Practical Tasks for Comparing Costs and Benefits?

The rest of this information sheet deals in more details with the process for carrying out the estimation of costs and benefits. Attempting to measure the net benefits for the whole economy would often prove impossible. For the assessment of costs and benefits, the assessment would therefore need to be limited to the parties *directly* concerned with the policy measures.

In fact, a derogation would often be sought for failing to meet the Directive's objectives at the level of a particular water body and the definition of the appropriate scale of analysis would also have to do with the spatial and hydrological characteristics of the water body. For example, in order to reach the environmental objectives for a small, acidified lake, you may consider implementing a liming scheme. When looking at the costs and benefits you may want to restrict the impact assessment to the population of the one village immediately adjacent to that lake. However, if you are dealing with pollution of a complex groundwater system, the scale of impacts may necessitate the inclusion of neighbouring villages.

Tasks for assessing costs and benefits of reaching the environmental objectives of the Directive are presented in *Figure 1* below and explained in the following sections.

Figure 1 – A Process for Assessing Costs and Benefits

KEY TASKS	... AND QUESTIONS
1. Define scale of assessment	What are the spatial and hydrological characteristics of the water body? → Who will be affected by the measures? → To what extent? Directly or Indirectly?
2. Identify types of costs and benefits	What types of costs and benefits can be derived from the measures? What types of costs and benefits can reliably be estimated? Are they quantitative, qualitative or monetary? Which costs and benefits appear significant?
3. Choose methodology	Which costs and benefits should be derived quantitatively, qualitatively and monetarily? Is it necessary to apply different methods? What resources are available for original research (time and finance)?
4. Collect data	What studies have been done before? → Do we need to create first hand data or can we rely on other sources?
5. Assess costs and benefits	Are quantitative, qualitative and monetary impacts important? Have all types been given sufficient weight? How can all these different impacts be presented in a way that facilitates decision-making?

Task 1 - Define the Key Groups Potentially Affected by the Measures Aimed at Achieving Good Water Status

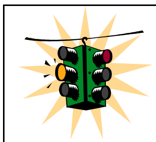
Achieving the environmental objectives set out in the Directive will have varying impact on a large number of parties. However, all these groups will not be affected directly and, as mentioned above, it might be difficult to assess the induced costs and benefits and unnecessary or too difficult to assess the tertiary impacts. Remember that every assessment has finite resources. It is therefore important to concentrate on groups that are most affected.

Task 2 – Identify the Types of Costs and Benefits Arising from the Measures and Focus on the Significant Ones

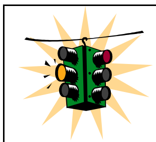
Once the user groups have been identified, the types of costs and benefits that are likely to arise must be determined. In *Task 3.2* of the guidance, the most cost-effective measures will need to be identified (see *Estimating Costs* and Task 4 of the *Cost Effectiveness Analysis*). Following this task, the direct and non-water related environmental costs of the programme of measures will be known.

It is important to evaluate and focus on the costs and benefits likely to have an important impact, for example those that appear to have a significant effect compared with the baseline (see *Baseline Scenario*) and, within them, identify the different types of benefits (requiring different methods of measurements).

As an option, a matrix can usefully be created to map and rank the different types and significance of benefits arising from achieving the objectives. This matrix/list should include both qualitative and quantitative benefits and address issues such as magnitude of benefits, importance in relation to decision-making and other criteria for selecting or deselecting different benefits.



Look Out! ...for double counting when estimating costs and benefits!
The use of multiple methods may be important to compare different measures of costs and benefits, however it is important to avoid *double counting*. Double counting may arise because the same benefits have been 'picked up' several times (either as benefits or avoided costs) within the same study or separate studies when adding values across and will overstate the expected benefits.



... and don't forget to take into account uncertainty of the estimates!
It is important to describe the sources of estimates and confidence for all sources of cost and benefit estimates. This is important since all estimations of benefits, whether qualitative or quantitative, can be more or less certain. In particular, when using benefits transfer, using estimates in a context that they were not derived in may induce a high degree of uncertainty.

Task 3 – Choose Methodology for Estimating Costs and Benefits and Collect Data

Estimating Costs outlines the many ways of measuring environmental costs and benefits. Different methods can be used to estimate different types of benefits and are appropriate in different contexts. For example, direct market methods are applicable when environmental goods are factor inputs and changes in availability or quality affects production costs and a qualitative description is useful under some circumstances. *Box 6* in *Estimating Costs* gives some guidance on when to choose what methodology.

Task 4 - Carry Out the Assessment of Costs and Benefits

It is important to assess *all* costs and benefits, including qualitative and quantitative (biophysical and monetary) items. By now, you will have estimated the cost of the measures (see *Task 3.1* of the guidance). Similarly, you will have assessed environmental impacts of the programmes of measures. You should describe these clearly.

If unit costs have been derived and will be applied to the environmental impacts, the number of units and cost or benefit per unit must be presented. This will facilitate the estimation of total effects: for unitary measures the unit environmental cost or benefits should be multiplied by the quantified biophysical impact.

- ***Note that technical expertise (e.g. from experts working on the analysis of pressures and imapcts) is necessary for producing such estimates. There is a need to integrate economic and biophysical impacts in the Cost Benefit Assessment.***

Where qualitative values are minor, these shall at least be listed alongside the quantitative estimates of net benefits to support/contradict them. However, it is likely that qualitative values will play an important role. Look at each sector for costs and benefits, and present these in a way that aids decision-making. A tool could usefully be developed to achieve an efficient presentation. A rough example of such a presentation for reducing anthropogenic pressures (mainly nitrates) in agriculture is given in *Illustration 6*.

Like the Cost Effectiveness Analysis, the Cost Benefit Assessment may be incremental. In initial stages, a large part of the assessment may be qualitative, this will help single out the key issues. Quantitative estimates (both monetary and biophysical) may be added over time and as more research is complete and data are available.

Neither point estimates nor simple qualitative descriptions will alone give the decision maker information on how changes to different variables may affect the results of the assessment. It is therefore important to address uncertainty in the information presented, whether quantitative or qualitative (see Illustration 1), to guard for different outcomes. Focus on the variables that are likely to have the greatest impact, and define how much these may change and would have to change in order to change the outcome of the whole assessment.

Illustration 6 - Improving the quality of water by reducing pressures from intensive agriculture by application of the proposed cost and benefit assessment methodology: An example

Objective: to improve the quality of water by reducing pressures from intensive agriculture. The assessment looks at the costs of investments and measures needed to improve water quality (and reduce the level of nitrates) and the expected benefits from these measures.

Task 1 – Define the Key Groups for the Assessment. Intensive agriculture over a limited area gives rise to a high anthropogenic pressure on the natural environment. This pressure may manifest itself in a deteriorating quality of surface waters, and may have negative economic impacts on a wide range of users, the most significant impacts being on the immediate geographical area on agriculture, industry, households, shellfish fishery and some recreational activities.

Task 2 – Identify the Types of Costs and Benefits. The programme of measures to restore water quality will affect users in the following ways:

Types of Costs

Agriculture	Restoring water quality entails investments and preventive measures and charging (a tax) on pollutants (an internalised environmental cost that can be treated as a financial cost). For curative measures, the storage and application of slurry have to be improved. This has different cost implications depending on animals. Preventive measures mainly involve the creation of grass strips, on 1 to 3 percent of the useful agricultural area. There is also a tax on every kilo of excess nitrogen.
Local Authorities and Households	To improve water quality, there has to be investment in municipal wastewater disposal systems. This involves investment and operating costs
Industry	Industry has to invest in wastewater disposal to preserve water quality and will also increase the operating costs. Costs will have a negative effect on the unit production cost of businesses.

Types of Benefits

Local Authorities and Households	In effect, local authorities are choosing between investing in measures to protect the drinking water supply, or to bear greater health risks. An improvement in water quality makes it possible to avoid these costs (generate benefits)
Recreational Activities	Households use surface and coastal water resources for recreational activities (bathing, sport, walks, fishing). Deterioration in the quality will lead to either less use or greater health risks, all of which entail a cost.
Effect on Shellfish Culture.	Water quality has a significant effect on the selling price of shellfish and the volume produced: where quality is good, it permits direct sales, giving bigger margins and a higher value added (packaging, dispatch, sale).

Task 3 - Choose Methodology and Collect Data. Once the types of benefits and costs have been identified, it is possible to select the appropriate methodologies for collecting data on benefits. Note that the costs will need to be assessed in the cost-effectiveness analysis required by *Task 3.2*. In this particular case, different methodologies are chosen for different benefit components.

Task 4 – Assess Costs and Benefits. Quantitative estimates of costs and benefits are aggregated and qualitative estimates are listed alongside.

Choice of Methods

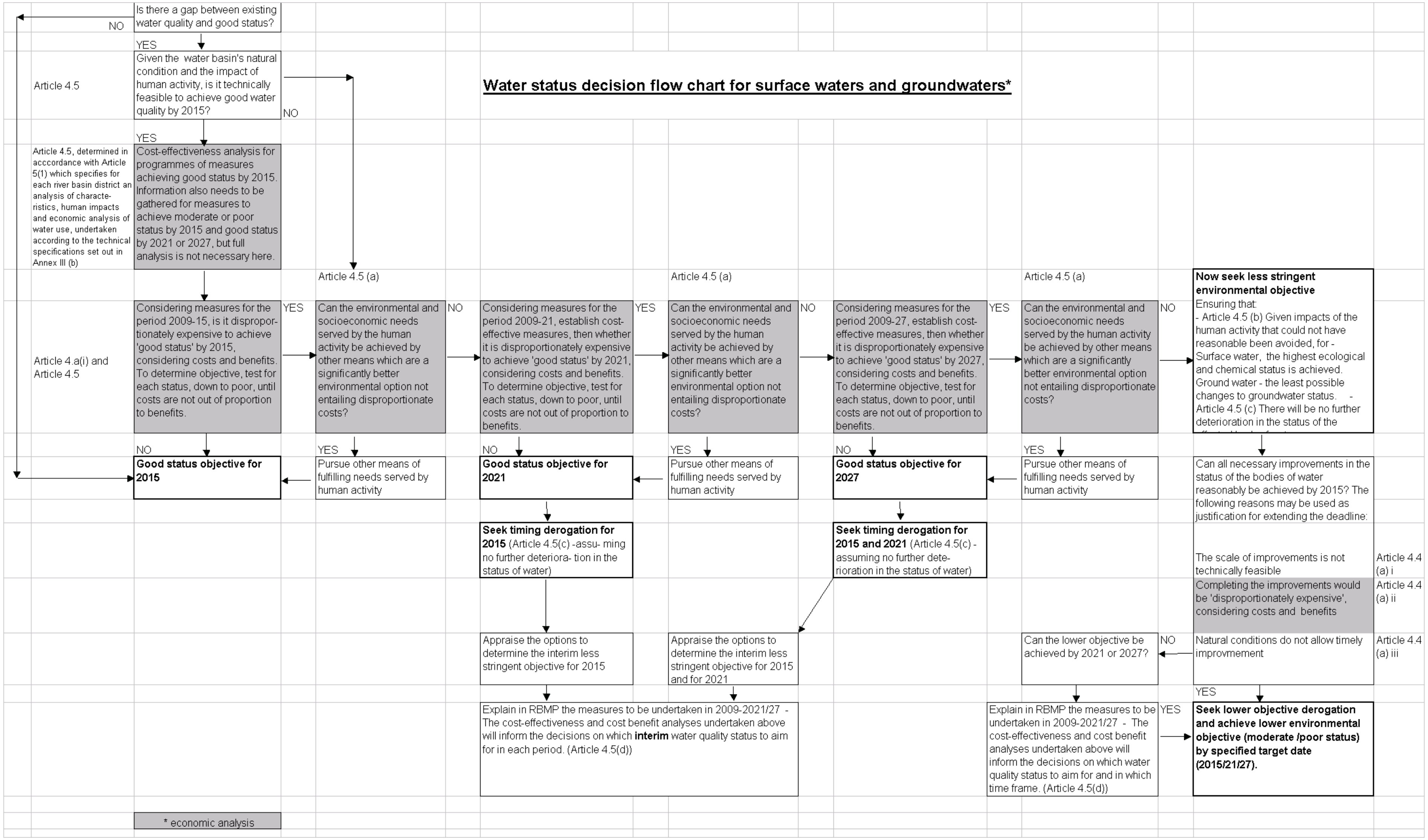
Local Authorities and Households	The costs of protection stem from the setting up of de-nitration or de-nitrification plants, changes in agricultural practices and the search for alternative sources of supply. Benefits are measured through the costs of mitigation.
Recreational Activities	Contingent valuations have been used to show households' willingness to pay to preserve these recreational uses (on top of their current water bills). These figures correspond to the user gain linked to bathing and to the value attributed to catching certain species of fish.
Effect on Shellfish Culture.	The economic loss for shellfish culture is reflected in the loss of production and profits for businesses located in the polluted area. Direct market methods were therefore used to elicit the values.

(Illustration 6 continued)

Figure 1- Assessing Costs and Benefits: ***Reducing the Anthropogenic Pressures (Mainly Nitrates) of Agriculture***

SECTOR	ITEMS	ASSESSMENT TYPE		
		Qualitative	**Quantitative** (Biophysical impacts)	**Quantitative** (Monetary impacts)
	Costs	-	-	(€)
Agriculture	Pollution control (slurry) of stock farming			
	Changing farming practices			
	Grass strips creation (preventative measure)			
Industry	*All industry* Wastewater disposal improvements: Investment costs Operating cost			
	Shellfish industry Investments in purification system			
Households	Effects of more costly wastewater disposal			
	Benefits	-	-	(€)
Agriculture	-			
Households	Avoided health costs from improved drinking water			
	Costs avoided for treatment of drinking water (de-nitration and de-nitrification plants)			
Industry	*Agri-business* Costs avoided for de-nitrification			
Recreation	Improved recreational quality			

Box 5 – Decision Flowchart



IV.II Analysis of derogation for New Modifications/Activities (Article 4.7) and for Designating Heavily Modified Water Bodies (Article 4.3)

INTRODUCTION

This annex (IV.II (a) and (b)) presents two methodological notes dealing with issues and options for integrating economics into:

- The justification for derogation that may be obtained for new modifications and activities that lead to a deterioration in water body status, following the provisions of Article 4.7 of the Water Framework Directive
- The designation process for heavily modified water bodies as specified in Article 4.3 of the Water Framework Directive

Both elements of the Directive have been combined in this annex because of similarities between the role economics can play in both processes. As they stand, these notes intend to provide *food for thought* for experts that will be involved in such processes.

The note on the designation of heavily modified water bodies has been developed by the working group dealing specifically with heavily modified water bodies in the Common Implementation Strategy (see *Annex I.I*), with input from the *WATECO* working group. It will be further modified, refined and integrated into the final guidance that will be developed by the heavily modified water bodies working group.

IV.II(a) Economic Assessment of New Modifications and New Activities Entailing a Deterioration in Water Status

The Directive recognises the need for integrating economic, social and operational concerns in the development of programme of measures and integrated river basin management plans. Consequently, it allows Member States to derogate from the Directive's environmental objectives, either through the setting of a longer time frame or lower environmental objectives.

This Annex focuses on derogation that may be obtained for new modifications and activities that lead to a deterioration in water body status, following the provisions of *Article 4.7* of the Directive. It suggests a possible approach in seven steps for carrying out the analysis aimed at supporting decisions on derogation, based on a close analysis of the text of the Directive. **Figure 1** summarises this approach and suggests that a number of conditions must be fulfilled in order to justify obtaining a derogation on the basis of Article 4.7.

Box 1 – Summary provisions of Articles 4.7 and 4.8 of the Directive

Member States will not be in breach of the Directive when:

- Failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of **new modifications** to the physical characteristics of a surface water body or **alterations** to the level of bodies of groundwater, or
- Failure to prevent deterioration from high status to good status of a body of surface water is the result of **new sustainable development activities**.

The conditions in which such derogation can be obtained are restricted in the following sections of Article 4.7, which provides that Member States have to ensure that:

(a) **All practical steps** are taken to **mitigate** the adverse impact on the status of the water body;

(c) The reasons for those modifications or alterations are of **overriding public interest and/or the benefits to the environment and to society** of achieving the objectives [of the Directive] are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development;

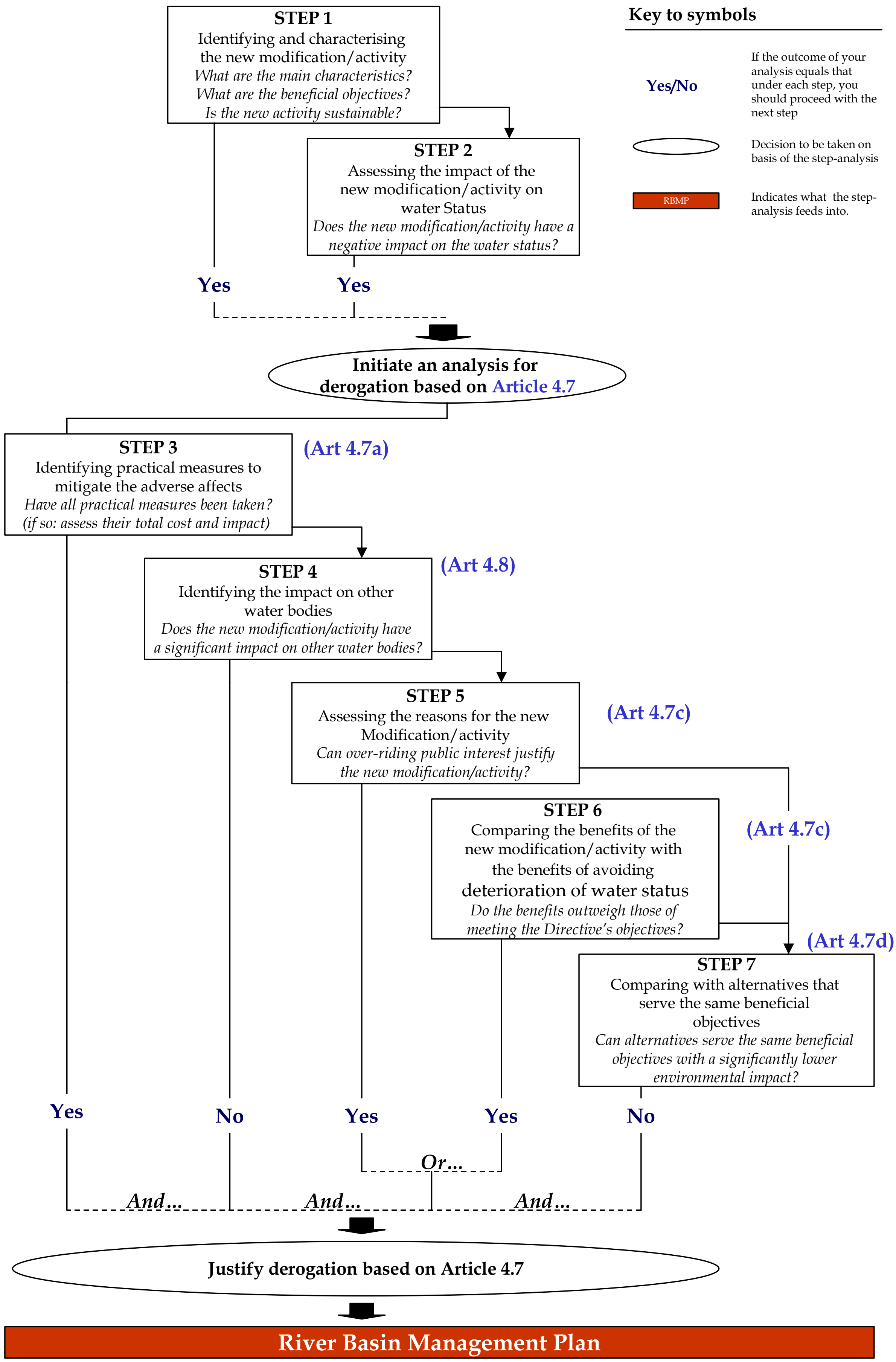
(d) The **beneficial objectives** served by those modifications or alterations of the water body **cannot for reasons of technical feasibility or disproportionate costs be achieved by other means**, which are a significantly better environmental option.

Finally, Article 4.8 sets some conditions for the use of Article 4.7 by stating:

- When applying paragraph… 7 [of Article 4], a Member State shall ensure that the application **does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water** within the same river basin district and is consistent with the implementation of other Community environmental legislation.

The rest of this document sets out a possible approach for making Article 4.7 operational. Note that this analysis could either take place in isolation when a new modification/activity emerges (for example, a new cropping pattern or a new industrial activity) or within the context of the application of the 3-Step Approach used for implementing the economic aspects of the Directive as a whole. In fact, many of the steps described below closely resemble some of the steps of the 3-Step Approach.

Figure 1 – Economic Assessment of New Modifications and Activities



The analysis below will be used as a tool for estimating the need for derogation, which ultimately, is likely to be a political decision. Key decisions will follow from the following steps of the analysis:

1. *Step 1 – Identifying and characterising the new modification/activity*
2. *Step 2 – Assessing the impact of the new modification/activity on water status*
   - ***Decide whether to initiate the analysis for obtaining an Article 4.7 derogation***

3. *Step 3 – Identifying practical measures to mitigate the adverse effects*
4. *Step 4 – Identifying the broader impact on other water bodies*
5. *Step 5 – Assessing the reasons for the new modification/activity*
6. *Step 6 – Comparing the benefits of the new modification/activity with the benefits of avoiding deterioration*
7. *Step 7 – Comparing the benefits of the new modification/activity with alternatives that serve the same beneficial objectives*
   - ***Assess whether a derogation based on Article 4.7 can be justified. This can only be justified if all of the conditions for each Step 3 to 7 are fulfilled, as per Figure 1.***

Step 1 – Identifying and characterising the new modification/activity

What defines a new modification or new activity?
There are two categories of "modifications" that may give rise to a derogation:
- ***A modification to the physical characteristics of the water body***, such as straightening a river or modifying the level of groundwater bodies, but without modifying the chemical and ecological dimensions of good water status (below: **new modification)**.
- ***A modification resulting from new sustainable development activities,*** although this can only be used for obtaining a derogation when surface waters go from high to good status (below: **new activity**).

The most complex issue here will be how to define *new sustainable development activity,* which mirrors the difficulties in defining the concept of *sustainability*, which integrates:
- Economic, social and environmental aspects;
- A temporal dimension (e.g. future generations) and potentially, a global dimension.

As a result, discussing the sustainability of a single economic activity or physical alteration must be put into the context of wide society objectives and goals. Box 2 gives a summary of the issues linked to the definition of sustainable development and sustainability.

Practical implementation will need to be done by answering key questions:

1. ***What are the main characteristics of the modification or new activity?***

   First, it is required to identify the issue. This will be done through collecting information on the modification or activity such as:
   Dimension and capacity of a dam, length of river modified, production capacity of a new industrial plant, employment linked to the development of this new industrial plant, total turnover, discharge and total volume of water potentially abstracted by a pump , total irrigated area and cropping pattern and number and type of water users involved.

Box 2 – Sustainable Development and Sustainability - Selected References and Issues

The profile of sustainability and sustainable development issues has constantly increased since the early Brundtland Commission report. Along with this increasing interest, a wide number of definitions have been proposed for this highly complex issue. For example:

- Looking at sustainability from a very global point of view like the World Commission on Environment and Development (1987): *Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.* The minimalist interpretation of this definition implies that future generations should not be left worse off than current generations.

- In 1992, the UNCED (United Nations Conference on Environment and Development) "Earth Summit" meeting in Rio De Janeiro, agreed prescriptions for achieving sustainable development. These prescriptions recognised that the "*integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future.*"

- Looking at sustainability with an increased environmental focus like the European Environment Agency (1995): … *Linked to this is the concept of the 'carrying capacity' understood as the maximum impact that a given ecosystem can sustain without permanently impairing the integrity and productivity of the ecosystem.* This clearly does not mean natural resources cannot be used; it is possible to use resources (even depletable ones) as long as the interest of future generations can be protected. The question remains on the sharing of natural resources between present and future generations and what form should this sharing take.

Thus, alternative interpretations of sustainability include (T. Tietenberg, 1996*):

- Sustainability as non-declining well-being: resources used by previous generations would not exceed a level which would prevent future generations from achieving a level of well being just as great. Thus, the value of individual components of capital stock (human, social and natural) can decline as long as the remaining elements increase to compensate this decline. This definition assumes a good substitution between natural capital and human and social capital.

- Sustainability as non-declining value of natural capital stock: the total value of natural capital should not decrease. Key to this definition is the recognition of the limited substitution between natural capital and man made capital. One form of natural capital could be decreased if it can be compensated by the increase of another natural capital (e.g. reduction of the value of fisheries compensated by an increase in the value of forests)

- Sustainability as non-declining physical service flows from selected resources. This definition stresses the physical dimension of the natural resources as opposed to their value as in the previous definitions. In the presence of critical thresholds for some resources, the cost of further degradation may escalate rapidly, calling for policies that maintain the quality and resilience of these resources. In the case of resources where critical thresholds can be defined, sustainability constraints are likely to be more binding.

The types of capital that sustain well-being including man-made, natural, human and social capital and their "adequacy" to support well-being depends on the interaction among them, as well as on the size of the population, its characteristics and preferences. The different types of capital also provide one of the main mechanisms through which generations are connected to each other – as the stocks are influenced by current investment decisions, but human lives span several generations.

To assess the sustainability of patterns of economic development, the level of demand of natural resources and the transformation processes required by human activities should then be considered. The trade-offs between different types of capital may need to be evaluated empirically for their substitutability (a rather controversial and difficult issue), describing the acceptable trade-offsThe social components and impact of policies has to be simultaneously considered. As summarised in the recent European Union strategy for sustainable development (2001), *in the long term, economic growth, social cohesion and environmental protection must go hand in hand*.

In the context of the Europe, the recognition of the importance of sustainable development has led to the promotion of new instruments of analysis and planning. This includes the preparation of sustainable strategies at national, regional and local level, the preparation of Local Agenda 21 after the Aalborg Charter. At the European Union level, key policy elements include the preparation of the new Spatial Development Perspective, the Vienna Framework for Action for sustainable development, and the above-mentioned recent European Union Strategy for Sustainable Development. Regions across the European Union are currently preparing and proposing strategies and measures towards a more sustainable future.

Source: T. Tietenberg (1996), 'Environmental and Resource Economics', 4th edition, Harper Collins

2. ***What are the beneficial objectives served by the modification or new activity?***
   Second, it is necessary to understand the beneficial objectives of this new activity or modification. This will be based on a comparative analysis whereby the proposed activity should be compared with alternative options from an environmental and economic point of view. Examples of beneficial objectives include:
   Supply of specific water services to consumers or specific users, power generation and supply of electricity, employment or rural development.

3. ***Is the new activity sustainable?***

   As mentioned above, the issue of sustainability is a complex one. To determine whether the activity is sustainable, a comprehensive assessment of its implications from an economic, social and environmental perspective will be required, such as:
   - *Economic impact: turnover, income and production patterns;*
   - *Environmental impact: water, air, soil, biodiversity, landscape, overall resource use, waste arising and renewability of resources;*
   - *Social impact: employment at both the local and the regional or national level of unemployment, social exclusion, etc.*

4. ***What is the coherence between the proposed modification/activity and existing sustainable plans and strategies?***

   Assessing the coherence between proposed modification or activity and existing local, regional, national and European sustainable development plans and strategies will ensure that the modification or activity is put into a more long-term sustainability perspective and that its contribution to broader objectives are assessed. Also, this will ensure that the interpretation of "sustainable development" is in coherence with the environmental impact assessment or strategic environmental assessment criteria that will be used prior to authorising this new activity or modification to go ahead.

Step 2 – Assessing the impact of the new modification/activity on water status

Why is it important to assess the impact on water status?
- To determine whether you need to carry out the analysis in the first place: it is only if the new modification/activity has an impact on water status that a derogation is needed;

Practical implementation can be done in two stages:

- Assess the new pressures related to the new modification/activity, especially the impact on water abstraction and pollution;
- Assess impact of these pressures in terms of likely changes in the ecological quality or quantity of water (e.g. when looking at alterations to the level of groundwater bodies).

➢ ***As mentioned above, the analysis carried out as part of Steps 1 and 2 will enable decision makers to assess whether the procedure for obtaining derogation based on Article 4.7 should be initiated. A procedure should be initiated if the proposed new modification/activity has a negative impact on water status and if the new activity is sustainable. The steps that follow include all the tests that will need to be carried out in order to justify a derogation based on Article 4.7.***

Step 3 – Identifying practical measures to mitigate the adverse effects

Why consider whether practical measures can be taken to mitigate the adverse effects?
Article 4 (a) specifies that Member States should ensure that all practical steps are taken to mitigate the adverse impact on water body status. Whether those steps (or measures) are practical or not will depend on them being both technically and financially feasible.

Practical implementation of this step will include:

- Define a range of practical mitigation measures based on their:
  - Technical feasibility within the timeframe considered (e.g. 6 years or 12 years if one time derogation is used);
  - Financial feasibility, based on their costs vs. available financial resources.
- Analyse the likely impact of these mitigation measures on the status of the concerned water body (quantity, quality, ecology);
- Assess the total costs of mitigation measures.

➢ ***An Article 4.7 derogation can only be justified if all practical mitigation measures have been taken. In addition, this Step will contribute to predicting the water status of the water body following the introduction of practical mitigation measures and assessing their total costs, so that they can be incorporated into the river basin management plan.***

Step 4 – Identifying the broader impacts on other water bodies

Why identify the impact on other water bodies?
Article 4.8 requires Member States to ensure that the new modification/activity does not permanently exclude or compromise the achievements of the Directive's objectives in other water bodies. Analysing the likely impact on other water bodies may be more difficult than analysing the impact on the local water body (as per ***Step 2***), as it requires a good understanding of the functioning of the hydrological cycle within the river basins and the biophysical relationships between water bodies. For example, it will require understanding the impact of installing a dam supplying water to an urban area in the upstream part of a river on the water status of the river's estuary, 50 kilometres downstream.

Practical implementation of this step will require:

- Assess the likely impact of the new modification/alteration/activity on the status of other water bodies within the same river basin district before mitigation measures;
- Assess the likely impact of the new modification/activity with mitigation measures.

➢ ***If the new modification/activity is likely to have a significant impact on other water bodies even if mitigation measures are implemented, then Article 4.7 cannot apply and the modification or new activity cannot be implemented. The contrary leads to continuing the analysis and applying the following tests.***

Step 5 – Assessing the reasons for the new modification/activity

Can over-riding public interest be invoked as a reason for the new modification/activity?
Article 4.7(c)) refers to modifications that are of over-riding public interest. However, this concept is not defined in the Directive. Similarly to what is specified in the Habitats Directive, it may cover issues of human health and human safety or other imperative reasons of social or economic nature. Making the concept of over-riding public interest practical is difficult. Key elements that may be considered for doing so include:

- Ensuring that the new modification/activity is primarily to fulfil public interests, i.e. not solely in the interest of private companies or individuals;
- The interest must be over-riding, i.e. not all type of public interest can apply. In this context, it is reasonable to assume that it must be a long-term interest. This time issue is coherent with Article 4(8) that stresses the need to ensure that improvements in the status of other water bodies cannot be permanently compromised.
- The proposed new modification/activity aims at protecting fundamental values for citizens' lives and society (e.g. health, safety), within the framework of fundamental policies for the State and society.

Practical implementation of this step will require analysing the following:

- Assess whether the new modification/activity fulfils a public service obligation;
- Assess whether the new modification/activity is in society's long-term interest;
- Assess whether it aims at protecting fundamental values for citizens and society.

Note that for the analysis of the long-term interest, prospective analysis similar to what is performed for the development of the base line scenario may be undertaken. Clearly, the analysis will need to be in proportion with the importance of the new modification/activity in terms of its economic impact, its impact on the quality of waters and of the environment and on sustainable development.

- ***If the new modification/activity is not justified by over-riding public interest, then Article 4.7 cannot applied except if the benefits of achieving the Directive's objectives are outweighed by the benefits of the new modification/activity to human health, human safety or sustainable development (as per analysis in Step 6 below).***

Step 6 – Comparing the benefits of the new modification/activity with the benefits of avoiding deterioration of water status

Do the benefits of the new modification/ activity outweigh those of meeting the water quality objectives of the Directive?
Article 4.7(c)) specifies that even if the new modification/activity is not of over-riding public interest, a derogation based on Article 4.7 could still be obtained if the benefits of the new modification/activity in terms of human health, human safety or sustainable development outweigh the benefits of achieving the objectives of the Directive in terms of water status.

Practical implementation of this step will require:

- *Investigate issues similar to those considered in analysing the "sustainability status" of new activities* as per ***Step 1*** of this analysis. These include: improvement in human health, improvements in human safety (e.g. in the case of flood protection projects), increase in economic activity or production.
- *Assess the foregone benefits resulting from the failure to achieve the environmental objectives of the Directive*, based on the evaluation of the environmental, economic and social water-related benefits. In both cases, it should be attempted to quantify and express benefits or foregone benefits in monetary terms so as to make both parts of the analysis comparable. In many cases, however, it will be difficult to express all benefits or foregone benefits in monetary terms. Thus, the different benefits and impacts should be presented, whether in monetary terms, quantified or assessed qualitatively, in a multi-dimensional table.

  - ***If the benefits of the new modification/activity outweigh the foregone benefits from improved water status, then an Article 4.7 derogation can be invoked.***

Step 7 – Comparing with alternatives that serve the same beneficial objectives

Can alternatives serve the same beneficial objectives with a significantly lower environmental impact?

Article 4.7d sets as a condition that a derogation can only be obtained if the beneficial objectives to be obtained by the new modification cannot be achieved by other means with a significantly lower environmental impact, due to reasons of technical feasibility or disproportionate costs. This analysis will be similar to that carried out for designating heavily modified water bodies.

Practical implementation of this step will require:

- *Identify the alternative options that provide the same beneficial objectives.* These may include local alternatives (e.g. pumping groundwater from an adjacent aquifer instead of building a dam on a river for supplying water to an urban area), or regional and national options (e.g. supplying electricity from a wind power station in other parts of the country instead of building an hydro-power plant on a river). A wide range of cost-effective options should be considered, and not only infrastructure development that may be easier to analyse.
- *Compare the environmental impact of the new modification with that of alternatives.* As a first step, a qualitative assessment of the main environmental issues is required. A simple table may be prepared comparing the new modification and the proposed alternatives from the point of view of their environmental impact on water, air, soils, biodiversity, landscape, etc. In some cases, it may be possible to quantify the physical impacts on specific media, and to transform them into monetary (thus comparable) values.
- *Estimate the costs of the new modification versus that of alternative options.* These costs include investment costs, operation and maintenance costs, and any foregone benefit that may result from changes in economic activities linked to the alternatives or proposed modification. As the lifetime of the activity and proposed alternatives are likely to vary, all costs need to be annualised and computed in net present values.

  - ***If the new modification has no alternative with significantly lower environmental impact, then a derogation based on Article 4.7 can be sought.***

INFORMATION AND APPROACHES TO UNDERTAKING THE STEPS

The different steps presented above require a wide range of information, expertise and knowledge on the biophysical (e.g. assessing the impact of the new activity on the status of the concerned water body), economic (e.g. assessing costs and impact on economic sectors) and social issues. Although one may attempt to quantify as much as possible the different elements to be investigated, this will often not be possible and most of the tests and questions presented above therefore needs to aggregate a wide range of quantitative and qualitative information. Approaches that can be used to gather this information include:

- *Qualitative description of the situation or impact*. In cases where it is difficult to quantify specific variables (e.g. a change in landscape), a qualitative description of a change is adequate;
- *Assessment of functional impacts (changes in services provided or functions linked to water bodies)*. Changes in services provided or functions linked to water bodies can serve as good proxy to changes in benefits or foregone benefits linked to a modification or new activity;
- *Consultative Forum*. Involving stakeholders for providing information and their assessment of various alternatives and options. This approach that takes account of social issues and cultural/local perceptions is clearly in line with the encouragement to involve all interested parties as spelled out in Article 14 of the Water Framework Directive;
- *Expert group Panels*. Involving a (subjective but well-justified and transparent) technical assessment of alternative options by a multi-disciplinary team of experts; and
- *Economic assessments*. Good for comparing the costs of different alternatives for delivering the beneficial objectives considered, for comparing the benefits and foregone environmental benefits linked to new activities, for comparing (when monetary valuation possible) the environmental impact of different options.

The involvement of stakeholders and of experts panel groups is particularly important to assess issues that are multi-dimensional and that cannot be summarised into a single variable or figure. This is particularly true for assessing:

- Existing trade-offs between social, economic and environmental issues and deciding whether a new activity is sustainable (***Step 1***);
- Whether the modification or new activity can be justified on over-riding public interest grounds (***Step 5***);
- Whether the benefits from the proposed modification or activity are higher (or better valued) than the degradation to water bodies (***Step 6***); and
- Whether the proposed modification or new activity is indeed better than possible alternatives (***Step 7***), i.e. how to interpret the notions of *significantly better environmental option* and *disproportionate* costs.

Table 2 summarises the general types of information required for the different steps of the analysis supporting the use of Article 4.7 and Article 4.8. The table stresses the multi-disciplinary approach required for assessing whether the use of derogation under these articles is indeed justified.

Table 2 – Information Needed for Undertaking the Steps

<table>
<tr><th colspan="2" rowspan="2">Steps in the assessment</th><th colspan="4">Type of information</th></tr>
<tr><th>Environment</th><th>Economic</th><th>Social</th><th>Technical</th></tr>
<tr><td rowspan="3">Describe the modification or new activity and its impact</td><td>Describe modification or activity</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assess sustainability</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assess impact on water status</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Identify mitigation measures and their impact</td><td>Define mitigation measures</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assess impact of mitigation measures on water status</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Assess impact on inter-connected water bodies</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Justify the modification or new activity</td><td>Assess overriding public interest</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Benefits of activity versus foregone benefits</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Compare the modification or new activity with alternative options for providing beneficial objectives</td><td>Identify technically feasible alternatives</td><td></td><td>e.g. economic instruments</td><td></td><td></td></tr>
<tr><td>Compare environmental impact</td><td></td><td>When monetary values available</td><td></td><td></td></tr>
<tr><td>Compare costs</td><td></td><td></td><td></td><td></td></tr>
</table>

IV.II(b) Consideration of the Possible Appraisal Techniques Involved in the Designation Process for Heavily Modified Water Bodies

1.0 Purpose

1.1 This paper is intended as guidance for the case studies being undertaken on Heavily Modified Waterbodies (HMW). It is anticipated that the experience gained from the case studies will inform the development of Common Implementation Strategy guidance.

1.2 The designation of water bodies as heavily modified involves the use of tests specified in Article 4(3) of the Water Framework Directive. This paper considers some of the options available to inform this decision making process.

1.3 The paper has been produced by the representatives from the HMW and Economics working group. It has been discussed and approved by the HMW Working Group.

2.0 Introduction

2.1 The designation process of heavily modified water bodies starts with the identification of those water bodies, which are substantially changed in character as a result of physical alterations by human activity (see HMW paper 3 (strategy)). This identification step does not require the use of economic assessment.

2.2 Following this initial identification step, two tests are proposed in Article 4(3) for the designation of heavily modified water bodies.

- Firstly, it is necessary to assess whether there are significant adverse effects on specified uses, which would result from the necessary mitigation measures required to achieve good ecological status for the water bodies considered.

- Secondly, if uses are significantly affected, then a review of other better options for providing the specified use should be undertaken by investigating issues of technical feasibility, environmental impact (better environmental options) and costs (disproportionate costs) of these options.

2.3 In practical terms, a very large number of water bodies will have to be assessed for possible designation as HMW over the period until 2009[1]. It will therefore be important to ensure that the methods used for the designation process are simple and pragmatic. Moreover, it is important to develop appropriate options so that the complexity of the assessment methodology can be made proportionate to the circumstances.

2.4 There are different appraisal techniques, which could help in the designation process by providing a systematic way of analysing and reporting designation decisions. Examples of techniques that may be chosen (independently or combined) include:

- **Qualitative description of the situation** - appropriate for circumstances where the situation is clear cut (refer to HMW paper 5 "pressures and physical alterations", No 11 negative list);
- **Consultative forum** - involving a participatory approach to identifying whether foreseen impact on uses is indeed considered as significant. This approach that takes account of social issues and cultural/local perceptions is clearly in line with the encouragement to involve all interested parties spelled out in Article 14 of the Directive;

- **Expert group panels -** involving a (subjective but well-justified and transparent) technical assessment of the options by a multi-disciplinary team of experts;

[1] How to identify water bodies (based on which criteria, which scale, etc) still needs to be discussed and agreed in the context of the Common Implementation Strategy activities. The chosen approach is likely to influence the total number of water bodies within a river basin, and thus the total number of heavily modified waterbodies to be designated.

- **Assessment of the functional impacts** - providing an assessment of the impact upon the "use(s)" in terms of changes in services provided or functions linked to the water body;

- **Economic assessments** - by comparing costs of different alternatives for delivering the beneficial objectives considered, or by comparing costs and benefits of options.

3.0 HMW Designation test “Significant Adverse effects upon specified uses” - Article 4(3)(a)(ii - v)

Article 4(3)(a) *the changes to the hydromorphological characteristics of that body which would be necessary for achieving good ecological status would have significant adverse effects on: …….[specified uses]*

3.1 This test requires consideration of the context and scale of the effects on the listed activities (uses) which would result from necessary changes to achieve good status. There is no obvious way in which a single value could be considered significant. The assessment of significance will, by necessity, be based on the context and scale of the modification to the water body.

3.2 Simple qualitative descriptive methods would be appropriate where:

- The adverse effects on uses are relatively small in relation to the specified use (clearly not significant); or

- The adverse effects on uses are large and clearly prejudice their viability (clearly significant). This is particularly relevant when necessary changes to achieve good status imply the cessation of specific uses, functions and related human activities.

3.3 There may be a number of circumstances where the scale of adverse effect is more finely balanced. Under these circumstances, it is appropriate to undertake a quantitative assessment of the impacts to the use to justify their significance. Simple and consistent tools and approaches may therefore be required to assess the significance of impacts upon uses. This could include the following approaches.

- An assessment can be carried out of the change in use and function (e.g. the reduction in the quantity of hydro-power that can be generated from a hydro-power scheme). This can provide a first and robust quantification of the resulting change in use.

- It may be possible to assess the economic impact resulting from necessary changes to achieve good status. Thus, the economic benefits (in €) linked to the use of water under the present situation are compared with the economic benefits (in €) that would be obtained from the required change in use.

3.4 In both cases, relative values are preferred to absolute values for discussing the issue of significance. For example, a reduction of an irrigated area by 100 ha can be considered as significant as compared to a total irrigated area of 105 ha, but not significant as compared to a total area of 120.000 ha. This clearly makes the choice of the denominator of the relative value of particular importance (i.e. to identify the scale of the use to be considered). The information obtained can be fed to a consultative forum or group of experts for deciding whether changes are indeed considered as significant.

4.0 HMW designation test "Significant Adverse effects upon the wider environment" - Article 4(3)(a)(i)

> ***Article 4(3)(a)***
> *the changes to the hydromorphological characteristics of that body which would be necessary for achieving good ecological status would have significant adverse effects on: …….*
> *(i) the wider environment*

4.1 Changes in the hydro-morphological characteristics of a given water body may have significant impact on the wider environment, for example:

- The restoration of flood plains may threaten a specific landscape and biodiversity that has developed over the years as a result of the elimination of the floods in the riparian zones and former floodplains;
- The removal of a dam that may lead to the elimination of wetlands that have developed in connection to the water storage.

4.2 Where the modified waterbody could be designated under another Directive such as the Habitats Directive, it is assumed that the Directive with the highest standards will apply. If a HMW was designated under the Habitat and Species Directive, it would not be appropriate to consider mitigation measures required to achieve good status, if this compromised the reason for designation.

4.3 As for the previous test on the significance of adverse effects on uses, there may be a need to quantify such changes. However, to provide meaningful quantification of changes in values of landscape or biodiversity is likely to be difficult and source of controversy (e.g. a reduction by 20% of the hedge rows of a given landscape clearly does not reduce the value of the landscape by 20%). Consequently, the qualitative assessment of changes is the preferred option. The information obtained could also be fed to a consultative forum or group of experts for deciding whether changes are indeed considered as significant.

5.0 Designation test: "Beneficial Objects" Article 4(3)(b)

> *the beneficial objectives served by the artificial or modified characteristics of the water body cannot, for reasons of technical feasibility or disproportionate costs, reasonably be achieved by other means, which are a significantly better environmental option.*

5.1 This part of the article requires consideration of whether there are better environmental options for delivering the beneficial objectives served by the artificial/modified characteristics. However, identification of better environmental options is constrained by consideration of reasonableness that is made operational through two elements: technical feasibility and level of costs.

5.2 Thus, there are three aspects to this test. Alternative means to achieve the existing "water use" (or uses) must:

- be <u>technically</u> feasible;[2]
- achieve <u>significantly</u> better environmental option;
- not be <u>disproportionately</u> costly.

Significantly better environmental option

5.3 Reaching an agreed understanding of the meaning of *significantly better environmental options* has proved difficult. Two interpretations of the Directive's requirements have been proposed.

- The assessment should only consider local alternatives associated with the water environment. This may be consistent with the Water Framework Directive *per se*, but not with the overall issues of sustainability as promoted in EU and national sustainable development strategies.

- A wider interpretation requires consideration of local alternatives and regional/national alternatives that may provide the same service/function (e.g. replacing navigation with road or rail transport, replacing hydropower with nuclear or wind energy) and investigating the impact of these options on a wide range of environmental concerns.

5.4 The wider interpretation involves looking at not only water, but also air, soils, bio-diversity or landscape issues. This ensures alternative options are not better options from a purely water point of view leading to replacing water problems by other environmental problems (this may be the case for example if navigation is replaced by road transport). In the case of water, options have to account for the improvement in water quality resulting from the restoration to good ecological status in the heavily modified water body considered.

5.5 As a first approach, a qualitative assessment of the main environmental issues is required. A simple table may be prepared comparing the existing use and the proposed alternatives from the point of view of their environmental impact.

5.6 In some cases, the quantification of the physical impacts of the existing use and alternatives may be possible. Such impacts may be transformed into monetary (and thus comparable) values.

Disproportionate costs

5.7 Three possible approaches to assessing whether costs are disproportionate are described:
- comparison of costs of alternatives;
- comparison of overall costs and benefits of modifications and alternatives; and
- costs versus ability to pay.

All three approaches could be considered in the case studies.

<u>*Comparison of cost alternatives*</u>

5.8 The concept of disproportionate costs can be assessed by comparing the existing costs of delivering the use, service or beneficial objective, with the costs of alternative options. The main cost elements that are to be considered include:

- For the existing situation*:* operation and maintenance costs, but also replacement costs (principal and interest payment);

[2] Technical feasibility is put here as the first check, as assessing the environmental impact of options that are not technically feasible is clearly of no use.

- For each option/alternative: capital costs (principal and interest payment), operation and maintenance costs, and possible foregone benefits from changes in economic activities resulting from the option (e.g. reduction in agricultural production resulting from the development of a retention area as an alternative to dikes for preventing floods)

Costs versus ability to pay

5.9 Assessing costs of alternatives with ability to pay. Although ability to pay is not directly a designation process issue, it can be a useful way to assess different alternatives serving the same beneficial objectives.

Comparison of overall costs and benefits

5.10 Comparing the overall costs and benefits of the existing modification. This assessment ensures that the modification provides an overall net benefit to society, and is more consistent from an economic perspective than the two tests (comparing environmental impacts and the costs of alternatives separately) proposed above.

General considerations

5.11 The economic appraisal of the alternative modifications will need to consider in priority:

- The best practice techniques customarily used for each type of modification (e.g. flood defence, navigation etc.) to ensure environmental impacts of alternatives are properly compared.

- The most cost-effective alternatives, i.e. those that provide the same service at the lower costs.

5.12 In some situations, local cost information may be collected for comparing alternatives. In other situations (e.g. when comparing the costs of hydropower as compared to other energy sources), or as a first step/proxy, benchmark information available at regional, national or European scales can be used.

5.13 To ensure cost information between existing modifications and options can be compared, and because of the likely different life times and temporal distributions of costs, all costs have to be annualised using standard discounted cash flow analysis and appropriate discount rates.

Descriptive or quantitative methods

5.14 It is considered that in many circumstances the Article 4(3)(b) test can be addressed by describing the modification, its use and the consequences of its removal. Where such a descriptive analysis is insufficient to reach a determination, further quantification and assessment of economic variables analysis should be undertaken until a determination is possible.

5.15 It is clear that it will not be possible to define clearly where the boundaries between qualitative and quantitative assessment should be drawn. The application of the designation test to the case studies will provide a better understanding of the situations and conditions under which general and qualitative descriptions are considered sufficient. These decisions will also be a matter of local expert judgement. Consequently, it will be important to ensure that the decisions are made in a transparent and objective manner. The process of designation will be part of the River Basin Management Planning process. Designation decisions will consequently be subject to the Article 14 requirements for active involvement of all interested parties as well as the formal consultation requirements.

5.16 The information obtained on the environmental impact and costs of alternatives could be fed to a consultative forum or group of experts for deciding whether costs of alternatives are indeed considered as disproportionately high as compared to the costs of the existing means.

6.0 Timetable and River Basin Planning

6.1 HMW should be provisionally identified by 2004 as part of the characterisation of river basin districts required by Article 5. As specified above, this only requires the identification of those water bodies, which are substantially changed in character as a result of physical alterations by human activity. The identification step does not include any economic assessment and the designation tests should not be considered at this stage.

6.2 The designation tests should be considered as part of the River Basin Management Plan process to be completed by 2009. However, the logistics of the plan will require the consideration of the designation tests early during the planning process. Indeed, the designation tests must be complete in time to allow for the identification of the programmes of measures required to deliver good ecological potential in the most cost-effective way. The recommended date for the completion of the designation tests will build on the work of the *Economics* and the *Good Practice in River Basin Planning* working groups.

6.3 In the context of the preparation of the river basin management plan, it is important to ensure compliance with Article 4.8. This requires Member States to ensure that the designation of specific water bodies as heavily modified *does not permanently exclude or compromise the achievement of the objectives of the Directive in other bodies of water within the same river basin district, and is consistent with the implementation of other Community environmental legislation*. Where failure to comply with Article 4.8 is predicted then the body of water cannot be classified as heavily modified and should reach good ecological status.

7.0 Conclusions

7.1 A common appraisal framework for designating heavily modified water bodies across Europe is presented in Figure 1. Although the different steps of this framework are valid for all situations, the level of analysis and the need for quantification and economic assessment is likely to be variable, to take account of differences of the modification examined and its importance at the local and national scale.

7.2 The case studies within the HMW project offer the opportunity for Member States to test in a consistent manner the different steps of the designation process and to assess the level of quantification and economic assessment that may be required under specific situations. This will provide valuable examples of how the process of addressing the designation tests can be undertaken, and may allow the identification of types of analysis adapted to types of situations.

The following issues should be considered:

- Identification of methods and procedures to make decisions;
- Consideration and testing of relevant methods for evaluating the impact of changes to natural conditions in terms of changes in uses, functions, economic benefits;
- Assessment of disproportionate costs in terms of: (a) comparison of costs of alternatives; (b) comparison of overall costs and benefits of modifications and alternatives; (iii) costs versus ability to pay;
- Consideration of who should be involved (e.g. consultation forum, experts groups) during the designation process.

7.3 In many cases full scale economic assessment will not necessary and descriptive methodologies may be sufficient for sound judgements to be made. The use of economic appraisal methodologies should themselves be proportionate, and used where such economic assessment is likely to improve decision-making. It will then be important to ensure adequate economic information is collected at right spatial scale (i.e. linked to the beneficial objective and use) so the economic assessment can be performed in a timely manner.

7.4 Table 1 attempts to provide preliminary guidance for the type of approach that may be required under different situations. However, Table 1 is to be taken cautiously for two reasons:

(i) the content of the table is to be refined and validated through the process of designating water bodies in the different case studies developed by the HWM group;

(ii) the designation of heavily modified water bodies can be part of an iterative process that alternate discussion with stakeholders and further analysis if required/no consensus is obtained on the answer to the specific tests that are part of the designation process.

7.5 To assist in the reporting of the case studies in a standard format is provided (Table 2). This table lists the range of issues and information that may be considered through the designation process. Clearly, not every cell of the table needs to be filled. This is particularly the case for comparing the environmental impact of the modification with alternatives: some environmental impacts will be described qualitatively, while others will be quantified in terms of physical changes or in monetary terms.

Figure 1. Flow chart summarising the steps required to address the Article 4.3 designation tests.

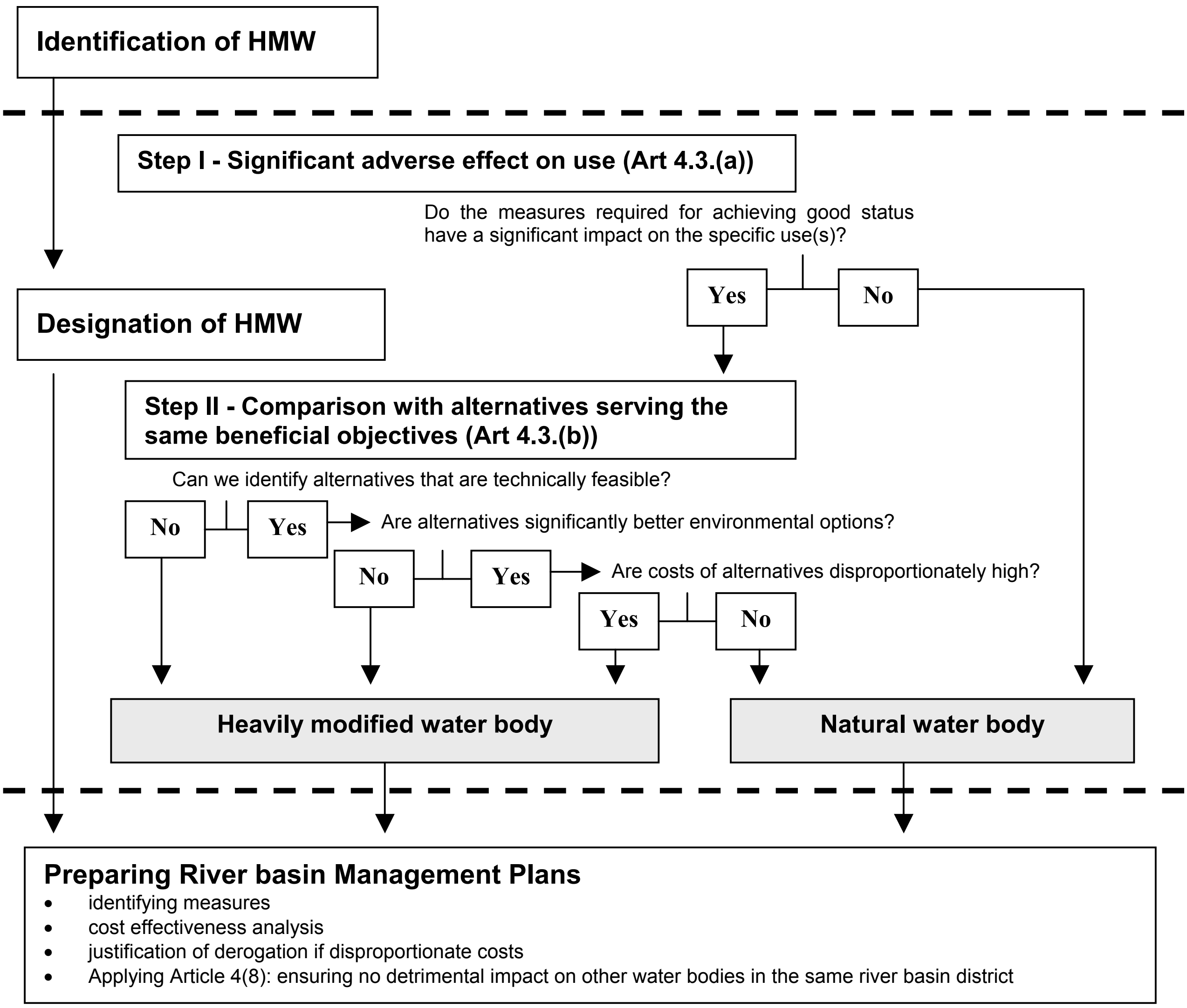


Table 1. Preliminary guidance on the use of descriptive and quantitative methods

Test	Qualitative assessment	Quantification of impact on use, function	Assessment of economic variables using benchmark information (costs, benefits)	Assessment of economic variables requiring specific methodology
Significant adverse effect	If abandonment of, or major change in, use/function/activity, or If very limited change in use	When partial change in use, function		Where significance of change in use uncertain.
Better environmental options	Qualitative assessment for impact on different media as basis for analysis	If uncertain about which option is best		
Disproportionate costs	Description of scale of costs and also benefits if judgement / conclusion is clear	N.A.	National / Local scale benchmarking may provide sufficient clarity for good judgement	Where local situation significantly different from benchmark case or where other reasons for uncertainty exist.

Table 2 Reporting template for appraisal methods

Assessing the significance of the impact on use(s)													
Assessing the significance of the impact on use(s)	Actual use				Foreseen use with good ecological status				Comparison actual versus good ecological status				Assesment
	Use (quantity, quality)	Production	Turn over, income	Employment	Use (quantity, quality)	Production	Turn over, income	Employment	Use (quantity, quality)	Production	Turn over, income	Employment	
Use 1													
Use 2													
Wider environment													
Significant impact on use(s) - Overall assessment													

Comparing existing modification with alternatives serving the same beneficial objectives													
Environmental impact	Actual Use			Option 1			Option 2			Option 3			
	Qualitative	Physical	Monetary	Qualitative	Physical	Monetary	Qualitative	Physical	Monetary	Qualitative	Physical	Monetary	
Air													
Water													
Soil													
Landscape													
Environmental impact - Overall assessment													

Costs	Actual use	Option 1	Option 2	Option 3	
Investment costs					
Operation & Maintenance costs					
Possible foregone economic benefits					
Total annualised costs					

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All final reports from the different scoping and testing activities undertaken in the context of the development of the economics guidance document are available on this website.

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Annex V

Results of Scoping and Testing in Pilot River Basins

INTRODUCTION

This annex presents the activities and projects undertaken by experts from different river basins and countries for testing specific elements of the economic approach proposed in the guidance document. These activities have been key in assessing the feasibility and practicality of this approach. Furthermore, they have provided opportunities in many countries for launching discussions between technical and economic experts, stakeholders and policy makers on the key elements of the economic analysis and more generally of integrated river basin planning.

The annex provides:

- A summary table of the activities in terms of location and key issues investigated;
- An individual summary for each activity, presenting: (i) the key water management issues at stake in the river basin or sub-basin considered; (ii) the objectives of the study and activities undertaken; (iii) expertise, stakeholders and information mobilised; and (iv) results, lessons for success, problems and outstanding issues.

The case studies included, with their specific area of focus are:

1. **Alsace Plain Aquifer (France):** Estimating disproportionate costs;
2. **Bordeaux Aquifer (France):** Testing the cost-effectiveness analysis;
3. **CIDACOS River Basin (Spain):** Undertaking the cost effectiveness analysis;
4. **Corfu Island (Greece):** Carrying out the economic analysis of water uses;
5. **Middle-Rhine River Basin (Germany):** Assessing the recovery of the costs of water services;
6. **Motala River Basin (Sweden):** Scoping an integrated appraisal for river basin management plans.
7. **Oise River Basin (France):** Testing the development of baseline scenario;
8. **Ribble River Basin (England):** Integrated appraisal for river basin management plans;
9. **Rhone-Méditerranée-Corse River Basin (France):** Assessing the pertinent spatial scale for the economic analysis;
10. **Scheldt International River Basin (The Netherlands, France, three Belgium regions):** Testing elements of the three-step approach;
11. **Sèvre Nantaise River Basin (France):** Testing the chronological feasibility of the three step approach;
12. **Vouga River Basin (Portugal):** Scoping key elements of the economic analysis;

More information on the individual summaries can be obtained:

- On the Web site www.eaufrance.tm.fr, where the final reports of the different case studies are stored and are accessible to all; and

- Directly from the contact person(s) identified at the end of each individual summary. This contact person(s) will be able to further explain the activities developed and results obtained, and to provide you with the names of other experts that have undertaken the projects and the analyses.

River Basin (country)	Issues addressed	Key lessons learnt	Part of the 3-Step Analysis
Alsace plain aquifer (France)	Assessing disproportionate costs	Use of simulation models for baseline/effectiveness analysis/disproportionate cost analysis - Difficulty to find benefits in an aquifer (except drinking water)	Step 3 – Identifying measures and economic impact ➢ Assessing disproportionate costs (Cost Benefit Assessment)
Bordeaux Aquifer (France)	Analysing the cost-effectiveness of measures	Importance of the scale of analysis in the results of cost effectiveness analysis	Step 3 – Identifying measures and economic impact ➢ Analysing the cost-effectiveness of measures, scale of analysis
Cidacos river basin (Spain)	Carrying out the full economic analysis, including the involvement of stakeholders – Specific focus on agriculture	Importance of linking water pricing/price elasticity with changes in sector policies – Key methodological issues for the cost-effectiveness analysis (scale, which costs, looking at impacts) – Importance of the financial feasibility of proposed measures	Main parts of the full 3-Step analysis ➢ water uses and services, costs, cost-effectiveness ➢ Disproportionate cost analysis
Corfu Island (Greece)	Initial assessment of water uses, test of data availability and organisations	Low data availability	Step 1 – Characterising RBs ➢ Mainly Water uses and services
Middle Rhine river basin (Germany)	Carrying out an economic audit of water uses - Assessing the recovery of costs for water services	Importance of data collection for the initial status – Role of existing statistics in assessing cost-recovery	Most of Step 1 – Characterising RBs ➢ Water uses and services ➢ Cost recovery
Motala river basin (Sweden)	Identifying information needs and gaps for the economic assessment and decision-making	Importance of data collection, link with stakeholders (public participation) and economics as a decision making tool – need to find coherence between data from wide range of organisations	Most of Step 1 – Characterising RBs
Oise river basin (France)	Building baseline and prospective scenarios	Need for building alternative scenarios	➢ Step 1 & 2 – Identifying significant water management issues - Baseline scenario
Ribble river basin (England)	Carrying out appraisal to construct efficient program of measure allowing to reach set objectives – integration between appraisal and consultation/participation – linking river basin planning and agriculture policy	Importance of common understanding and training process – Proposed approach considered feasible and applicable to other river basins	Main parts of the full 3-Step analysis ➢ Identifying water uses & services, estimating costs, analysing the cost-effectiveness of measures, disproportionate cost analysis
Rhône Méditerannée Corse river basin (France)	Identifying/Assessing criteria for the definition of the scale of the analysis	General approach linking economic, biophysical and planning/land use information for investigating scale issues, no specific economic methodology tested	Step 1 – Characterising RBs ➢ Defining the scale of the analysis
Scheldt International river basin (The Netherlands, France, Belgium regions)	Analysing water uses, initial identification of measures, cost-effectiveness analysis – Looking at water quality, groundwater abstraction and morphology	Importance of physical parameters (hydro morphology), in economic analysis (links with experts on pressures & impacts) – Use of expert panel for assessing disproportionate costs – Lack of coherence between different parts of an international river basin	Main parts of the full 3-Step analysis ➢ Water uses and services, costs, cost-effectiveness
Sèvre Nantaise river basin (France)	Testing of the feasibility of the 3-Step approach	Need to check data availability – Need to involve stakeholders Difficulty to find data on environmental benefits	Main parts of the full 3-Step analysis ➢ water uses and services, costs, cost-effectiveness
Vouga river basin (Portugal)	Identifying gaps in available data and creating links with stakeholders and other working groups	Low data availability Link with stakeholders (public participation) and other technical groups (e.g. dealing with Heavily Modified Water Bodies)	Most of Step 1 – Characterising River Basins

Alsace Plain Aquifer (France): Estimating disproportionate costs

Keywords	Cost effectiveness analysis, disproportionate costs, derogation, groundwater, pollution, hydrodynamic model, simulation
Location (river basin, country)	Alluvial aquifer of the upper Rhine valley, Alsace region, France
Key water management issues	• Groundwater pollution: since the 1910s, the potash mining industry has generated huge waste dumps with high salt contents (NaCl). These dumps have been leached by rainfall, resulting in significant contamination of one of the largest European aquifers. • Significant pollution control measures have already been implemented, leading to a progressive restoration of the aquifer. However, these measures might not be sufficient to reach the objective of "good status" by 2015. Additional measures may be needed to reach the objective but their cost is likely to be disproportionate with regard to the benefits and the financial capacity of actors.
Objective and the study's function in the overall analysis	• Estimate the risk of non-compliance using hydrodynamic simulation models. • Compare alternative programmes of measures through cost effectiveness analysis. • Define "disproportionate costs" using different approaches and implications. Develop a method to justify derogation on the basis of the disproportionate cost argument. Test this method on the case study. • Identification and evaluation of benefits (in case of groundwater quality restoration).
Planned activities and overall structure of the study	• Step 1: Development of a simple hydrodynamic model to simulate the impact of various programmes of measures. Key issue: choosing a model (trade-off between accuracy and cost). • Step 2: Simulation of the baseline scenario & identification of additional measures needed to reach the objective in 2015. Key issue: addressing uncertainties. • Step 3: Cost-effectiveness analysis of the alternative measures. • Step 4: Defining what is a disproportionate cost: (i) costs versus ability to pay; (ii) cost versus benefits; (iii) costs versus best alternative use of public finance. • Step 5: Identifying and assessing the value of benefits related to groundwater restoration.
Disciplines and expertise mobilised	• Economist & hydrologist from BRGM. • Consultative group (Rhin Meuse Water Agency, government administrations & regional authority): discussion of the method, assumptions and results. • Stakeholders (mining company, municipal water suppliers, farmers organisations, industrial water user association, scientists).
Key information source mobilised (reports, books, statistics…)	• Pollution monitoring data & geological information (to develop the model): annual pollution monitoring reports. • Interviews with stakeholders to identify and quantify benefits. • Scientific reports to cross check information from experts.

Alsace Plain Aquifer (France): Estimating disproportionate costs

Stakeholders involvement

- Experts of the consultative group involved in: (i) the definition of "disproportionate"; (ii) the identification of the programmes of measures;
- Stakeholders consulted through interviews on: (i) the definition of benefits for current water users and (ii) the prospects of future water demand and potential benefits for future generations of aquifer restoration.

Highlights/Results/Successes

- Pointing at:
  - ⇨ The need to use simple hydrodynamic models to simulate the baseline scenario and to assess the effectiveness of alternative programmes of measures.
  - ⇨ The need to involve stakeholders in the identification of costs and benefits, and to cross check this information with experts/scientists/secondary data.

Key problems and potential solutions

- All costs and benefits cannot be assessed in monetary value. How can they be aggregated when expressed in different units (Euros, number of jobs, etc)? How can this difficulty be solved to calculate a cost-effectiveness ratio? To compare costs with benefits?
- Some benefits, in particular those accruing to future generations, are uncertain. We suggest that the estimate of these benefits should be associated with a probability of occurrence. The total benefits should be expressed as the sum of the benefits weighted by their probability of occurrence.

Outstanding issues

- Three very different approaches can be used to define what is a "disproportionate cost". This choice determines the methodology to be adopted to justify a derogation:
  - ⇨ Costs are reputed to be disproportionate if costs to be born by actors exceeds their financial ability to pay; or
  - ⇨ If the overall costs exceed the overall benefits for the society as a whole (the State should only implement measures which lead to an improvement of the social welfare); or
  - ⇨ If the rate of return over public investment needed to finance the measures (given the maximum amount that can be reasonably paid by other actors) is lower than any other water restoration programme in the river basin district that can be financed given the limited financial resources.

It is important the one of these approaches be selected as a reference.

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Bordeaux Aquifer (France): Testing the cost effectiveness analysis

Keywords	Cost effectiveness analysis, scale issues, groundwater, economics and decision making
Location (river basin, country)	Deep aquifers of Gironde (Bordeaux) department: Adour-Garonne district (southwest of France). A local master plan (SAGE) was adopted on the coastal zone of this geographic area.
Key water management issues	• Over-exploitation of these aquifers with 150 Mm^3 abstracted per year • Important catchment for domestic uses mainly for the Bordeaux municipality and tourism along the coast. • Abstraction for irrigation (corn and vegetables). • Abstraction for industry and geothermics. • Risk of saline intrusion to the aquifer, and of decreased piezometric water levels.
Objective and the study's function in the overall analysis	• Testing the feasibility of the cost effectiveness analysis: ⇨ Determine the type and availability of needed data? ⇨ Determine the coherent scale of analysis ⇨ Determine the analysis' level of certainty: which type of costs should be taken into account?
Planned activities and overall structure of the study	• Step 1: Comparison between baseline scenario and 2015 objectives. • Step 2: Defining technical and economic adjustment variables. • Step 3: Crossing these variables and using them to model the aquifer and define alternative scenarios. • Step 4: Identification and calculation of cost needs to be taken into account (using models for non-market costs). • Step 5: Comparison of alternative scenarios by actualisation of costs.
Disciplines and expertise mobilized	• Technical expertise: agency experts, BRGM for building the models of the aquifers, and a local coordinator for the master plan. • Economic expertise: economist from the university; support from the agency.
Key information source mobilised (reports, books, statistics…)	• Data collected for the master plan: data on abstraction (agency) and model of the aquifer (BRGM). • University studies on economic losses for users. • Estimation of experts on "water saving policies".
Stakeholders involvement	• The experts of the agency were involved in the technical analysis, but it was more difficult to involve them in the economic part. • The local coordinator of the master plan represented local decision makers.
Highlights/Results/Successes	• Pointing at the reliability and the interest of the cost effectiveness analysis at a local scale, particularly when the master plan only contained small elements of economic analysis.

Bordeaux Aquifer (France): Testing the cost effectiveness analysis

Key problems and potential solutions	• Difficulties linked to data: insufficient data on water uses, water pricing, and "water saving policies". • Difficulties linked to economic tools, particularly when transferring results from one or two other cases, or in making methods understandable to non-economists.
Outstanding issues	• Need to set precise limits for cost effectiveness analysis: it is impossible to compare the results of a global cost effectiveness analysis (at the scale of the whole aquifer) with the sum of cost effectiveness on separate, homogeneous part of the aquifer. • Need to develop a socio-economic database for water issues and water uses. • Need to develop links and common understanding between economists and decision makers.
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Cidacos River Basin (Spain): Undertaking the cost effectiveness analysis

Keywords	Cost-effectiveness, integration between economics and biophysical expertise.
Location (river basin, country)	Ebro River Basin (Spain)
Key water management issues	• High variability in water supply. • Water abstraction pressures. • Diffuse pollution from farms. • Water emergencies for domestic water supply. • Flooding problems during specific times of the year. • One of the main axis of economic development for the Navarra region. • Existence of plans in the region to conserve biodiversity, using rivers as ecological corridors.
Objective and the study's function in the overall analysis	• The study developed a step-by-step implementation of the cost effectiveness analysis proposed in the guidance with special emphasis on measures affecting water flow. It addresses the implications of conducting the analysis at a river basin level (inter-related water bodies) versus water body by water body. Implications of analysing the inter-relation between measures affecting water quality and water quantity are detailed. The study also draws lessons for the planning processes.

Cidacos River Basin (Spain): Undertaking the cost effectiveness analysis	
Planned activities and overall structure of the study	• Step 1: Initial information collection on natural water regime, regime of abstractions in the river, water quality and information on biotic indexes; location of control stations and regularity and reliability of information of parameters. Assessment of additional information required by the Directive (mainly related to hydro-morphological indicators). Site visit. Preparation of characterisation initial report. • Step 2: Interview key stakeholders in the river basin for a first overview of significant water issues in the basin (key pressures today and for the future), for interpreting existing information; for defining objectives for the basin for each parameter and for establishing a first catalogue of measures. Analysis of gap. Selection of parameters where there is gap and control parameters. • Step 3: Collection of additional information on key pressures, cost of measures and effectiveness of measures for improving water status (focus on water flow and physico-chemical parameters). Calculation of cost effectiveness indicators (focus on agricultural measures and urban measures). Ranking of measures for improving water status as they affect individual parameters and considering reassessment of gap in linked water bodies and interrelations between parameters. Development of an ad-hoc model. • Step 4: Analysis of the economic impacts of the programmes of measures and the distributional implications of different financing plans. Analysis of environmental costs of programmes of measures (non water or in other basins). Analysis of sensitivity of changes in ranking of measures when incorporating environmental and economic impacts. • Step 5: Refinement of the analysis incorporating feedback in Workshops with EC experts • Step 6: Workshop with key stakeholders for discussing and validating the preliminary results and comparing costs and benefits of achieving different levels of objectives. Stated preference survey. • Step 7: Write conclusions for a protocol for the economic analysis in RBP to facilitate implementation in the country
Disciplines and expertise mobilised	• Combination of economic expertise, hydrologist, engineers, biologist, chemical engineers. • Input from water managers, agricultural organisations, local organisations, academics, regional and basin authority administrators, environmental concerns.
Key information source mobilised (reports, books, statistics…)	• Existing Planning documents and information from the ministries of agriculture, environment, from the river basin authority, the regional government, specialised water organisations (irrigation, domestic water supply and WWT). • Statistics from national organisations. • Monitoring information from monitoring stations. • Previous research on effectiveness of measures, elasticity of demand and behavioural models of water use behaviour when confronted with uncertainty.

Cidacos River Basin (Spain): Undertaking the cost effectiveness analysis	
Stakeholders involvement	• Key stakeholders from the river basin (environmental authorities and experts, water service suppliers, irrigation authorities, river basin authority and regional authorities, water users, beneficiaries of water improvements, majors of urban areas, local environmental groups, water supply companies). • Two workshops organised to share/discuss the results of the study, to take key decisions/collect information, evaluate environmental benefits and analyse disproportionate costs issues.
Highlights/Results/Successes	• Cost effectiveness analysis completed resulting in measures being ranked according to their cost effectiveness (including economic impacts and environmental costs). Preparation of river basin plans including a variety of measures affecting agricultural and urban users. Analysis of final costs of river basin plan when considering the linked effects of improvement in inter-related water bodies. Analysis dealing with uncertainty of quantitative value of environmental costs. • Analysis of the different financing alternatives of RBP and their impacts on prices paid by different users (and upstream and downstream). Analysis of institutional viability of measures and distributional effects of measures. Disproportionate costs analysis structure. Stated Preference survey for analysing environmental benefits. • The study used real information on the basin as much as possible.
Key problems and potential solutions	• Information for assessing environmental costs and benefits was not available. Different hypotheses on environmental costs were considered to analyse their impact on the relative desirability of different measures. • The effectiveness of measures was difficult to assess. Consequently, some assumptions were made. • Data on unit costs of measures exists in many cases but needed to be analysed in detail to insure proper calculation of AEC.
Outstanding issues	• The contribution of different pressures to the actual status of water bodies remains a key priority to perform cost effectiveness analysis and to choose programmes of measures. • Analysis of effectiveness of measures and incorporating considerations of institutional viability of measures. • The analysis had concentrated on measures affecting water flow and physico-chemical parameters. Further analysis is required to analyse how these measures improve habitats and hence biological parameters. Measures affecting any one parameter will have “knock on” effects and this needs to be known. • Need to carry out further analysis of social impacts of implementing programmes of measures.
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Corfu Island (Greece): Carrying out the economic analysis of water uses

Keywords	Integration between economics and biophysical expertise.
Location (river basin, country)	Island of Corfu (NW Greece). The island was considered as a River Basin on a pragmatic basis, given that Greece has a large amount of islands, each with many small river basins.
Key water management issues	• Water reserves are subject to very high pressures since a significant water deficit exists on the island. This leads to conflicts between water uses. Note that water for all uses on the island is of groundwater origin and that apart from the deficit, groundwater deterioration problems exist (presence of gypsum and saltwater intrusion due to over-exploitation). To highlight the magnitude of pressure on water resources, we have to take into account the high seasonal variability of water demand, which inevitably follows the tourism peak, condensed in the summer period. To illustrate the high priority of tourism and the magnitude of conflict among uses, it is interesting to observe that in the Ropa Valley where the main land use is agriculture, the only irrigated area is a golf-terrain.
Objective and the study's function in the overall analysis	• The study aims at investigating the link between biophysical information and the economic analysis process. • It has been designed as a "non-virtual" exercise, to test the feasibility of the process of data collection/analysis and not to undertake the overall economic approach proposed in the Guidance Document. • A specific approach has been adopted based on the use of a GIS system to facilitate data storage, retrieval, processing/analysis and final data visualisation and map output. • This is considered necessary due to spatial (temporal) variability of water resources/demand characteristics, of water uses, economic activities, and pricing policies.
Planned activities and overall structure of the study	• Step 1: Initial literature review for assessing the information base. • Step 2: Interview key local water administrators (Region, Prefecture, Municipalities) for developing main assumptions for the analysis. • Step 3: Analysis of data collected and preparation of synthesis report. • Step 4: Refining the results, further elaboration. • Step 5: A Workshop with all target groups for discussing the results and raising awareness in all river basins in the country about the role of economics in the WFD is scheduled for late Summer 2002.
Disciplines and expertise mobilized	• Combination of economic expertise, hydrogeology (water quantity and quality characteristics), climatic data, land use.
Key information source mobilised (reports, books, statistics…)	• Planning documents from the Ministries of Agriculture and Interior. • Statistics on demographic data and activities by socio-economic sector. • Information collected by I.G.M.E. on water quality and quantity. • Information collected on costs of water services and water demand.
Stakeholders involvement	• Local water administrators, harbour authority, and water service suppliers were interviewed during the initial phase of the study

Corfu Island (Greece): Carrying out the economic analysis of water uses

Highlights/Results/Successes	• Some issues were not investigated due to the specifics of the pilot area. Thus, not all aspects of the Guidance Document were assessed. • Overall, readily available statistical information provided most of the information included in the study. • Lack of time hindered the development of a strategy for raising proper awareness, resulting in poor reporting from local authorities on data they are responsible to collect. • Data from more centralized sources were better organized and more easily obtained.
Key problems and potential solutions	• Information for assessing environmental costs was not available. • Difficulties with project financing. • The establishment of a "Water Agency" to operate as the sole organization for water management and to serve as the advisory and coordinating office for regional competent authorities may bring solutions for more coherent information collection and storage. Such establishment is currently being discussed in Greece.
Outstanding issues	• The allocation of costs to different uses was not performed, and the analysis remained at a very aggregated level. Further analysis will be required for assessing cost-recovery at the sectoral level. • The feasibility of applying the approach chosen in this study to all river basins in Greece remains to be assessed. Due to a potential lack of funding and time constraints, the collection of new data as performed in this study may pose significant problems. These issues need to be faced in a pragmatic way.

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Middle Rhine River Basin (Germany): Assessing the recovery of the costs of Water Services

Keywords	Cost recovery, economic assessment, data access
Location (river basin, country)	Middle Rhine, located in Germany
Key water management issues	• Cost recovery in the water services sector.
Objective and the study's function in the overall analysis	• The study addresses the methodological and empirical issues associated with the collection and evaluation of economic characteristics relating to water services (water supply & sewage disposal). It was carried out to prepare for implementation of the provisions of the European Water Framework Directive (reporting; preparation of a Middle Rhine management plan); to consolidate the methodological concept for an economic analysis of water use (recovery of costs for water services, with due regard for economic and resource costs); and to develop an appropriate empirical concept to obtain necessary economic data and information to complete the analysis.
Planned activities and overall structure of the study	• Conduct a three-stage survey in the Lander of Hesse and Rhineland-Palatinate concerning economic characteristics of water services. • Stage 1: Collect and evaluate generally available, primary data from federal and regional statistical offices concerning manufacturing data and environmental, manufacturing, employment and investment costs, and financial data for water and energy companies. Local data included information on population, and environmental statistics, financial data on local water supply companies and sewage plants. Data and information from the technical and financial authorities of the Lander provided information about information systems on water services, land survey data, water and shipping authorities, various charges for water services, and on subsidies, measures for water protection, and sustainable use of resources. Any gaps in the data may be supplemented with third party data. • Stage 2: Collect and evaluate third party data and information, such as water statistics and water rates from the Federal Gas and Water Management Association (BGW), ATV-DVGW/BGW's joint survey on public sewage disposal, and also evaluate special surveys and expert reports. • Stage 3: Primary surveys within the context of implementing the Water Framework Directive. No primary surveys were implemented within the context of this pilot project, as the data available was enough to complete the analysis. Primary surveys should only be implemented in isolated cases where there are decisive information gaps. When carrying out primary surveys, collaboration with the relevant specialist organizations is advisable.
Disciplines and expertise mobilized	• Economics for the Hessian Ministry for the Environment, Agriculture and Forestry.

Middle Rhine River Basin (Germany): Assessing the recovery of the costs of Water Services

Key information source mobilised (reports, books, statistics…)	• Primary data was used from the Federal Statistical Office, regional statistical offices for local authority data, research from water authorities and environmental agencies. Other primary data from the technical and financial authorities of the Lander was used regarding information systems about water supply and sewage disposal, land survey information, data about water and shipping authorities, on subsidies for water management plants and measures for water protection, and on charges (wastewater, groundwater, etc.) • This includes an evaluation and full census of all companies in the State of Hesse for 1998. These evaluations are annual and comparable in form by all Lander, constituting a comprehensive, reliable information base. • Secondary data and information came from the Federal Gas and Water Management Association, ATV-DVGW/BGW's joint survey on public sewage disposal, and evaluation of special surveys and expert reports. • Primary surveys in collaboration with specialist organizations.
Stakeholders involvement	• None.
Highlights/Results/Successes	• Principal findings of an analysis of the public water supply reveals that cost recovery from revenue (excluding allocations and subsidies) in Hesse is approximately 90%. Internalised environmental and resource costs (groundwater charges) significantly exceed the sum of total subsidies and the cost recovery shortfall. • For sewage disposal in the Hesse, cost recovery from revenue (excluding allocations and subsidies) is approximately 80%. Cost recovery from revenue including allocations and subsidies is approximately 92%. Internalised environmental and resource costs (sewage charge) was significantly lower than the sum of total subsidies and the cost recovery shortfall.
Key problems and potential solutions	• Not all of the sources for third party information are generally available. The availability of results from special surveys and the requirements governing the adoption of such data should be reviewed in each individual case. Where data is adopted, agreements must be signed with the respective institutions and fees may be payable. It would appear expedient to aim for centralized solutions in this context. • The abundance of data contributes to substantial time and efforts to provide an analysis, as it was necessary to combine fundamental data and information from various sources that were not necessarily compatible. Adapting the official statistics of the Federal Government and the Lander to the data requirements of the WFD may significantly improve overall reliability when determining economic characteristics. • Further, the area-wide implementation of the proposed survey and requisite constant updating necessitate a suitable form of data processing and the supply of information to the specialist authorities, as well as advance clarification of accessibility for the various parties involved in sub-regional management plans. Setting up a central data pool from which the required data about river basins could be extracted would be beneficial for this purpose.

Middle Rhine River Basin (Germany): Assessing the recovery of the costs of Water Services

Outstanding issues	• Decentralised nature of the water services sector in the Middle Rhine River Basin (with 275 water supply companies and 562 sewage treatment plants) has major significance to the potential impacts of water use on the environment and for determining economic characteristics of the water supply. • There are a number of small impoundments used for energy extraction that are of local significance and were not considered for this report.
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Motala River Basin (Sweden): Scoping an integrated appraisal for river basin management plans

Keywords	Water quality control and management, economic appraisal, river basin characterization, staff resources, information gathering
Location (river basin, country)	Motala River Basin, Sweden.
Key water management issues	• Intensive agricultural pressure (cereal crops, meat production). • Diversified farming and forestry. • Coastal areas face decline in fisheries and increased tourism, leading to eutrophication in some water bodies. • Acidification on the fringes of lakes in the central plains. • Diversified economic sector in urban areas with IT industry and small metal industries. • Surface water used for drinking in urban areas. • Hydropower fully exploited between 1890-1918; energy production still important.
Objective and the study's function in the overall analysis	• This study aims to show what type of information is needed to inform decision-makers (at which level and for what decisions) on the various types of options available to meet the requirements of the WFD. Additionally, the study shows how different elements of the appraisal system could best generate this information, and how the information could be implemented into decision-making. Finally, key information gaps and specific research needs and priorities are identified.
Planned activities and overall structure of the study	• Step 1: Characterise and differentiate (parts of) water bodies to identify bodies of water where objectives must be set and measures both identified and appraised. • Step 2: Characterise various possible measures to achieve good quality status and the level at which these measures have to be implemented. • Step 3: Characterise the diverse parties affected positively or negatively by the impacts of these possible measures. • Step 4: Determine the best use of information provided by the existing appraisal system on the environmental, economic or social impacts of the possible measures, and identify key gaps in expertise and information to be addressed to undertake cost-effectiveness and cost-benefit analysis. • Step 5: Identify staff resources. • Step 6: Identify outstanding research issues.
Disciplines and expertise mobilized	• Environmental issues, economics • Agencies involved in (general) river basin management: Municipal governments, Motala River Association for Water Care, the Lake Vätten Association for Water Care.

Motala River Basin (Sweden): Scoping an integrated appraisal for river basin management plans

Key information source mobilised (reports, books, statistics…)	• Statistics Sweden (collects data for 119 main river basin). • Swedish Meteorological and Hydrological Institute (has a register where all Swedish river basins larger than 50 km^2 and all lakes larger than 1 ha are being mapped). • Swedish Waster and Wastewater Association (for data on costs for water use and wastewater disposal). • Regional and municipal government information • Water-related associations (e.g., Swedish Board of Agriculture, Farmers Association, National Board of Fisheries, Swedish Environmental Protection Board).
Stakeholders involvement	• None
Highlights/Results/Successes	• Because of a long history of attention towards environmental quality issues, national and regional environmental strategy programmes are in place to address sustainable water management, to protect endemic marine species populations, to limit pollution in lakes and rivers, and to reduce water-borne emissions of nitrogen from human activities to the Baltic and its archipelago by half (between 1985-1995). • Scaling for basin-wide and sub-basin levels to achieve specific targets for phosphorus and nitrogen reduction was accomplished, and specific sectors were assigned the responsibility to meet each measure's objectives.
Key problems and potential solutions	• Despite ongoing programs to meet targets, some sub-basins are not meeting the established environmental targets. Starting from an existing source apportionment that shows the contribution of polluters in the sub-basin, a cost-effective pollution abatement scheme should be made for the whole river basin and including the whole River Basin District, to achieve good quality status. Ideally, such a scheme would be based on marginal costs for pollution control, although required economic information is difficult to obtain and the criteria for the trade-off between sectoral needs and wants are not yet well developed. • The abatement level of point source emissions in Sweden is already high, particularly regarding phosphorus, due to the implementation of tertiary wastewater treatment in the 1970s and 1980s, and regulation of industrial emissions. This increases the marginal costs for further treatments, and may influence a cost-effectiveness analysis. In other sectors, for example in farming, where these are fewer technical fixes, reliable data on marginal pollution control costs are less distinct. Instead, actual data for selecting among measures are (i) efficiency (achievement of effects with little regard to costs), and (ii) the degree of acceptance from stakeholders.

Motala River Basin (Sweden): Scoping an integrated appraisal for river basin management plans

Outstanding issues	• Need for further information about the link between pollution abatement costs in the most polluted water bodies, to investigate cost-effective solutions, including improvements such as wastewater treatment plants, costs of constructing wetlands and buffer zones, restore old industrial sites and waste deposit for heavy metals and other harmful substances. • Need to assess the costs/reduced profits for farmers that change their land use practices. • Need to research subject of valuing environmental public goods, possibly through contingent valuation methods adapted to include social learning and public participation in decision-making. • Need to research the extent to which environmental changes, in particular regarding water quality in Sweden, will be a consequence of endogenous socio-economic factors over the next 25 years.
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Oise River Basin (France): Testing the development of Baseline Scenario

Keywords	Baseline projection, baseline scenarios, surface water, ground water, integration between economics and biophysical expertise, cost recovery
Location (river basin, country)	Oise river basin, part of the Seine river district (France)
Key water management issues	• High diffuse pollution from agriculture (mainly intensive cropping, high livestock density). • Important urban areas, mainly downstream but also on some upstream areas. • Dense industrial concentration on main and smaller rivers. • Poor quality of Oise river and very poor quality of some smaller rivers. • Existence of a master plan for the Seine river district.
Objective and the study's function in the overall analysis	• Assessment of data availability. • Simple technical and socio-economic previsions testing: population, activity growth, population growth; pollution abatement equipment programmes and their effects on future discharge. • Methodology testing and improvement for baseline projection and scenarios, focusing on surface water quality. • Illustration of potential benefits of baseline scenarios for water policy settings.
Planned activities and overall structure of the study	• Step 1: Identify past trends and present state of water policy, surface water quality and pollution (including sewage equipment and discharges). • Step 2: Establish baseline projection; assessment of the confidence of key data, methods and results (water quality, investment estimation); water quality evolution estimated by expert knowledge. • Step 3: Baseline scenarios including cost recovery examination; water quality evolution estimated by model. • Step 4: Insights for water policy-making: evaluation of the relevance of present policy, cost recovery issues, knowledge needs. • Step 5: Insights on methodology: feasibility of global approach and of specific tools (e.g. environment response modelling), along with needed improvements.
Disciplines and expertise mobilised	• Biophysical expertise, engineering (sewage techniques and efficiency) and economics. • Multi-disciplinary coordination and synthesis. • Communication expertise for effective dissemination of study output.
Key information source mobilised (reports, books, statistics…)	• Detailed data on water pollution sources (raw pollution, treatment, discharge, main investment program or needs proceeding from present water policy), water intakes and water quality. • Expert knowledge on mean pollution ratios. • Demographic data (past, present and future provisions). • Regional planning documents.

Oise River Basin (France): Testing the development of Baseline Scenario	
Stakeholders involvement	• Main stakeholders involved in the study: water agency bureau for Oise river basin (manager, planning expert, investment support manager, water quality expert), water agency experts (economics, engineering and water quality), independent scientists (modelling environment response) and private consultancy (coordination and synthesis, communication). • Associated stakeholders include regional representatives of Environment Ministry.
Highlights/Results/Successes	• Proved feasibility of methodology on Oise river basin scale. • Good confidence can be reached on assessment of pollution sources, discharges and equipment needs for industry and households. • Baseline scenario highlights major difficulties for achieving surface water quality objectives: durable nitrate pollution involving ground water, long improvement process for very poor quality sectors, incompatibility between good status definition and some natural processes (suspended matter standards towards erosion).
Key problems and potential solutions	• Main problems are related to groundwater: distribution of discharges (non connected households, breeding farms) between surface and ground water, magnitude and speed of contaminating and decontaminating mechanisms in soils and groundwater, pollution transfer from ground to surface water. There is a need for specific knowledge and for integrating surface and ground water. • Drastic uncertainty about future level of economic activities (industry and agriculture): scenarios are needed but not sufficient, perspective has to be used.
Outstanding issues	• Specific key expertise involved is not economics, but "economic approach", i.e., multi-disciplinary coordination and synthesis plus uncertainty management. • Existing data allow baseline projection on surface water pollution and quality, highlighting needs for scenarios and for environment response models. • Methodology feasible at Oise river basin scale, projection relevant for 5 to 7 years (anticipated), scenarios and probably perspective necessary for a projection up to 15 years. • Study provides useful results about compliance defaults of present policy towards good status objective for 2015, allowing a wider vision than recent planning preparation (up to 2006).
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Ribble River Basin (England): Integrated appraisal for river basin management plans

Keywords	System of measures; risk-based assessment, cost-effectiveness
Location (river basin, country)	Ribble River basin, located in the Northwest of England.
Key water management issues	• Pressures from sewage treatment works. • Water abstraction pressures. • Diffuse pollution from agricultural land, compounded with somewhat impermeable clay soils. • Varied water quality in urban and rural reaches. • Lack of wastewater treatment facilities. • Pressures from tourism and economic development and regeneration.
Objective and the study's function in the overall analysis	• This hypothetical study uses existing data and assumptions for missing data. It charts the whole process of carrying out an integrated appraisal of measures – from choosing a system of measures and conducting a cost-effectiveness analysis to determining options for disproportionate costs - for achieving good water status in the basin through a six-step process, rather than the three-step process suggested by the Guidance Document. Specific emphasis is paid to the Cost Effectiveness Analysis. The case also identifies and investigates the issues and problems that arose throughout this "virtual" process, and looks ahead to future requirements beyond the 2004 deadline.
Planned activities	• Use of expert interviews (both telephone and face-to-face) with key decision makers, stakeholders and experts, to gain perspectives on the appropriate processes for developing an integrated study, developing tools and information to perform the "virtual" study. • Develop a background review and issues report that presented an illustrative, outline an approach for integrated assessment in six steps (detailed below), along with a range of worked examples to indicate how this assessment process could address some of the issues raised by stakeholders and decision makers. • Host a two-day workshop to discuss findings and issues regarding practical implementation of this approach; identify strengths of the approach and priority future research needs.

Ribble River Basin (England): Integrated appraisal for river basin management plans	
Overall structure of the study	• Step 1: Objective specification, to produce an agreed and consistent framework for the appraisal of measures, which incorporates national, regional and local objectives related to water and other quality issues. Interview key decision-makers, stakeholders and experts to seek their views regarding the appraisal system, determine the information needed to aid decision-making and on the availability of data for this. • Step 2: Assessment of pressures and risks of non-compliance under a business as usual case. This risk-based assessment maps the likelihood that water bodies will fail to achieve good water status in future planning periods without any additional policy measures. • Step 3: Option screening. Identify feasible and cost-effective measures aimed at reducing the risk of not achieving good water status in different plan periods. • Step 4: Option appraisal. Identify and appraise cost-effective measures for achieving various classes of water quality status, and an assessment of the costs and ancillary impacts of these measures. This aims to cover in an even-handed way all of the effective measures for the main sectors (e.g., water industry, non-water industry, agriculture, and other diffuse sources of water pollution). • Step 5: Objective refinement. To assess the most appropriate measures for particular water bodies given the feasibility of identified measures in achieving different classes of water status and their costs. This process focuses on examining whether the system of measures selected is disproportionately expensive, so as to inform the decision of whether derogations may be needed. • Step 6: Plan agreement. Develop an agreed set of actions for the Agency, its partners, sectors and specific geographic areas and involving national, regional and local stakeholder consultation
Disciplines and expertise mobilized	• A range of experts with backgrounds including economics, consultation, policy, environmental data assessment, water quality, water resources, HMWB, agricultural specialists, local and regional authorities. • Experts in public consultation/participation • Functional experience included the strategic, policy, and operational levels.
Key information source mobilised (reports, books, statistics…)	• Expert interviews with key decision-makers, stakeholders and experts. • Available data assisted with assumptions where data is unavailable. • The appraisal is a virtual study; no new empirical research was used, nor do the findings have any empirical status.
Stakeholders involvement	• Study was developed by the Environment Agency with the Water Research Center and Environment & Society Research Unit (ESRU, University College London). • Two-day workshop hosted 55 delegates, about half were from the Environment Agency, and the rest representing a wide range of organizations including the Department for Environment, Food and Rural Affairs (DEFRA) in England and Wales, European experts including EC DG Environment officials, OFWAT, academics, NGOs and expert stakeholders from the water industry, National Farmers Union, and the Royal Society for English Nature.

Ribble River Basin (England): Integrated appraisal for river basin management plans

Highlights/Results/Successes	• Uses a six-step approach rather than the three-step approach suggested by the WFD. The study stresses that the six steps identified are not linear; there are numerous links and feedbacks required and inputs regarding consultation, the framework (guidance) and tools that feed into all stages at different points. • Process-oriented study addresses how the different steps required to implement an integrated system of measures system might be considered, with clearly detailed responsibilities, inputs, outputs, relationship to the WFD deadlines, and relationship to WFD requirements, while identifying further issues for discussion. • Identifies the need to undertake a risk assessment of water bodies that may fail to achieve a good quality water state in future plan periods when developing the business as usual case. Addresses issues with developing the proper tools and methods to conduct a risk analysis where lack of data with different levels of certainty, and where qualitative data may. • Discuss the integration between sector policy (namely agricultural policy) and the process of developing integrated river basin management plans.
Key problems and potential solutions	• Simplistic worked examples demonstrate the need for more complicated analysis modelling multiple outputs and indirect impacts of measures. • Use of "fail one fail all" for indicators projecting water quality status fails to capture the degrees of impact each indicator may have. • Study considers using a weighting system to differentiate between levels of indicator.
Outstanding issues	• The overall process for integrated appraisal for RBMPs in the context of the direct needs of the WFD, and the capabilities of the Environment Agency to meet these needs. • Whether to assess impacts measure by measure, or strategy by strategy. • With the large number of water bodies and lack of resources to study each, developing a form of benefits transfer will be necessary to apply valuations derived from other studies of similar cases.

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Rhône Méditerranée Corse River Basin (France) :
Assessing the pertinent scale for the economic analysis

Keywords	Scale, agriculture, industry, tourism, local water management plans, redefining perimeters, detailed data on water use, public consultation.
Location (river basin, country)	Rhône-méditerranée-Corse Basin (France)
Key water management issues	• Population density with diversified spatial distribution. • Heterogeneity of population with high demand and discharges in vulnerable zones. • Desertification of mountainous zones. • Importance of tourism with accompanying pressures on water supply. • Intense agricultural region with cattle breeding. • High industrial activity concentrated in five areas.
Objective and the study's function in the overall analysis	The Rhône-Méditerranée-Corse Agency investigated the basic territorial scale that could be used for an economic analysis. The main objective was to define operational ways (choice of criteria, indicators, cartographies) that would allow competent district authorities to define criteria suited to their river basin for identifying coherent and relevant geographic territories to undertake the economic analysis and to address the constraints raised by an analysis strictly limited to a water body scale.
Planned activities and overall structure of the study	A preliminary study was carried out at the end of 2001.The objective of the study is not to give a "recipe" for all districts, every case being specific and presenting a specificity due to the natural environment and the socio-economic context. Rather, the aim is to propose a methodological approach based on an exhaustive research of criteria describing economic activities, while keeping in mind the need to adapt data, tools and geographic zones (hydrography or management entities) in each district.
Disciplines and expertise mobilised	• The study was undertaken by the RMC water agency. • Multi-disciplinary consultation.
Key information source mobilised (reports, books, statistics…)	• Detailed data on water use sources (agriculture, tourism, industry, natural parks, population, etc.). • Expert knowledge.
Stakeholders involvement	No stakeholder involvement in the study.

Rhône Méditerranée Corse River Basin (France) : Assessing the pertinent scale for the economic analysis

Highlights/Results/Successes	It was necessary to stay within a reasonable budget for data collection to define territorial scales for economic analysis. Consequently, comments relative to indicators and cartographies demonstrate that most of the time and for most basins, hydrographic territories close to the socio-economic areas can be defined based on the criteria for the study. In the RMC basin case, the "SDAGE territories" seem most relevant for adaptation to the model. In other basins, territories can be defined with assistance from geographic commissions, local water development and management plans (SAGE), or other local management areas. The following stage consisted in redefining perimeters of SDAGE territories (in the case of RMC basin). As a result, the basin was cut in 18 large zones. The final division will be defined taking into account the water bodies' perimeters while taking care, if possible, not to divide the entities of local management (local water development and management plan, parks, etc.).
Key problems and potential solutions	It is necessary to avoid as much as possible dividing a territory such as natural reserves, parks, or other entities and divide it between two entities. However, it is sometimes difficult to conciliate all of the existing divisions with the information brought by a study of socio economic criteria and hydrographic logics. The methodology used tried to identify successively relevant criteria and, if possible, to discriminate between economic activities. It was then a question of identifying all the hydrographic partitions to identify one that had closer information brought by the interpretation of the previously identified criteria. This method limits costs and offers a necessary qualitative approach that accounts for local and concrete characteristics. The methodology is based on a compromise between socioeconomic, hydrographic, territorial criteria, etc., and so contains some degree of interpretation.
Outstanding issues	The study began with significant efforts in terms of data collection and information research with data suppliers or with competent entities in the main economic fields of economic activities (agriculture, industry, tourism, etc). In the French case, it has to be underlined that the majority of information is available easily (at low cost) on the municipal scale even if certain sectors for confidentiality purposes provide their data only for larger scales, as is the case with the agricultural sector. It is thus a question of refining the initial division by including each local community in a single economic zone, and each water body in a single economic zone, following the text of the framework directive, which specifies that the economic analysis can be made by grouping water bodies.

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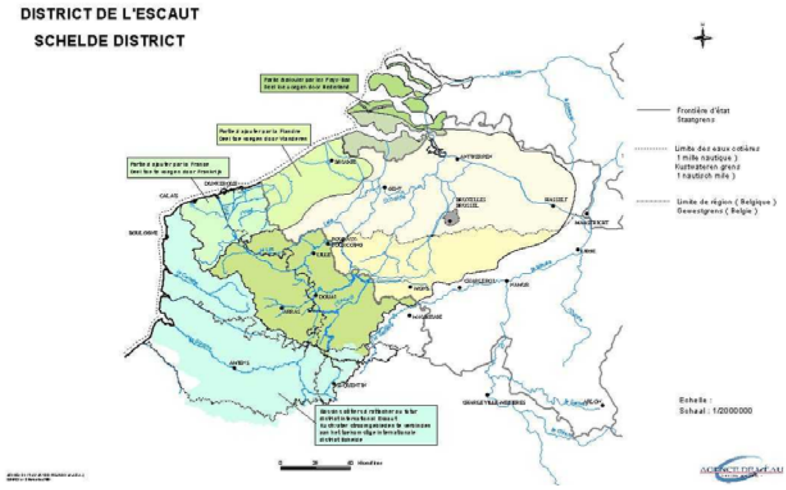
Scheldt International River Basin (The Netherlands, France, three Belgium regions): Testing elements of the three step-approach

Keywords

Characterisation, cost-effectiveness, integration between economics and biophysical expertise (Impact & Pressure), groundwater abstraction, Surface water quality, morphology, International district, data availability

Location (river basin, country)

Scheldt International River Basin (France, Belgium[1] and The Netherlands)



Key water management issues

- **International context**
- **High density of population and industry**
- Rather bad quality of surface waters and Heavily modified water bodies
- Diffuse pollution from agriculture
- Local stress on water resources (groundwater)
- Existence of master plans for some parts of the river basin and an international commission for the protection of the Scheldt

Objective and the study's function in the overall analysis

- The study aims at applying the approach and some elements of the draft guidance document (baseline scenario, cost-effectiveness analysis) on three individual case studies: surface water quality, groundwater abstraction and morphology. The purpose of this work was to test the feasibility of the process and methods rather than to provide specific results, and to assess the availability and comparability of data between the five parties involved in the Scheldt International River Basin.

Planned activities and overall structure of the study

- Step 1 - initial literature review phase for assessing the information base in the five parties involved in the river basin considered.
- Step 2 – workshop in Amsterdam involving WATECO and IMPRESS working group experts (November 2001) – analytical process based on the Ribble scoping – identification of 3 sub-case studies (water quality, groundwater abstraction, morphology)
- Step 3 – Workshop in Brugges (February 2002) – report from each of the three case studies team
- Step 4 – Presentation of the preliminary results at the "Lille 3" conference – March 2002
- Step 5 –Writing of a synthesis and possible follow-up of the work started through the "Scaldit" project

(1) [1] including the 3 belgian regions : Brussels, Flanders and Wallonia

Scheldt International River Basin (The Netherlands, France, three Belgium regions): Testing elements of the three step-approach

Disciplines and expertise mobilised	• Combination of economic expertise, impact and pressure, soil scientists • Input from River 21 project for the characterisation and baseline scenario • Support from the EC DG Environment, consultants (ERM) and academics (ENGREF) for the case study on groundwater abstraction; • Access to the data collected by the Secretariat of the International Commission for the Protection of the Scheldt
Key information source mobilised (reports, books, statistics…)	• Planning documents and indicators from the water bodies and administration from the fives parties (mainly from the RIZA, VMM, Artois-Picardie Water Agency, IBGE and Ministry of Environment from Wallonia) • Data on water quality, groundwater abstraction
Stakeholders involvement	• The involvement of stakeholders was limited (initially a workshop with stakeholders was proposed but had to be cancelled due to time constraint). However, the need for stakeholder' input has been clearly identified (data, expertise, discussion on potential measures...)
Highlights/Results/Successes	• The test of the process has allowed to clearly identify the working links required for integrating the economic analysis in the whole process of developing an integrated river basin management plan in an international river basin district • All the steps of the economic approach (characterisation, risk assessment, cost-effectiveness analysis) performed for the morphology case • Elaboration of a rough method to assess the impact of main water uses on water quality • Analysis of the aquifer system of the entire river basin district and proposal of a simple model for applying the economic approach
Key problems and potential solutions	• The monitoring system differs between countries/parties. A solution could be to harmonised these systems; this could be developed along activities aimed at modelling the entire district integrating sub-catchments to tackle upstream/downstream interdependencies • The need to find the "right" scale to undertake the analysis. This generates preliminary work in order to understand the functioning of the district (e.g. relations between the different aquifers)
Outstanding issues	• The baseline scenario and the cost-effectiveness analysis were skimmed over as the data or the expertise were lacking or difficult to collect for a test in an international context. • Set up of an informal network of experts (mixing disciplines and countries) that could be a resource for the implementation of the WFD
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Sevres-Nantaise River Basin (France): Testing the chronological feasibility of the three step approach

Keywords	Cost effectiveness, cost benefits, baseline scenario, scenarios of investment, costs of program of measures, cost recovery
Location (river basin, country)	Sèvre Nantaise river basin – Loire Brittany district (center of France). A local water master plan (SAGE) was adopted over this geographic area
Key water management issues	• Lack of own water resources: 50% of the drinking water comes from other river basins. • Important tourism in the river basin • Abstraction for irrigation (corn and vegetables) • Abstraction for industry (96 large industries in the river basin) • Important diffuse pollution (pig farming)
Objective and the study's function in the overall analysis	• Testing the chronological feasibility of the three-step approach: • Availability of data required (mainly for cost recovery). • Building of prospective scenarios. • Elaborating and evaluating programmes of measures based on cost effectiveness and cost benefit analysis. • Estimating the current level of cost recovery for the three main sectors (household, agriculture, industry).
Planned activities and overall structure of the study	• Collection of existing data and "proxy" to assess initial status. • Build a baseline scenario. • Build an alternative programme of measures, estimating costs and benefits. • Compare the alternative scenarios on the basis of cost effectiveness and cost benefit analysis. • Estimate the current level of cost recovery per sector.
Disciplines and expertise mobilised	• Technical expertise: agency experts and consultant. • Economic expertise: consultant with support from the agency and the Ministry.
Key information source mobilised (reports, books, statistics…)	• Data collected for the master plan: data on abstraction, water quality and economic activities, along with modelling of the impact of alternative investment programmes. • University studies on environmental benefits. • Estimation of experts on: investment costs, level of cost recovery.
Stakeholders involvement	• Agency experts were involved in the technical and economic aspects of the study. • No involvement of the actors of the master plan (local decision makers) was required, because they did not have to validate the proposed scenarios due to the short duration of the study, and the earlier stage of development of the master plan (initial status).
Highlights/Results/Successes	• Pointing at the reliability of the chronological link of each step of the 3-step process provided in the guidance document

Sevres-Nantaise River Basin (France): Testing the chronological feasibility of the three step approach

Key problems and potential solutions	• Difficulties linked to the data: there is an important need for data (physical, economic, etc.), for each step. The availability has not been tested with this study, as data was collected or constructed from other, former studies. • Difficulties linked to economic tools: environmental costs and benefits are hard to quantify, and they are hard to transfer easily. • Difficulties linked to reporting cost recovery: it is possible to have data on cost recovery for households. For industry and agriculture, little data exists at each scale (local, regional, district, national).
Outstanding issues	• Need to involve stakeholders in future studies. • Need to develop an economic database in the field of environmental cost and benefits. • Need to develop knowledge about cost recovery in industry and agriculture.
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Vouga River Basin (Portugal): Scoping key elements of the economic analysis

Keywords	Linkage between economic and biophysical analysis, sources of information, stakeholder participation, cost recovery, current price structures
Location (river basin, country)	Vouga river basin (Portugal)
Key water management issues	• Urban, industrial and agricultural pollution. • Institutional arrangement complexity. • Inappropriate management resources. • Implementation of the existing River Basin Plan and National Water Plan.
Objective and the study's function in the overall analysis	• The main goal was to perform a virtual economic analysis, along the lines of what will be required for 2004 (Art. 5 of the WFD).
Planned activities and overall structure of the study	• Step 1: Identification and characterisation of the main users. • Step 2: Collection and organisation of the existing information; identification of information gaps. • Step 3: Interviewing stakeholders. • Step 4: Analysis of price and cost structures. • Step 5: Analysis of cost recovery and incentive properties of pricing schemes. • Step 6: Initial analysis of gaps in water status in cooperation with other national working groups.
Disciplines and expertise mobilised	• Direct involvement of economists and environmental and water resource engineers. • Work developed by the economic group of INAG, the institution responsible for the WFD implementation in Portugal. • Universities and research centers were involved though protocols with INAG (UNL and ISCTE).
Key information source mobilised (reports, books, statistics…)	• Vouga River Basin Plan and National Water Plan. • Stakeholder interviews. • Other official statistics (INE).
Stakeholder involvement	• Development of specific questionnaires to fill the main economic information gaps. • Group visits to the river basin with direct stakeholder contact.

Vouga River Basin (Portugal): Scoping key elements of the economic analysis

Highlights/Results/Successes	• There is considerable variability in municipalities' price structures and there are no clear criteria in the definition of price schedules. The revenues of supply and wastewater systems are not usually enough to cover investment and operation costs. The only case where data was sufficient yielded estimates between 85% and 115% of operation cost recovery for water supply. • For agriculture, data is very poor. Infrastructure values are outdated, there are no organised records of exploration costs, and water volumes are not metered. Prices in public irrigation facilities are low and unrelated to actual water consumption. The managers of those facilities expressed a common opinion that no one would use the water if prices increased. For other types of irrigation systems, no information is available. • For industry, there is some data on consumption and costs for large industrial facilities, but information is missing for many plants, especially those that have self-services for water abstraction, treatment and wastewater discharges.
Key problems and potential solutions	• Available economic information is incomplete, piecemeal, unevenly spread in space and time and not always comparable. Existing information is not readily available since it is not organised in a way that would make it straightforward to use. • The situation should improve with the recent approval of a mandatory set of accounting standards for local authorities, and with the carrying out of planned national surveys of supply and wastewater systems as well as water uses in general. • Information on water quality is not complete, as the national monitoring network is in the process of being set up. • The group was unable to go very far into the identification of gaps in water status and subsequent selection of programmes of measures because the other working groups were just starting their activities. • Some information is at most disaggregated into municipalities. As municipal boundaries do not coincide with river basin boundaries, the compatibility of scales will be a relevant issue.
Outstanding issues	• Cooperation with the other working groups did not go as far as would be desired to perform the complete economic analysis. • Very limited approach to baseline scenario development. • Available information was insufficient for cost-effectiveness analysis.
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