STUDY ON THE IMPACT OF COMMUNITY ENVIRONMENT - WATER POLICIES ON ECONOMIC AND SOCIAL COHESION

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SYMBOLS AND ABBREVIATIONS

:	=	Not available
M	=	Million
B	=	Billion
ha	=	Hectare
m^3	=	Cubic metre
p.e.	=	Population equivalent
kg	=	Kilogram
MS	=	Member State

1. INTRODUCTION

Following the Call for Tender No 2000.CE.16.0.AT.076 from the European Commission Directorate General – Regional Policy, WRc were selected to undertake a study entitled *The Impact Of Community Environmental-Water Policies On Economic And Social Cohesion.*

The study aims at providing material relevant to the production of a *Second Report on Economic and Social Cohesion* in relation to the impact of environmental policies in the area of water policy (see Appendix 1 for a summary of the equivalent assessment in the 1996 *First Report on Economic and Social Cohesion)*.

Economic and Social Cohesion is defined as convergence on a number of criteria between different "cohesion units". The key criteria include income, productivity and employment opportunities and key cohesion units include Member States or regions thereof (NUTS level) rural-urban groups, sectoral and social groups.

Economic and social cohesion may be impacted significantly from the operation of EU environmental policy relating to water. There has been a recent recognition of the so-called "resource-paradox" involving the simultaneous over use of natural resources and under-use of human resources and hence the potential role of environmental policy in promoting sustainability in Europe.

Most focus from the perspective of policy evaluations has been on the UWWTD, the Drinking Water Directive and the Nitrate Directive. However, from the perspective of economic and social cohesion it is important to start from the totality of EU environmental policy affecting the water environment rather than concentrating on the more high profile directives. A further point is the need to focus on changes since 1995, as many of the earlier directives have seen no significant changes since that time. The long implementation periods of environment-water policies, however, means that some directives adopted before 1995 have important impacts post 1995, and hence warrant examination here. Of considerable importance is the Water Framework Directive (WFD) a conciliation text for which has recently been agreed.

The WFD will lead to the rationalisation of much water legislation and is taken as the starting point in this analysis. Analysis of the economic and social cohesion impacts of the Water Framework Directive can at this stage only be limited although a number of key issues can be identified, particularly in terms of:

- integrated river basin management;
- the recovery of costs from users/polluters; and
- from setting common quality targets (on an ecological basis) across the community.

The WFD itself contains a number of other pieces of legislation as basic measures (not all of which are strictly environment-water related) that can be analysed as supporting measures to the WFD. These measures are the main environment-water related policies: Urban Wastewater, Drinking Water, Bathing Water and Nitrate.

This report is structured as follows:

- Section 2 provides relevant background material and a general introduction to the issues. This section aims to provide a succinct and authoritative overview of the relevant policies, based on policy documents, interviews with key actors and more general literature. The focus is on the policy developments since the mid-1990s and on those aspects of policies most relevant to cohesion. The section is written in general terms to facilitate an understanding of the issues by non-environment specialists.

- Section 3 presents the results of the work carried out in identifying the linkages between water policies and cohesion units. This involves the examination of directives and other literature to identify mechanisms through which policies may impact on economic and social cohesion. Causal relationships are identified examining the aspect of the directive involved, the mechanism through which cohesion objectives are impacted and the cohesion groups affected. Section 3 ends with a discussion of the key impacts, selecting a number for more detailed examination:

  - Cost recovery charging and the Water Framework Directive,

  - Health and productivity and the Drinking Water Directive,

  - Employment and the Urban Waste Water Treatment Directive,

  - Agricultural productivity and the Nitrate Directive.

- Section 4, 5, 6 and 7 present the quantification of first order and final effects of the environment-water policies on economic and social cohesion for the selected linkages. The main sources of information are the Eurostat REGIO database and the European Environment Agency's Data Warehouse.

Throughout this report particular attention is paid to a number of important horizontal issues:

- *Regional differences in implementation costs of existing and proposed directives on water policy.* Considerable differences are observed in the implementation costs for EU water policy as a result of a number of factors. These include the interpretation of the requirements of the Directives by Member States, their initial environmental situation and the nature and status of the environmental infrastructure affected (e.g. the existing level of treatment capacity).

- *The impact of the directives on the environmental situation.* It is necessary to recognise that the distribution of impacts between cohesion groups based on the costs of environmental measures may differ from the distribution of benefits. Hence an overview of the impact of the directives on the environmental situation is necessary.

- *Possible impacts on the location of activities given different degrees (strictness) of application of regulations.* An example of this "pollution dumping" effect may be the relocation of industrial or agricultural activity from regions in which policies are strictly applied to other areas. Significant examples of this effect are highlighted.

- *Accession Countries* – Although focussing on the current EU-15, the likely impact on national, regional and social cohesion in Accession Countries is examined.

- *Effects of derogation* – of environmental legislation (temporary and permanent) are highlighted.

Finally, Section 8 presents the summary and recommendations from the work carried out.

2. BACKGROUND TO WATER AND COHESION

2.1 Overview of section

This section provides relevant background material and a general introduction to the issues. The section aims to provide a succinct and authoritative overview of the relevant environmental pressures and policies, based on policy documents, interviews with key actors and more general literature. The focus is on the policy developments since the mid-1990s and on those aspects of policies most relevant to cohesion. The section is written in general terms to facilitate an understanding of the issues by non-environment specialists.

2.2 The framework

To facilitate an understanding of the relationship between environmental pressures, policies and their impact on social and economic cohesion, an analytical framework must first be adopted. Cohesion may be defined in terms of cohesion indicators (income, productivity etc.) and cohesion units (states, regions and sectors). This allows at least 12 cohesion impact categories to be identified (Table 2.1) through which environment-water policies may have an impact on economic and social cohesion.

Table 2.1 Typology of cohesion linkages

	Cohesion indicators		
Cohesion units	**Income** ***(e.g. GDP/head at PPP)***	**Productivity** ***(e.g. GDP/employee)***	**Employment opportunity** ***(e.g. employment, unemployment and long term unemployed)***
Regional (i.e. MS and NUTS levels)	1. Impacts on national/regional income	2. Impacts on national/regional productivity	3. Impacts on national/regional employment opportunities
Demographic (i.e. rural-urban)	4. Impacts on rural-urban income differentials	5. Impacts on rural-urban productivity	6. Impacts on rural-urban employment opportunities
Sectoral *(i.e. industrial-service)*	7. Impacts on sectoral income	8. Impacts on sectoral productivity	9. Impacts on sectoral employment opportunities
Social *(i.e. women, young, poor)*	10. Impacts on incomes of social groups	11. Impacts on productivity of social groups	12. Impacts on employment opportunities of social groups

An alternative way of looking at linkages is to recognise the cohesion and water-environment gaps that exist and the possible ways in which such gaps may be closed through environmental, social and economic policies. The Figure 2.1 illustrates this framework.

In this figure, an indicator of social and economic opportunity is drawn on the vertical axis and an indicator of environmental pressure is drawn on the horizontal. The area is bisected to identify four areas characterised by high and low levels of economic opportunity and high and low levels of environmental pressure. The impacts of environment-water policy and policies for economic and social cohesion may then be identified in terms of the way in which gaps in environmental quality and economic opportunity are closed.

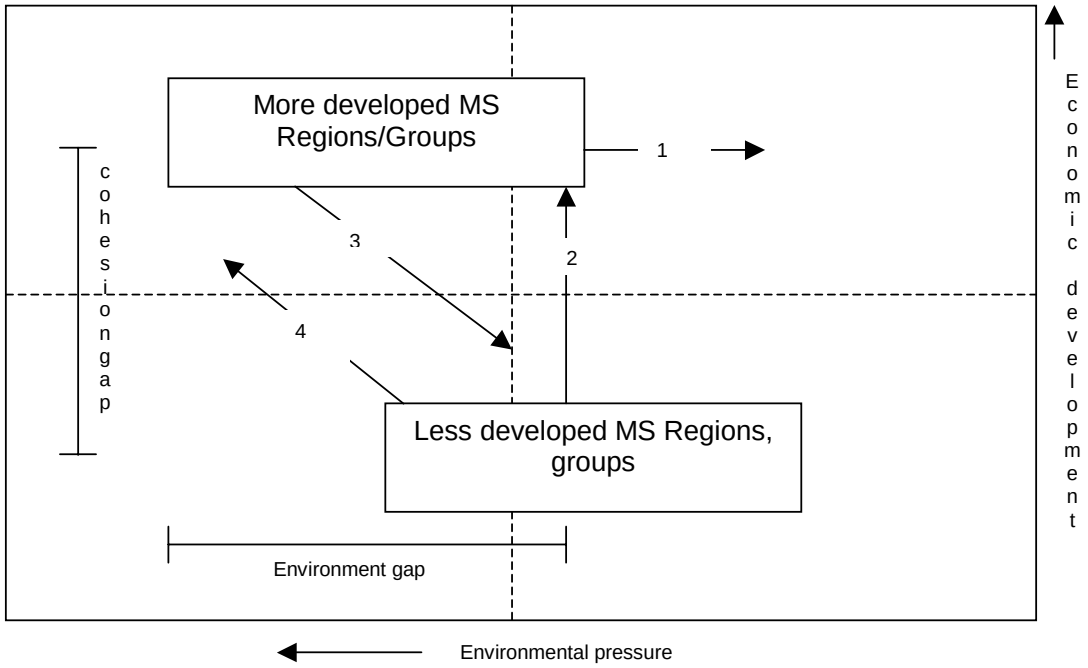

Figure 2.1 Cohesion and environmental gaps – types of links

Arrow (1) represents a characterisation of largely sustainable environment-water policies in that pressures are reduced without reducing social and economic opportunity.

Arrow (2) characterises sustainable economic and social policies in that positive movements towards cohesion are brought about without further degradation of the environment.

Arrow (3) represents unsustainable environment-water policies, where, environmental pressures are reduced but only through a negative impact on economic opportunity. It should be noted that such a development on face value contributes to cohesion. Such negative cohesion, is however, not considered sustainable.

Arrow (4) characterises unsustainable economic and social policies in that positive cohesion impacts are induced but at the expense of the environment. As with (3) such cohesion is not considered sustainable.

As the nature and extent of the environmental problems that are the subject of the policies differ spatially, it is to be expected that there will be consequent impacts on economic and social cohesion. The environment-water policies have dual outputs in terms of a benefit

(linked to the achieved improvement or protection of the environment) and a cost (related to the expenditures required to achieve the objectives). In the water sector (unlike the air sector) the spatial distribution of benefits will be closely aligned to the distribution of environmental problems. This is a natural consequence of the localised nature of environment-water problems. The distribution of costs is less naturally aligned to the source of the environmental problems largely because of the important role of public authorities versus private actors in managing water resources.

As impacts on linkages may be observed at a number of levels (i.e. regional impacts may also be seen at a national level) the focus adopted is firstly on the cohesion indicator impacted (income, productivity and employment opportunity) and secondly on the unit affected.

Using these two, related, perspectives on the types of linkages between environment-water policies and social and economic cohesion, the following sections discuss the pressures and the policies adopted to confront them.

2.3 The pressures

Like economic opportunity, water quality and quantity are not evenly distributed in the EU. A variety of pressures are placed on the environment by human activities that vary in intensity and impact. Variation in intensity relates to the scale of the economic and other activities contributing to the pressures. The variation in the impact varies also because of differences in the ability of the ecosystems affected to absorb the impacts.

Pressures on the water environment from human activities tend to arise from increased loading of contaminants above the absorptive capacity of the water bodies. Quantitative pressures also reduce absorptive capacity but may also lead to resource depletion. A number of the key pressures are discussed below.

Nutrients

Eutrophication is the result of nutrient (e.g. nitrogen and phosphorous) enrichment of water bodies. Enrichment leads to changes in the ecosystem balance and affects the beneficial uses to which the water resources may be put. The main human sources of eutrophication pressure are nitrogen and phosphorous discharges. These discharges may be either diffuse in nature (e.g. run off from agricultural and built up land surfaces) or point source (e.g. discharges from industry and wastewater treatment plants).

Heavy metals

The most common heavy metals in marine and coastal environments are cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium and zinc. Many heavy metals are needed in trace amounts for the normal functioning of animals and plants. Excessive amounts of these metals however become toxic. Heavy metals tend to be persistent (not broken down in the environment) and tend to accumulate in organisms and in the food chain.

Organic matter

Organic matter produced through various types of human activity is a major source of pollution in rivers. The breakdown of organic matter consumes oxygen that is needed by aquatic plants and animals. High levels of organic pollution (measured as Biological Oxygen Demand, BOD) can lead to a rapid depletion of oxygen in water bodies and the disappearance of fish and aquatic invertebrates. The main sources of organic matter are discharges of domestic and industrial sewage. In turn organic pollution can limit water uses and increase pathogenic concentrations of micro-organisms.

Pesticides

Pesticides have become an essential component of modern farming techniques and have contributed significantly to ensuring food security in Europe in the latter half of the 20th century. Contamination of water by pesticides occurs through a number of mechanisms including spray drift and leaching from soils. Although agriculture is a major source, important contributions also come from amenity (e.g. spraying of road and rail verges) and household uses. Pesticides entering drinking water supplies must be removed through expensive treatment methods. Within water bodies pesticides can be toxic to aquatic animals and plants.

Resource depletion

A mismatch between demand and supply of water leads to the over-exploitation of water resources and hence depletion. This problem is particularly apparent for groundwater because of often very slow recharge rates. Resource depletion gives rise to conflict between water users. In addition, groundwater often contributes to river base flows and over-exploitation can lead to low flows in dry periods.

2.4 The policies

One of the primary objectives of EU Policy in the field of the environment is the reduction of pressures placed upon the water environment. Some 20 or so directives have been agreed since 1973 that relate to aspects of the management of water pollution and quality.

Table 2.2 Directives for the protection of water

Water Quality Directives - whereby standards are set for the protection of specific uses of the aquatic environment.	Surface Water Directive (75/440/EEC) Bathing Water Directive (76/160/EEC) Freshwater Fish Directive (78/659/EEC) Shellfish Directive (79/929/EEC)
Sector Directives – whereby controls are set on specific industrial sectors.	Titanium Di-oxide Industry Directive (92/112/EEC) Urban Waste Water Treatment Directive (91/271/EEC)
Individual Substance Directives - whereby controls are set on certain dangerous substances, irrespective of their source.	Dangerous Substances Directive (76/464/EEC) Nitrate Directive (91/676/EEC) Groundwater Directive (80/68/EEC)
Product Directives - where controls are set to minimise the presence of certain dangerous substances in products that may ultimately end up in the aquatic environment.	Drinking Water Directive (80/778/EEC) Detergent Directives (73/404/EEC) Plant Protection Product Directive (91/414/EEC)

Four different types of directives have been employed by the EU to control pollution of the aquatic environment. Table 2.2 classifies the individual directives within this scheme.

All of the quality directives with the exception of the Bathing Water Directive have been taken over by the recently agreed EU Water Framework Directive but they remain legal instruments for another 7 years once the Water Framework Directive has been adopted.

The Water Framework Directive itself identifies a number of directives as basic measures to be included within the programme of measures to achieve the directive requirements. These are:

- The Bathing Water Directive 76/160/EEC;
- The Birds Directive 79/409/EEC;
- The Drinking Water Directive 80/778/EEC as amended by Directive 98/83/EC;
- The Major Accidents (Seveso) Directive 96/82/EC;
- The Environmental Impact Assessment Directive 85/337/EEC;
- The Sewage Sludge Directive 86/278/EEC;
- The Urban Wastewater Treatment Directive 85/337/EEC;
- The Plant Protection Products Directive 91/414/EEC;
- The Nitrate Directive 91/676/EEC;
- The Habitats Directive 94/43/EEC;
- The Integrated Pollution Prevention and Control Directive 96/61/EC.

The inclusion of these directives as part of the basic measures of the WFD reflects their importance in determining the ecological quality of river basins. Each of these measures is discussed in the following sections.

Water Framework Directive

The Water Framework Directive will be the key element of future water policy in the EU. It represents a landmark in the way water is managed because it sets targets for good quality of waters across the EU and involves significant changes in the way water will be managed. Previously, water has been managed mainly in relation to identifiable uses (e.g. waters used for bathing, shell fishing, drinking etc.). Quality standards or emissions limits were developed in order to protect these identified uses. The Water Framework Directive takes a different approach by defining good status in relation to relatively un-impacted water bodies.

The Bathing Water Directive 76/160/EEC

The Bathing Water Directive 76/160/EEC is one of the oldest pieces of environment-water related legislation. It is now considered to be out of date and there are unanimous calls from the MS for the Directive to be updated and the necessary research is now in progress. The Directive defines standards that are applicable to both fresh and marine waters designated for bathing or where bathing has traditionally been practised by a large number of users. Compliance with the standards often requires significant improvements in wastewater treatment works' discharges in the vicinity of designated waters.

The Birds Directive 79/409/EEC and the Habitats Directive 94/43/EEC

The Birds Directive 79/409/EEC provides a system of protection for all species of wild birds found in EU Member States. The Directive requires the provision of sufficient diversity and area of habitats so as to maintain the population of all species. This is to be done mainly by creating protected areas and promoting and managing the necessary habitats. The Habitats Directive extends many of the protection mechanisms established under the Birds Directive to other species and habitat types.

The relationship to water policy stems from implications for water management (particularly the pattern of abstraction and discharge) arising from the need to meet the objectives of the Directive in the affected areas. In the UK for example, the recent water industry investment programme included £20M of expenditure for improvements to sewage treatment works that are affecting some 33 protected sites. A further £50 M of expenditure is required to reduce problems of over abstraction affecting sites designated under the Birds and Habitats Directive. Such expenditures are however, small in relation to the overall scale of water quality improvement expenditure (<0.1% for 2000-2005).

Drinking Water Directive (80/778/EEC)

The original Drinking Water Directive (80/778/EEC), adopted in 1980, has recently been revised and replaced by 98/83/EC to adapt the Directive to new scientific and technical developments. The objective of the Directive remains 'to protect human health from the adverse effects of contamination of drinking water supplies". The Directive includes standards for microbiological, chemical and some physico-chemical parameters and sets out monitoring requirements and some methods of analysis or performance characteristics. Measures to achieve compliance depend upon the nature of the problem causing non-compliance, but may involve changes in the management of source water (e.g. designating water protection zones), water treatment (e.g. investing in new treatment capacity to remove particular contaminants) or improvements in the distribution system. Often a combination of measures is required.

The Major Accidents (Seveso) Directive 96/82/EC

The Directive on the control of major-accident hazards involving dangerous substances requires applicable industries to establish a policy for the prevention of major accidents and submit safety reports if certain chemicals are stored on-site above threshold quantities. The relationship between this Directive and the environment-water policy stems from the vulnerability of the water environment to accidents involving dangerous substances.

The Environmental Impact Assessment Directive 85/337/EEC

The EIA Directive requires that prior to consent being given for certain development projects an assessment is required of the effects this may have on the environment. The Directive has procedural but limited technical obligations (it does not for example require projects damaging to the environment to be refused a consent).

The Sewage Sludge Directive 86/278/EEC

The Directive is aimed at protecting man and the environment from the uncontrolled spreading of sewage sludge on agricultural land and to promote its correct use. Application is banned where the concentration of one or more metals in the soil already exceeds the limits of the Directive. The Directive has an important impact on water management principally because wastewater treatment is the source of sludge and because the regulations are partly aimed at protecting surface and groundwater from pollution by contaminants in the sludge. Recent increases in the demand for agricultural land as a disposal method for sewage sludge (consequent from the ban on sea disposal and the increase in the generation of sludge as a result of the UWWT Directive) have increased the importance of this Directive in the 1990s. No significant changes have occurred since 1990 although a new Directive is in preparation. This is likely to extend regulatory controls to all domestic and industrial sludge (paper production etc.) and extend the substances controlled beyond heavy metals to cover organic pollutants.

Urban Waste Water Treatment Directive (91/271/EEC)

Adopted in 1991 the stated aim of the Directive is to protect the environment from the adverse effects of the discharge of urban wastewater and wastewater from certain industrial sectors. The Directive requires that all communities above a certain size install adequate collection, treatment and sludge management systems to dispose safely of the urban wastewater they generate. The main measures associated with the Directive are investments in necessary infrastructures that may involve either new capacity or the upgrading of existing infrastructure. It is estimated that this will involve the construction/renovation of over 40,000 wastewater treatment plants in order to meet the limit values of the Directive (CoA, 1997).

The Plant Protection Products Directive 91/414/EEC

The primary aim of the Directive is to introduce a system for the prior authorisation and placing on the market of plant protection products. The Directive includes an authorisation system whereby pesticides can be included on a community list of authorised active ingredients providing that they meet certain requirements. In particular, these requirements relate to likely effects on human health and the environment. Two aspects of the Directive are important in the context of environment-water policy. Firstly, the Directive means that pesticides cannot be authorised if they would lead to the exceedance of the Drinking Water Directive standard for pesticides in groundwater (and not just groundwater intended for human consumption). Secondly, all substances on the market prior to the adoption of the Directive are in the process of review leading to a phasing out of those substances that do not meet the requirements of the Directive.

Nitrate Directive (91/676/EEC)

The Directive was formulated because of concern over the frequent occurrence of algal blooms in the coastal regions during spring and summer and an increase in nitrate concentrations, in many surface and ground waters used for abstraction for potable supply, in intensive agricultural areas. The main provisions are the preparation, application and promotion of a code of good agricultural practice which is mandatory in areas regarded as

vulnerable to nitrate and voluntary elsewhere. Within designated vulnerable zones the main additional element is the application standard for minerals from animal manure.

The Integrated Pollution Prevention and Control Directive 96/61/EC

The IPPC Directive replaces older legislation for the control of pollution from industrial sites by focussing on all media (air, water and land) rather than media in isolation. All facilities that are subject to the Directive must be authorised through the granting of an *Integrated Permit*. The aim of integrated permitting is to select the best environmental option for the control of pollution. The inclusion of the IPPC Directive within the basic measures of the WFD reflects the importance of large industrial facilities in determining the ecological quality of water bodies.

2.5 Summary

A range of pressures is exerted on the European water environment. These pressures vary in intensity and impact throughout the EU. A range of policies has been implemented at a European level to provide a common approach to resolving the problems. 20 or so directives have been adopted since 1973 most recently culminating in the adoption of a conciliation text on the Water Framework Directive, which replaces a number of the older directives and incorporates the remaining directives as basic measures aimed at achieving good ecological status for all EU waters.

As the focus of this research is on the water environment, changes that have occurred since 1995 and impacts most relevant to cohesion, it is clearly not appropriate to discuss many of the directives outlined above. A number of the older directives will soon become part of the Water Framework Directive and are no longer relevant. A number of the directives (basic measures under the WFD) are significantly wider in remit than the water environment (e.g. Habitats, EIA, IPPC) and hence could not be well dealt with here. A number of Directives have not significantly altered since 1995 and hence present no substantive new requirements. It should be noted, however, that many directives have very long implementation periods and although adopted pre 1995, have additional implications now and in the future. In addition, there have been significant delays in the implementation of some Directives (e.g. the Nitrate Directive). As a result the focus of the present assessment is drawn on:

1. The Water Framework Directive;

2. Drinking Water Directive;

3. UWWT Directive;

4. Nitrate Directive.

These directives are assessed in terms of potential linkages to cohesion objectives in Section 3.

2.6 References

CoA (1997) Special Report No3/98 concerning implementation of the Commission EU policy and action as regards water pollution accompanied by the replies of the commission. OJ C191 Vol41 18 June 1998.

3. LINKAGES BETWEEN ENVIRONMENT-WATER POLICY AND SOCIAL AND ECONOMIC COHESION

3.1 Overview of section

This section presents the results of the work carried out in identifying the linkages between water policies and cohesion objectives. This involves the examination of directives and other literature to identify mechanisms through which policies may impact on economic and social cohesion. Causal relationships are identified examining the aspect of the directive involved, the mechanism through which cohesion objectives are impacted and the cohesion groups affected. Section 3 ends with a discussion of the key impacts, selecting a number for more detailed examination in Sections 4, 5, 6 and 7.

3.2 Cohesion impacts of the Water Framework Directive

The Water Framework Directive has recently been adopted with a joint text approved by the Conciliation Committee[1]. It will involve substantial changes to the way in which water is managed and obligations in achieving good ecological quality for all EU water bodies.

Water bodies may fail to achieve good ecological status (and hence require measures under the Directive) for a number of reasons:

- Poor physico-chemical status due to excessive inputs of nutrients, heavy metals, organic matter, pesticides and other dangerous substances,
- Poor quantitative status due to excessive extraction and resource depletion,
- Poor physical status due to human modifications to the water bodies.

Many of these problems will be completely or partially resolved by other legislation, which are basic measures under the Framework Directive (e.g. the Urban Wastewater Treatment Directive, Nitrate Directive, and Drinking Water Directive). The Directive, however, is likely to require supplementary measures to go beyond this existing legislation in order to achieve good status. Although a definition of good status has been developed it is far from an operational concept and hence it is not presently possible to determine the scale of the measures that will be required in addition to the basic measures.

In addition to requirements to achieve good ecological status the Directive will also require significant changes in the way water is managed. The management of water on a river basin basis is already practised in some MS (UK, France) but less so in others. An important cohesion impact, therefore, will be the redirection of focus away from the units on which water

[1] PE-CONS 3639/00

is traditionally managed (municipalities) towards more integrated management[2]. This is likely to involve a number of positive socio-economic impacts:

- It will reduce the extent of water externalities because impacts across the basin will be managed more consistently. It will make it more likely that downstream impacts of activities are recognised. For example, an abstraction in one part the system may lead to a reduction in the assimilative capacity of another part of the system imposing additional clean up costs on other users.

- It will lead to the selection of more cost-effective compliance strategies by recognising the range of potential solutions to environmental problems and tackling these in a more integrated manner. For example, there is a large potential for cost savings by transferring obligations from point to diffuse sources of pollution. Typically, this will involve transfers of obligations and costs from households, industry and other commercial activities to agriculture but only where agriculture presents a more cost-effective solution. Demand side management will be able to compete more effectively with supply side management measures by being placed on a more equal footing.

It will lead to behavioural responses that better recognise the social and economic implications of water use by fully recovering the costs of water activities by users and polluters. In many countries users are traditionally charged directly only for the operating costs of water, with the capital costs being recovered more indirectly through general taxation. An extensive system of cross-subsidisation results, with a consequent blurring of the economic incentives.

Within these changes one of the most important cohesion impacts will be the requirement to adequately recover the costs of water services from users and it is this aspect which is discussed more fully in Section 4.

3.3 Cohesion linkages of the Drinking Water Directive

The recently updated Drinking Water Directive sets uniform maximum allowable concentrations (MACs) for water supplied for human consumption. The Directive is a relatively old piece of environmental legislation having been originally adopted in 1980. The main environmental issues across Member States have been the microbiological standards; the standards for nitrate and pesticides and the standards for problems caused by poor quality distribution systems. The main recent developments (post 1995) have been the revised standards for a number of parameters including lead.

The main impact of the Directive is in the improvement in the quality of drinking water. Improvements in the quality of drinking water manifest themselves in a number of ways. A distinction can be drawn between improvements that are clear to the consumer (improved odour, clarity and taste) and improvements that are less tangible (mainly because the impacts are removed in time) but have longer-term impacts on health status. In the latter case, contaminants in drinking water can affect health status in a variety of ways:

[2] It is less clear whether this integration will lead to the changes in institutional structure or can be achieved adequately through greater co-ordination within existing structures. The Directive does not require structural changes, however, these may develop over time in response to the need to manage waters in an integrated way.

- Poor microbiological quality leads to an excessive incidence of gastrointestinal disease such as non-specific gastro-enteritis, hepatitis A, giardiasis, cryptosporidosis etc.

- Poor chemical quality can give rise to a number of more complicated impacts through the introduction of toxins to the body and consequent adverse impacts on health.

The promotion of a healthy population is obviously a goal in itself, however, health status also impacts on economic parameters. In order to understand the impact on social and economic cohesion, it is necessary to build relationships between drinking water contamination and health status and from health status to economic and social opportunity.

The most significant recent development in the Directive has been the introduction of a revised standard for lead. Elevated blood lead concentrations are associated with hypertension related health effects (e.g. cardiovascular disease, stroke) and the reduction in the cognitive development of children. Lead pipes were widely used in the 19th century and thus form a major part of the distribution infrastructure in many European cities that experienced substantial economic growth at that time. Lead pipes are no longer used in distribution systems although a substantial quantity remains.

The contamination of drinking water supplies by lead is a useful example of the impact of the quality of drinking water on human health and is the issue chosen for more detailed analysis in Section 5.

3.4 Cohesion linkages of the Urban Wastewater Directive

The UWWT Directive is a cornerstone of EU environment-water policy, having been adopted in 1991. The main cost drivers of the Directive are the sensitivity of the receiving waters and the populations of urban areas discharging wastewater into them. The scale of the investment requirements (150 B Euro[3]) for additional treatment and sewage collection infrastructure gives rise to a large scope for impacts on economic and social cohesion.

A variety of cohesion impacts can be identified for the UWWT Directive:

- Increased capacity of wastewater collection and treatment systems in areas of the community where capacity was previously low, facilitating growth in economic activity without reducing the quality of the environment;

- The replacement of poorly functioning alternative wastewater disposal systems which may in many circumstances have been higher cost (e.g. septic tanks with tanker collection and disposal);

- The reduction in the load of organic matter and nutrients to water bodies through improved treatment, leading to improved water quality and improvements in the conditions of use for a number of use categories (direct abstraction, fisheries, amenity etc.) reduced production costs and an increased quality of life;

[3] This expenditure largely occurs between 1995 and 2005. These investments also entail additional operating and maintenance expenditures. (WRc 2000)

- Increased costs of wastewater disposal for industry and households because of the high investment requirements for wastewater collection and disposal. These high investments however will stimulate economic activity where they are additional hence raising demand for goods and services and employment.

The sheer scale of the investments required for the Urban Wastewater Treatment Directive, however, suggest that this final impact category may be one of the most significant and is therefore selected for more detailed examination in Section 6.

3.5 Cohesion linkages of the Nitrate Directive

The Nitrate Directive requires the designation of areas regarded as being vulnerable to nitrate from agriculture (either because of potential contamination of drinking water supplies or the eutrophication of water bodies). Two key aspects of the Directive are the implementation of a maximum use standard (kg/ha) for the application of animal manure and the promotion of codes of good agricultural practice. The use standard differentially impacts on the most intensive farmers (those which generate a large amount of manure per unit of land). As a consequence agricultural incomes are likely to be affected in the most intensive sectors that are geographically concentrated in the EU (e.g. Netherlands, Belgium, Denmark, Brittany).

The application of codes of good agricultural practice has as its aim increasing the efficiency with which nitrogen is managed on farm. Traditionally in many livestock enterprises manure has been treated as a waste product and its potential as a source of nitrogen for crops has been ignored. Codes of good agricultural practice therefore are likely to bring currently less productive farms up to the level of the most efficient farms currently operating.

The balance between these two impacts is unclear and both are selected for more detailed examination in Section 7.

3.6 Conclusion

This section has attempted to highlight a number of significant linkages between EU environment-water policies and social and economic cohesion (Table 3.1).

Table 3.1 Water - Cohesion linkages selected for more detailed examination

Directive	Nature of linkage	Cohesion indicator/units affected
Water Framework Directive	Increasing the level of cost recovery charging for water services.	Principally sectors (industry, agriculture, and households) because of differences in CR between these groups in the MS.
Drinking Water Directive	Health related impacts on economic opportunity using the example of lead.	Member states and social-economic groups most affected by reduced contaminant exposure.
Urban Wastewater Directive	Investment and employment impact of additional expenditure for wastewater collection and disposal.	Member states, regions and sectoral groups.
Nitrate Directive	Increased cost of agricultural activities in intensive areas. Improvement in productivity of agricultural activities through the provision of information/advice.	Member States and regions, sectoral (agriculture) and social (rural) groups.

In terms of the scale of the impacts on cohesion or the number and type of cohesion units affected some of these links are more important than others. It is considered important that an understanding is maintained of the range of ways in which environment-water policies can impact on economic and social cohesion. In selecting impacts to be taken forward for more detailed analysis an attempt has been made to use examples from a number of different directives that are representative of more general impacts. The selected directives to be analysed further in sections 4, 5, 6 and 7 are summarised in Table 3.1.

4. COST RECOVERY, INCENTIVE PRICING AND THE WATER FRAMEWORK DIRECTIVE

4.1 Introduction

As discussed in Section 3, the WFD is likely to be associated with a variety of cohesion impacts. A central aim of the WFD is to take account of the principle of cost recovery (CR) of water services to provide adequate incentives (incentive pricing or IP) for users to use water efficiently. Currently the extent of CR/IP differs by MS and consequently, the Directive will have different impacts across the Community. In addition the extent of CR/IP differs sectorally (industry, households and agriculture).

4.2 The nature of the link between policy and cohesion

First, the issue of cost recovery needs to be understood. In particular a distinction must be made between cost recovery from the user (the user pays and polluter pays principles[4]) and short and long run cost recovery. The problems associated with partial long-run cost recovery are different from those of partial user cost recovery.

Partial long-run cost recovery means that the water services system is unsustainable in that some time in the future there will be insufficient funds available to maintain the system. The extent to which long-run cost recovery is achieved is difficult to estimate not least because of the very long life of some of the assets (e.g. reservoirs, pipe networks). Not recovering the long-run costs of the system will mean that there is insufficient maintenance of the existing assets and consequently their quality and performance will be impaired in the long run. This may mean that prices will have to increase sharply in the future or funds found from alternative sources. Long-run cost recovery has been a problem in the UK for example where, during the 1970s and 1980s, insufficient investment was made in the system to ensure long-term sustainability. This under investment coupled with increasing environmental targets eventually lead to the need to privatise the industry in order to generate sufficient additional funds.

Partial cost recovery from users/polluters means that the wrong price signals are sent to users and polluters leading to a distortion of water user behaviour. Long-run cost recovery can exist alongside partial cost recovery from users/polluters through systems of subsidy and cross subsidy. If some of the funds for water services (particularly investments) are financed through general taxation there is a subsidy from taxpayers to users/polluters. Cross subsidies exist where costs from particular classes of water user are over-recovered at the same time as being under-recovered from other classes. The consequences of such an incentive system may be a supply-orientated approach to water management (at the expense of more cost-

[4] The User Pays Principle (UPP) is a variant of the more widely understood Polluter Pays Principle (PPP). The Polluter Pays Principle is a widely accepted concept that requires that the costs of damage imposed on the environment should be recovered from the polluters themselves rather than from society as a whole (e.g. through general taxation). The User Pays Principle extends this concept to environmental resources as well as damages, such that the (opportunity) costs of resource use should be borne by individual users. Both principles embody the concept that it is only where users and polluters are faced with the true costs of their activities will they be in a position to make socially optimal decisions about use and consumption patterns.

effective demand-side options) and relatively low unit prices for water, that encourage over use and lead to under maintenance of the system. The perverse result is that it may cost more in aggregate to run a system in which costs are partially recovered from users/polluters than one in which there is adequate cost recovery from individual users/polluters.

The interest here is more in terms of moving from a system of partial cost recovery from users/polluters to one based on greater cost recovery as a result of the implementation of the WFD. The consequences of such a move are likely to be:

1. overall increases in the cost of water services in areas or for particular users where user cost recovery is presently low;

2. more cost reflective charging through the removal of cross-subsidies between user groups.

There are therefore likely to be costs and benefits of a move towards greater cost recovery. The central question in terms of cohesion is to what extent does the distribution of costs and benefits between different cohesion groups affect the ability to meet the wider objective of economic and social cohesion. A number of related questions can be asked. Firstly, which areas and user groups presently face the lowest levels of cost recovery and therefore are likely to see significant increases in the costs of water services. Secondly which user groups are likely to be most affected by the move towards more cost-reflective water tariffs? Finally, how do the effected groups relate to groups to which cohesion objectives apply?

4.3 Information and measurement

4.3.1 The extent of cost recovery by member state and user

Answering the first question is difficult because of the very complex system of cross-subsidisation that can exist. In its explanatory memorandum to the Directive, the commission noted that: "*subsidies flow from households to industries in the richer regions of the community and from industry to households in the poorer* regions" and that *"in parts of the community with considerable water stress there is also evidence of subsidies from households and industry to agriculture*[5]*".*

The extent of cost recovery may be examined in terms of the three principal user categories. Table 4.1 summarises the available information on the extent of cost recovery for households, industry and agriculture.

Households

There are significant variations by Member State in the level of cost recovery from households, with the Cohesion Countries in particular presently recovering only a small proportion of the actual costs. The estimated extent of cost recovery from households ranges from 18% in Ireland to over 90% in the UK and Denmark.

[5] COM 95/647 Final

Table 4.1 Cost recovery by user category[6]

MS	Households	Industry	Agriculture
A	:	Y	100% 0&M
B	:	Y	100% O&M for piped
DK	90%	Y	:
FIN	:	Y	:
F	73%	Y	100% O&M
D	83%	Y	Extraction costs only
EL	19%	:	60-100% O&M
IRL	16%	N	:
IT	O&M + 30% capital	N	64-93% O&M
NL	Y	Y	> 100% O&M
P	18%	N	> 100% O&M
E	25%	N	100% O&M
S	:	Y	:
UK	92%	Y	100% All

Source: OECD (1999). Y= yes, N=no costs are adequately/not adequately recovered. O&M= Operating and maintenance costs. Note: the extent of cost recovery also depends on whether water is supplied from the public network or privately. Generally private abstractors pay full costs.

Table 4.2 summarises this information in another way by expressing the costs as a percentage of average household income under the present system and under full cost recovery.

Table 4.2 Existing and full cost recovery household tariffs in selected Member States

	Water charges as a proportion of household income %		Change in household income
Member State	**Existing**	**Full cost recovery**	**%**
Cohesion Countries			
Portugal	0.5	2.8	-2.3
Greece	0.4	2.1	-1.7
Ireland	0.3	1.9	-1.6
Spain	0.4	1.6	-1.2
Cohesion average	*0.4*	*2.1*	*-1.7*
Other Member States			
France	1.1	1.5	-0.4
UK (England and Wales)	1.2	1.3	-0.1
Germany	1.0	1.2	-0.2
Denmark	0.8	0.9	-0.1
Other Member State average	*1.0*	*1.2*	*-0.2*

Source: Ecotec (1996)

[6] The extent of cost recovery is expressed by user category and is therefore a maximum of 100% regardless of whether users subsidise other users (in which case they would pay greater than 100% cost recovery).

This data indicates the extent to which Cohesion Countries are likely to be disproportionately affected by moves to greater cost recovery and incentive pricing. On average the Cohesion Countries would see a 1.7% decrease in household income as a result of full cost recovery charging, with other Member States seeing a much smaller decline (0.2% on average). It is also clear that the full cost recovery charges in the Cohesion Countries are on average much higher than those in other Member States. This reflects to some extent the relative scarcity of water in these areas[7].

A further consequence of such increases will be to force greater consideration of the way in which costs are recovered from households through tariffs and lead to more cost reflective charging. This may have negative consequences for certain user groups (e.g. those on low incomes but with high basic needs because of large families and those where costs of supply are relatively large (e.g. in smaller communities). This raises the issue of the relative incidence of water charges versus general taxation on less advantaged groups. Much general taxation (e.g. income) is progressive in its incidence, however many water charges are also progressive as a result of having higher unit charges for higher consumption levels (increasing block tariffs). The net effect is unclear but warrants further analysis.

It should be noted that much of the cost gap in the Cohesion Countries is presently met through Cohesion funding, which has the potential to offset some of the impacts noted above. This raises the question as to the extent to which the principle of greater cost recovery and the Cohesion Funds are compatible.

Clearly there is a trade off between raising cost recovery levels to help *incentivise* water use and providing subsidies to the water sector in order to meet cohesion objectives. In fact it is not that the two instruments are incompatible in terms of their objectives although the way in which the objectives are achieved may be.

A recent communication on pricing policies for enhancing the sustainability of water resources (CEC, 2000), suggests the main issue is in ensuring that water services financed through structural and cohesion policies help to maintain and enhance the incentives for good water management. In particular "*funding with no incentive to promote efficient use of water should be phased out*" and priority should be given *to "sustainable water use and investment that supports it*".

Industry and agriculture

As can be seen from Table 4.1 cost recovery from industry is generally higher, with complete cost recovery in most Member States. The exception again, however, is the Cohesion Countries, all of which do not adequately recover costs from this category of use. A move to greater cost recovery therefore is likely to increase the costs of water use by industry in the Cohesion Countries.

As indicated by Table 4.1 cost recovery is lowest in the case of agricultural use, with very few countries fully recovering the costs. Most countries only aim to recover the Operation and Maintenance costs for agriculture and in a number of these countries not even the O&M cost are fully recovered.

[7] In Spain for example hydro-geographic characteristics result in the need for large water infrastructures (reservoirs and transfers) and hence elevated supply costs.

Moves towards more adequate cost recovery therefore, are likely to increase the costs of industrial and agricultural water use. Such moves are likely to impact industries and agricultural activities most where the relative value of water use is low (i.e. below the adequate cost recovery rates). These activities are likely to be those with a relatively high level of water consumption but with low value added, such as the manufacture of textiles and cereal production.

4.3.2 Extent and relevance of existing cross-subsidies

The above analysis implicitly assumes that where costs are not fully recovered from particular user categories they are met principally from the public budget and hence have the same incidence as general taxation. This assumption, however, very much over-simplifies the situation by ignoring the complex system of cross-subsidisation that actually exists between and within different user categories. This is a complex area and the difficulties of correctly articulating the level of cost recovery given the existence of multiple cross-subsidies should not be ignored.

One of the most important systems of cross subsidy is between agriculture and households. This takes place through a number of mechanisms. For example where cost recovery from agriculture is low this may be subsidised in part by higher charges to households (and perhaps industry). Additionally, agriculture is responsible for a number of important external costs facing households in terms of treating water to remove contaminants such as nitrates and pesticides from agricultural production.

In the UK for example, contamination by nitrate and pesticides has added some 1.5 B Euro to the water industries investment programme (WRc, 2000) and hence household bills. This expenditure represents around 16% of the total investment associated with the Drinking Water Directive. In the Netherlands 70 M Euro per annum will be required in 2020 for extra purification to deal with nitrate and pesticides. In Denmark waterworks receive a payment of 65 million DKr under the Waterfund law because of contamination by pesticides. Removal of these cross subsidies would be more cost effectively achieved by making agriculture face the full cost of the reducing their contribution to this pollution. The Nitrate Directive is one way of achieving this.

4.3.3 Relative impact on cohesion groups

Clearly, the fact that cost recovery is presently low and water costs relatively high, in the Cohesion Countries relative to other Member States, means that these countries will be disproportionately affected by moves towards greater cost recovery/incentive charging. The Cohesion Funds are a mechanism to resolve some of this problem, however, it is important that this is done in a manner in which the incentives for an efficient use of water are retained.

As noted above moves to greater cost recovery are likely to significantly reduce aggregate affordability of water services in the Cohesion Countries. Clearly, however, some households are likely to be disproportionately affected. Two such groups are those where incomes are low relative to their level of consumption (i.e. households with large families on low incomes) and those where the costs of supply are relatively large. In this latter group, for example, may be rural areas where the costs of supply are elevated because of diseconomies in water treatment and distribution.

Moves to greater cost recovery are also likely to impact on cohesion groups sectorally because of the relatively low levels of cost recovery from agriculture and because of a number of important sources of existing cross subsidy between agriculture and households.

4.4 Assessment

The Water Framework Directive is a very important piece of legislation in terms of EU environmental policy in the sphere of water. The Directive has a number of important impacts on social and economic cohesion mainly through two processes: firstly the targets set for good water status and secondly in terms of the way in which water is managed.

In terms of good status it is presently impossible to predict the impact on cohesion, as there is as yet only limited progress on defining operational parameters for good status. In terms of management there are likely to be significant cohesion benefits in terms of more cost-effective and integrated solutions to water quality and quantity problems. Of significant importance however is the requirement for greater recovery of the costs of water services from users. Presently cost recovery from users is low, especially in the Cohesion Countries and from agricultural water users. Increasing the level of cost recovery will have significant impacts and there is an evident need to ensure that the goals of cost recovery are integrated with the need to promote greater economic and social cohesion.

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5. HEALTH, ECONOMIC OPPORTUNITY AND THE DRINKING WATER DIRECTIVE

5.1 Introduction

Many environmental policies, in particular those related to water, have human health objectives. The Drinking Water Directive sets a number of maximum allowable concentrations for drinking water from public supplies, with the aim of providing water that does not adversely affect the health of the population.

5.2 The nature of the link between policy and cohesion

Water supplies may be contaminated in a number of ways. Contamination may be natural (e.g. naturally high levels of metals which would have an adverse effect on human health) or as a result of human activities. It is important to distinguish between two sources of human contamination. The first arises from the contamination of raw waters for example from organic matter, nutrients or pesticides from agriculture. The second source is the recontamination of water, which may occur in the distribution system because of its poor quality or the use of inappropriate materials.

The Directive has been around for a considerable time and has led to efforts in locating and protecting sources and in installing sufficient treatment capacity to remove any unwanted contaminants.

As a result of changes in scientific knowledge the limits set by the Directive need to be changed over time. The most significant recent change has been the adoption of a more stringent target for lead. The target for lead in the original Directive was in most circumstances high enough for water distributed through lead pipes (which although now banned are still in use in many areas of Europe) to meet the quality standard. The revised Directive significantly reduced this standard on the basis of concerns about the health impacts of even low levels of exposure to lead. The lower standard means that it is typically impossible to meet the standard where water is delivered through lead pipes (even if water is treated to reduce the amount of lead it leaches from pipes). Although these pipes would be replaced naturally over time (as buildings are refurbished etc.) they would need to be replaced before the end of their economic lives.

The standard, therefore, will give rise to changes in the water distribution system that will involve a cost eventually passed on to the consumer, but also a benefit in terms of reduced exposure to lead.

The health impacts of lead are numerous but two of the most important and best-understood mechanisms are:

1. reduction in the cognitive development of children,

2. increase in blood pressure (hypertension) and increased risk of coronary heat disease (CHD) and cerebro-vascular accident (CVA or stroke).

While of immediate concern in itself, impaired health states also lower economic opportunities by reducing the productive potential of those affected. The reduction in exposure to lead as a result of the conditioning of water and the replacement of lead pipes will, therefore, lead to an increase in health status and also improve economic opportunity.

It must be recognised, however, that lead from drinking water is one of many exposure pathways. Other major sources of lead are from the atmosphere and from exposure to lead containing materials in the home (e.g. lead based paints) or workplace (e.g. stainless steel production).

Differences in exposure exist both spatially and by socio-economic groups, and there are reasons to suspect that exposure is negatively correlated with socio-economic status: less advantaged sections of the population:

- tend to live closer to major point sources of contamination (e.g. smelting works);
- tend to be in occupations where exposure is greatest (e.g. construction);
- tend to live in poor quality older housing (where lead pipes are more common);
- are less able to finance any necessary defensive expenditure (e.g. bottled water, point of use treatment devices or voluntary pipe replacement);
- are less educated and less likely to undertake low cost mitigation techniques like avoiding first draw consumption.

As a result, the reduction in lead exposure as a result of the Drinking Water Directive not only impacts globally on health status but also is predisposed to alleviating problems that face the worst off social groups.

5.3 Information and measurement

An attempt to quantify the positive impact of lead pipe replacement on social and economic cohesion requires information on:

- Differences between regions in the occurrence of lead pipes and elevated lead levels in drinking water,
- Evidence of causal relationships between lead in water, blood lead and the health end points (IQ, hypertension related disease), and
- Evidence of the relative burden being faced by different social groups.

These issues are addressed in turn in the following sections.

5.3.1 The spatial distribution of the lead problem

A study undertaken in 1997 by WRc for the European Commission investigated the costs of the revised lead limit in the then proposed revision of the Drinking Water Directive. This study gathered data on the occurrence of lead pipes in EU Member States and the costs of various

measures to alleviate the problem (replacing pipes, conditioning the water). The distribution of lead pipes in the EU is far from uniform, as can be seen in Table 5.1.

Table 5.1 Occurence of lead communication pipes (number per 1000 persons)

A	**B**	**DK**	**FIN**	**F**	**D**	**EL**	**IRL**
:	38	0	:	32	2	5	25
I	**L**	**NL**	**P**	**E**	**S**	**UK**	**EU-15**
5	7	7	1	11	:	29	14

Source: WRc (1995),

Relatively high occurrence is seen in Belgium, France, Ireland and the UK. The costs of reducing lead concentrations in drinking water generally reflect the occurrence of lead pipes. However, there are a number of other factors. Costs are relatively high in Ireland because of high unit costs of pipe replacement and in France because of the large number of small supplies that need additional treatment facilities to be introduced. Lower costs are seen in the UK because of the large number of supplies where treatment already occurred for other reasons. The WRc study of 1995 put the overall costs for the EU-15 at between 27 and 37 B Euro.

5.3.2 Relationship between exposure and economic opportunity

A number of sub-processes need to be understood in linking reduced concentrations of lead in drinking water to increased economic opportunity. Relationships need to be established between water lead and blood lead levels, between blood lead and health related outcomes (IQ, hypertension related disease) and between these outcomes and economic opportunity. A study by Andrews *et al* (1997) examined the issues in detail in a study for the UK Government that attempted to quantify the benefits of reduced exposure to lead in drinking water for the UK.

The two toxic endpoints currently associated with low blood lead levels and which can be quantified are IQ and blood pressure. Other toxic endpoints that occur at low blood lead levels include effects on gestation age and biochemical effects. However, given the low clinical significance of the biochemical effects at low blood lead levels, these were not included in the analyses.

Relationships were developed between waterborne lead and blood lead levels, with adjustments to account for the fall in blood lead levels since the original models were developed. Current exposure to water lead was derived from the results of water company compliance sampling and populations affected were derived from official actuarial figures.

The benefits that would accrue through increased IQ on future earnings were monitored, taking into account the several linkages between lead, IQ, school performance, work-force participation and wages (see Figure 5.1).

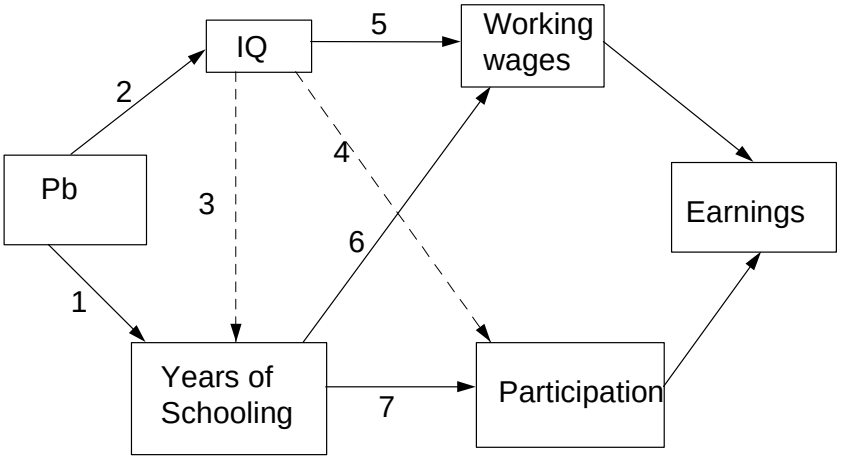

Figure 5.1 Impact of lead exposure on earnings opportunities

The benefits of improved IQ are estimated on the premise that:

- a more intelligent population will have a higher overall productivity leading to greater economic growth; and

- this higher productivity can be measured by the increased earnings accruing to the individuals whose IQ has been enhanced as a result of the reduction of lead in drinking water.

Figure 5.1 illustrates the complex relationship between exposure to lead and eventual life earnings. Lead is thought to have an impact on the years of schooling because of adverse behavioural effects that can reduce school performance and the number of years of schooling completed. Lead also impacts directly on IQ by impairing the cognitive development. Together these effects on IQ and years of schooling impact in a complex way on each other and on expected earnings and likelihood of workforce participation, which are ultimately reflected in lifetime earnings. The reduction in lifetime earnings can then be used as a measure of the reduction in income opportunity arising from elevated blood lead levels. In the UK the expected increase in earnings as a result of the lead pipe replacement programme was estimated be between £0.5 and £1.5 billion.

There is clearly great uncertainty in extrapolating this figure to the European level. However a very rough estimate of the European wide benefits (based on applying the unit benefit from the UK to the number of lead pipes in Europe as a whole) would suggest benefits in the region of £1.5 to £5 Billion.

The economic benefits of reducing blood pressure were examined in terms of:

- reduced medical costs;
- enhanced quality of life;
- increased life expectancy.

Reduced medical costs can be quite easily estimated based on the resource costs of various treatment stages (medicines, hospital stays etc.). The valuation of changes in the quality and length of life is more difficult and two approaches are possible. This first is based on the population's willingness to pay for quality of life (quality adjusted life years – QALY) while the second looks at the value of lost earnings through sickness and premature death. These methods were used to estimate the benefits from reduced morbidity and mortality associated with hypertension, coronary heart disease and stroke. In the UK these benefits ranged from around £0.2 to £1.3 billion. Overall the study concluded that lead pipe replacement would be beneficial providing that water treatment could achieve some of the exposure reduction and hence avoid some costly pipe removal.

5.3.3 Evidence of the differential burden faced by social groups

As noted above the exposure to lead from drinking water is not uniform across the EU Member States. As regards, the Cohesion Countries, only Ireland is relatively highly impacted, having a large proportion of the distribution system made from lead pipes. The reductions in lead exposure therefore would be expected to give rise to significant benefits (through the mechanisms described above) in the case of Ireland. Belgium, France and the UK would also see relatively large impacts compared to the other Member States.

A more important impact on cohesion, however, is likely to be the differential impact on social groups. As noted above there are a number of reasons to suspect that the more disadvantaged social groups would be impacted more significantly. To understand why this is the case for lead, the various sources of exposure to lead (of which drinking water is only one) need to be understood.

Exposure to lead from drinking water adds to the burden received from other sources. Reducing exposure from the drinking water route (through the lead pipe replacement programme) will not affect the residual burden from other sources. As noted above there are reasons why the lead replacement programme would be relatively more beneficial to some social groups (the presence of lead containing materials in properties would be expected to be positively correlated with the age of the property).

Perhaps more important, however, is the fact that existing elevated blood lead levels may be correlated with poor living standards and low earnings. As a result the removal of the drinking water source of exposure may be relatively more beneficial to disadvantaged groups for which cohesion objectives apply.

Primatesta (1997) in a recent review of blood lead levels in the population of England in 1995 demonstrated a variety of ways in which elevated blood lead was connected to social and economic conditions of the population. The results of this research are summarised in Table 5.2 and Box 5.1.

Box 5.1 Survey of Blood Lead Levels in the Population of England (1995)

Overall Blood lead levels increase with **age** from a mean of 2 µd/dl at age 11-15 to 3.7 µd/dl for those 65 and over. **Gender** is important with levels significantly higher in males than females. Mean lead levels among men tend to be higher in individuals from a lower **social class** than in those from a higher social class. **Manual workers** tend to have higher blood lead levels than non-manual workers do. No differences in relation to **ethnic origin** were determined because of sample size.

Small differences were detected in terms of **area of residence** with levels higher for those living in urban relative to suburban and rural areas. The age of the **dwelling** was also seen to be important with blood lead being higher in people who live in houses built before the WW2. Although not seen in children, there is a **north/south divide** at other ages with, higher lead levels in the North relative to the Midlands and the South.

Source: Primatesta (1997)

Table 5.2 Variables influencing blood lead levels in male adults

Variable	Number in sample	Blood lead level (difference µd/dl from reference category)	95% confidence interval
Age			
16-24*	259	0	
25-44	1156	0.32	0.22, 0.44
45-64	944	0.52	0.41, 0.65
65 and over	632	0.66	0.53, 0.81
Social class			
Professional-intermediate*	1155	0	
Skilled non manual	320	0.01	-0.06, 0.08
Skilled manual	970	0.15	0.10, 0.21
Partly skilled/unskilled	546	0.04	-0.02, 0.10
Region			
North	751	0.08	0.05, 0.11
Midlands	562	0.02	-0.02, 0.05
South	1588	-0.09	-0.11, -0.48
Residence			
Urban	778	0.60	:
Suburban	1840	0.10	:
Rural*	706	0	
Age of dwelling			
Before 1945	668	0.60	:
After 1945*	1100	0	

Source: Primatesta (1997). * = reference group from which differences are measured.

This information clearly illustrates the beneficial effects of the reduction in drinking water exposure in a number of cohesion groups. Of particular importance are the relatively more significant impact on lower social classes and for the lower income regions in the North and Midlands.

5.4 Assessment

The Drinking Water Directive is aimed at providing wholesome water that does not adversely affect the health of the population. The Directive covers a wide variety of parameters that may contaminate water supplies and have impacts on health. The example examined in this section was lead, which clearly has impacts both upon the cognitive development of children and hypertension related disease. A reduction in contamination from lead has a number of important effects on the quality of life, which in turn impact on social and economic opportunity. Improved cognitive development in children increases IQ, years of schooling, working wages and workforce participation leading to higher lifetime earnings from a more productive population. Reduced hypertension related disease reduces treatment resource costs and increases and extends the quality and length of life leading to greater productivity.

While these impacts are likely to be beneficial in terms of general social and economic cohesion a further positive impact arises because of the inequitable pattern of exposure to other sources of lead and health inequalities generally. For a number of reasons high exposure tends to be associated with low incomes, social classes and poor living conditions. A reduction in the exposure from drinking water is likely therefore to have a disproportionate and positive effect these cohesion groups.

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6. EMPLOYMENT OPPORTUNITY AND THE URBAN WASTEWATER TREATMENT DIRECTIVE

6.1 Introduction

As noted in Section 4, the UWWT Directive is a cornerstone of EU environmental policy. An aspect that sets the Directive apart from other related legislation is the sheer scale of investments that are required for implementation. WRc has recently examined investment and employment associated with the Directive in a study for DG Environment (WRc, 2000). This study examined the investment and employment implications of ten directives across three dimensions of EU environmental policy: air, water and waste. The UWWT Directive was seen to be the directive with by far the highest investment implications, accounting for some 150 B[8] of the total 260 B Euro identified for the ten air, water and waste directives examined.

This study is one of a number of recent attempts to recognise the linkage between environmental policies and employment. Other examples include:

- Ecotec (1997) study into the size of the eco-industries in the EU in terms of turnover and employment;
- UBA (1998) examination of the links between environmental protection and employment in Germany;
- GWU (1999) study on improving the environment and promoting employment in Denmark.

The focus of all of these studies is the potential of policy design to resolve the "resource paradox" – the simultaneous overuse of natural and under use of human resources in Europe, manifested by high levels of environmental pressure together with high levels of unemployment.

6.2 The nature of the link between policy and cohesion

Wastewaters from urban areas are the natural consequence of a variety of human activities. These waste streams include sewage from houses, from commercial premises, from industry and rainwater run-off that is collected in the same systems. The waste streams contain a large amount of organic matter and as a consequence a high biological oxygen demand (BOD) as well as pollutants such as nitrate, phosphorous and smaller amounts of toxic substances. Collecting these effluents and treating them before discharge is considered to be essential in urban areas. The exact requirements of the Directive depend on size of the urban system from which the waste originates and the sensitivity of the receiving water. The larger the urban area and the more sensitive the receiving environment the more stringent are the treatment requirements.

[8] This expenditure largely occurs between 1995 and 2005. These investments also entail additional operating and maintenance expenditures.

As a consequence of the Directive substantial investments are required to install collection infrastructure and to build or upgrade existing treatment works. It is estimated that this will involve the construction/renovation of over 40000 wastewater treatment plants in order to meet the limit values of the Directive (CoA, 1997). These investments give rise to considerable expenditures that in turn give rise to employment opportunities:

- In the wastewater industry directly in commissioning and operating the facilities;
- In the industries (construction and capital goods) building the new facilities;
- In industries supplying consumables for the operation of the facilities (chemicals, energy, waste disposal services etc.).

Financing of these expenditures comes from a variety of sources. Wastewater charges from industry and households are an important source. In Ireland, Spain, Greece and Portugal much of the investment is financed through the Cohesion Fund. The scale of the expenditures suggest a tangible impact on cohesion by stimulating investment and creating demand for goods and services and hence employment. The extent to which these expenditures and hence employment opportunities are additional (i.e. they are not simply replacing investments in other productive activities) will depend upon local labour market conditions. In addition the industries supplying the necessary goods and services are at different levels of development in Europe and as a consequence some countries are less able to meet the requirements from the home market so that much of the expenditure leaks out through imports.

The central question in terms of the impact of the Directive on social and economic cohesion therefore is the extent to which the Directive is able to raise the level of economic activity in different regions of the EU and to provide income and employment opportunities. This in turn depends upon the extent to which the expenditures are additional and met through local markets.

6.3 Information and measurement

In order to understand the link between the Directive requirements, the associated expenditures and resulting employment impact a number of issues must first be understood. Firstly, what is the pattern of requirements and associated costs faced by the different Member States? Secondly, what types of expenditures are called for and what are the sectors most affected? Thirdly, to what extent are these expenditures additional in the sense of stimulating new economic activities rather than replacing other productive investments? Finally, how well are Member States able to meet demand given differing levels of development of the home markets for the required goods and services? These issues are addressed in turn in the following sections.

6.3.1 Pattern of pressures and costs

An indicator of the environmental pressure from urban wastewater is its biological oxygen demand, which can be measured in terms of population equivalents (i.e. the biological oxygen demand equivalent to one inhabitant, which is approximately 60g of BOD per day). It is estimated (CEC 1997) that following implementation of the Directive there will be a capacity of almost 500 million population equivalents in collection and treatment systems by 2005. The

number of population equivalents is greater than the population because of the contribution of non-domestic sources.

When the Directive was adopted Member States were at different levels of development with regard to their collection and treatment systems and hence faced different investment requirements. There are also differences in the sensitivity of receiving waters in Member States, which moderates the scale of the investments required. The following table summarises the estimated *per capita* increase in the capacity (measured in terms of p.e.) of collection and treatment systems and the percentage of wastewater discharges going to sensitive areas.

Table 6.1 *Per capita* increase in capacity of collecting and treatment systems for the Urban Wastewater Treatment Directive 1990 to 2005

	Increase in capacity of collection systems (p.e. *per capita*)	Increase in capacity of treatment systems (p.e. *per capita*)	% p.e discharged to sensitive areas
Austria	0.37	0.64	0%
Belgium	0.05	0.44	81%
Denmark	-	0.63	100%
Finland	0.04	0.07	100%
France	0.25	0.49	29%
Germany	0.16	0.41	74%
Greece	0.14	0.64	21%
Ireland	0.88	0.97	4%
Italy	:	:	:
Luxembourg	0.14	0.49	100%
Netherlands	-	0.04	100%
Portugal	0.72	1.08	11%
Spain	1.01	1.28	6%
Sweden	-	-	100%
United Kingdom	-0.02	0.78	5%

Source: WRc (2000) Note p.e. (population equivalent) is a measure of the scale of wastewater discharged – being equivalent to the discharge from one person.

As can be seen Ireland, Portugal and Spain are all estimated to see large increases in the capacity of collecting systems. The UK actually sees a small decrease in capacity while the more developed countries see relatively small increases. This pattern is reflected in the required increases in the capacity of treatment systems, which is close to or greater than 1 p.e. *per capita* in Ireland, Spain and Portugal but generally much less for other Member States. There is a significant difference between the Cohesion Countries and other Member States in terms of the discharges going to sensitive areas. For the Cohesion Countries this ranges from 4% (Ireland) to 21% (Greece), while in many of the other countries all discharges are to sensitive waters. The sensitivity of waters has an important impact on the costs of the Directive. Germany, Denmark, Netherlands, Finland and Sweden all discharge into waters which are either naturally sensitive (such as the Baltic) or have only limited additional absorptive capacity because of existing discharges (North Sea). The Cohesion Countries by contrast generally discharge to waters with a high absorptive capacity (Portugal and Ireland). Hence as a consequence of largely natural environmental conditions, the implications of the Directive for the Cohesion Countries are relatively less onerous than for other more developed Member States.

These differences in the requirements of the Directive are reflected to a large extent in terms of the required investments. WRc (2000) estimated the total investments required for the implementation of the Directive as 152 B Euro largely occurring between 1995 and 2005. The equivalent annual value of the expenditures (taking into account the lifetime of the investments and the operating costs) is estimated to be 48 Euro *per capita* or 18 B Euro per annum across the EU-15. The largest share of total costs are seen in Germany (7 B Euro/yr.). In terms of *per capita* costs there are five significant clusters of countries (as illustrated in Figure 6.1). In general the Cohesion Countries face the lower *per capita* costs, the exception here being Ireland, which faces higher than average *per capita* costs.

Source: WRc (2000)

Figure 6.1 *Per capita* annual costs of the UWWT Directive by MS

The differences in costs between Member States largely reflect the scale of the required infrastructure. Costs are also affected by a number of other factors, however. In the case of Portugal, a derogation allows that country to designate some water as “less sensitive” reducing the investment requirements for discharges into these areas. Costs also tend to be higher in those countries where discharges are to predominately sensitive waters (Germany, Netherlands and Luxembourg) and where a substantial part of the investment is in retrofitting existing facilities. Retrofitting existing facilities tends to be more expensive than building new capacity principally because of the design constraints and the inability to optimise design factors.

6.3.2 Types of expenditures and affected sectors

The investment requirements give rise to demand for goods and services. As a general rule capital expenditure in the water industry is largely subcontracted to specialist civil engineering companies who tender competitively for contracts encompassing various stages of the process (e.g. design and build). For a new treatment works a wastewater provider (usually a municipality) will undertake some preliminary design work and then subcontract the bulk of the activity to a specialist firm. The three main expenditures for the investments are capital goods

(i.e. mechanical and electrical equipment), civil goods (buildings, tanks etc.) and services (design, administration). WRc (2000) estimate the proportion of expenditure in these areas to be 30:60:10. Operating expenditures tend to be shared between labour, capital goods (maintenance etc.) energy and consumables (chemicals etc.).

The following tables summarise the available information on the destination of the expenditures in relation to the size of the Member States supply sectors (measured in terms of annual GDP at market prices).

Table 6.2 UWWT Directive capital expenditure (10-year program) as a proportion of sector activity (GDP at Market Prices)

MS	Annual Capex M Euro	Agricultural, forestry and fishery products	Fuel and power products	Manufactured products	Building and construction	Market services	Non-market services	Total
	Share	0%	0%	30%	60%	10%	0%	100%
A	1,002	*	:	:	:	:	:	0.6%
B	406	*	*	0.3%	2.4%	*	*	0.2%
D	6,519	*	:	:	:	:	:	0.4%
DK	138	*	*	0.2%	1.3%	*	*	0.1%
E	1,216	*	*	0.4%	2.0%	0.1%	*	0.3%
FIN	162	:	:	:	:	:	:	:
F	1,237	*	*	0.2%	1.4%	*	*	0.1%
EL	149	:	:	:	:	:	:	:
IRL	164	*	*	0.3%	3.7%	0.1%	*	0.3%
I	1,587	:	:	:	:	:	:	:
L	28	*	*	0.4%	2.1%	*	*	0.2%
NL	860	*	:	:	:	:	:	0.3%
P	249	*	:	:	:	:	:	0.3%
S	296	:	:	:	:	:	:	:
UK	1,209	:	:	:	:	:	:	:

* = <0.1%
Source: WRc (2000) and EC Regio database (1999)

The capital expenditures in aggregate represent a small proportion of industry activity (ranging from 0.1% in France to 0.6% in Austria). As a result of the concentration of expenditure in certain sectors, however, more significant impacts are observable, particularly in terms of building and construction. This reflects to some extent the high proportion of expenditures going to this sector (60% of capital expenditures are estimated to be received by the construction industry). These figures also reflect the relative size of the industrial base in the Member States and indicate a significant possibility of additional demand for these sectors in a number of the Cohesion Countries.

For operating expenditures an estimated 25% is received directly as compensation to employees in the wastewater industry. The remaining 75% of expenditures are shared between energy production, manufacturing (including intermediate and capital goods) and services (principally waste disposal). Typically the largest relative impact in terms of operating expenditure is in the energy sector, with the energy expenditures in Ireland representing almost 1% of the sector annual GDP.

Table 6.3 UWWT Directive operating expenditure as a proportion of sector activity (GDP at Market Prices)

MS	Opex M Euro (95)	Agricultural, forestry and fishery products	Fuel and power products	Manufactured products	Building and construction	Market services	Non-market services	Total
	Share	0%	20%	25%	0%	30%	0%	75%
A	56	*	:	:	:	:	:	*
B	73	*	0.2%	*	*	*	*	*
D	668	*	:	:	:	:	:	*
DK	39	*	0.2%	*	*	*	*	*
E	456	*	0.4%	0.1%	*	0.1%	*	0.1%
FIN	9	:	:	:	:	:	:	:
F	185	*	0.1%	*	*	*	*	*
EL	47	:	:	:	:	:	:	:
IRL	71	*	1.0%	0.1%	*	0.1%	*	0.1%
I	291	:	:	:	:	:	:	:
L	6	*	0.6%	0.1%	*	*	*	*
NL	49	*	:	:	:	:	:	*
P	70	*	:	:	:	:	:	0.1%
S	16	:	:	:	:	:	:	:
UK	351	:	:	:	:	:	:	:

* = <0.1%
Source: WRc (2000) and EC Regio database (1999)

6.3.3 Additionality of investments

The extent to which the Directive expenditures are translated into actual income and employment opportunities depends on the extent to which the expenditures are additional. The question of additionality is a very difficult one, as it will depend upon very specific local labour market issues. However, in broad terms it can be expected that much of the investment in the Cohesion Countries will be additional because it is financed through transfers from other Member States. Similarly much of the investment in East Germany will be additional because of the use of Structural Funds. In other countries, this issue is more complex. In the UK for example it would be expected that much of the investment in the North of the country would be additional because of the generally depressed level of economic activity. This is a situation likely to be repeated across the EU with specific areas of Member States in which the expenditure raises the level of economic activity and other in which it does not.

In the Cohesion Countries much of the investment is additional because of financing through the Cohesion Fund. The total capital investments for the Cohesion Countries are estimated as 16 B Euro occurring mainly between 1995 and 2005. Wastewater allocations under the Cohesion Fund between 1993 and 1999 represent some 3.8 B Euro with probably a similar amount in 2000 to 2005. Hence a significant proportion (50%) of the expenditures in the Cohesion Countries can be considered to be additional leading to a stimulation of demand for goods and services and hence employment.

6.3.4 Home market and import leakage

The second factor affecting the extent to which the expenditures are capable of raising income and employment opportunity is the size of the relevant home market and its ability to meet the demand for goods and services or otherwise. Two issues are of importance: firstly the scale of the investments in relation to the size of the sectors effected and secondly the propensity for demand to be met through imports.

The size of the home market can be examined in terms of the size of the wastewater eco-industry in the Member States. The wastewater eco-industry is made up of a number of economic activities which supply goods and services that are characteristic of the type of goods and services required for wastewater collection, treatment and disposal. Ecotec (1997) measured the size of the wastewater eco-industries in the Member States in terms of their turnover. Table 6.4 illustrates the size of the relevant eco-industry in comparison to the scale of the annual expenditures required under the Directive.

Table 6.4 Directive expenditure in relation to the size of the eco-industries

Member State	Eco-industry turnover M Euro	Directive expenditure M Euro	%
A	1,580	1,077	68%
B	450	487	108%
DK	690	179	26%
FIN	610	174	29%
F	8,040	1,445	18%
D	14,470	7,311	51%
EL	80	199	249%
IRL	350	239	68%
IT	2,630	1,907	73%
L	80	35	44%
NL	2,010	925	46%
P	300	324	108%
E	650	1,695	261%
S	950	318	33%
UK	4,660	1,583	34%
EU-15	37,550	17,898	48%

Across the EU-15 in aggregate the expenditures represent around 50% of the estimated turnover of the wastewater eco-industry. In most individual MS this proportion varies between 30 and 70%. However, for the Cohesion Countries the proportion is significantly higher. In Greece and Spain for example the expenditures are around 2.5 times the eco-industry turnover. The only exception here is Ireland where the investments represent a more modest proportion of the eco-industry expenditure.

These figures suggest significant opportunities for growth in the wastewater eco-industries in the Cohesion Countries. In the absence of a sufficiently large home market for this demand however, a large proportion will be met through imports. The following table summarises available trade data in wastewater goods and services.

Table 6.5 Inter and Intra EU trade in wastewater goods and services

MS	Eco-industry investment 1994 M Euro	EU trade balance M Euro	RoW Trade Balance M Euro	EU Trade balance as % of turnover	RoW Trade balance as % of turnover
Net importers					
D	8060	-20.96	80.028	-0.26%	0.99%
A	950	-19.38	-2.628	-2.04%	-0.28%
E	320	-18.77	-2.702	-5.87%	-0.84%
B	180	-12.95	-1.377	-7.20%	-0.77%
NL	540	-11.71	-3.797	-2.17%	-0.70%
FIN	230	-6.43	13.584	-2.80%	5.91%
EL	40	-3.94	-0.55	-9.85%	-1.38%
P	220	-3.52	-0.678	-1.60%	-0.31%
Net exporters					
UK	2160	0.74	6.193	0.03%	0.29%
DK	330	5.40	2.894	1.64%	0.88%
S	390	11.00	0.857	2.82%	0.22%
IT	1870	20.45	20.13	1.09%	1.08%
IRL	220	29.11	0.439	13.23%	0.20%
F	3290	31.00	17.052	0.94%	0.52%
EU-15	18800	0.03	129.45	0.00%	0.69%

Source: adapted from Ecotec (1997)

In Table 6.5 countries are grouped and ranked into those which are net importers within the EU market (the Cohesion Countries with the exception of Ireland, Netherlands, Belgium, Germany, Austria and Finland) and those that are net exporters in wastewater goods and services.

Germany is the highest net importer of wastewater goods and services with net imports of approximately 21 M Euro. Germany, however, unlike almost all of the net importers has a very significant positive trade balance with the rest of the world (80 M Euro of a total EU world trade balance of 130 M Euro) only Finland displays similar characteristics. All of the Cohesion Countries with the exception of Ireland are net importers. In Spain, Greece and Portugal between 1% and 10% of the eco-industry investment expenditure is met through imports.

For the net exporters France is the EU leader followed closely by Ireland. Unlike Ireland, France also shows a significant positive trade balance with the Rest of the World (17 M Euro). Ireland shows a positive trade balance with the rest of the EU of almost 30 M Euro, this is very significant in terms of the scale of the Irish wastewater eco-industry, representing some 13% of total investment.

Using these trade characteristics it is possible to determine the likely flow of funds between EU Member States as a result of the UWWT Directive expenditures. These estimates are summarised in the following table.

Table 6.6 Trade flows between EU Member States associated with the UWWT Directive

MS	Funds flow from UWWT Directive M Euro	UWWTD Investment expenditure B Euro
Net importers		
E	-638	11
B	-281	4
A	-200	10
NL	-180	8
D	-167	64
EL	-148	2
FIN	-43	2
P	-38	2
Net exporters		
UK	4	13
DK	21	1
S	82	3
F	113	12
IT	196	18
IRL	216	2
EU-15	0	151

As can be seen on the basis of the available trade data the largest outflow of funds will be from Spain (640 M Euro), a further 190 M Euro will flow from Portugal and Greece to other Member States. For the Cohesion Countries as a whole, the flow of funds is reduced because of the scale of Irish exports in the sector, so that in aggregate it is estimated that some 600 M Euro will flow out of the Cohesion Countries to other Member States. This represents around 15% of the 4 B Euro in transfers to these countries under the Cohesion Fund. This is much lower than the previous estimates (e.g. CEC (1996) *Estimates show that around 30-40% of all funding that flows into the poorest MS returns to the richer ones in the form of purchase of know-how or capital equipment*. p10)

6.4 Assessment

The UWWT Directive calls for substantial investment in wastewater collection and treatment. There are significant differences in the estimated costs of the Directive between Member States as a result of differences in the starting point of the countries (some MS were more advanced in the provision of sewage services when the Directive was adopted) and the state of the natural environment. The first factor tends to push up the costs in the Cohesion Countries because the requirements are higher, while the second factor tends to reduce costs in these countries because of the relatively high assimilative capacity of the receiving environment.

The large scale of investments associated with the UWWT Directive mean real possibilities for stimulating income and employment opportunities. The extent to which possible income and

employment opportunities translate into actual opportunities depends on two factors, the degree to which the investments are additional and the degree to which they are met through home market supply and not through imports. In the Cohesion Countries and East Germany much of the investment is additional because of the use of EU transfers. Most of the Cohesion Countries, however, also see a large degree of leakage because of the presently small scale of the domestic wastewater eco-industries. As a result the cohesion impact of the expenditures is likely to be strongly positive, however, it could be improved further by encouraging supply side growth and import substitution for the main wastewater goods and services.

6.5 References

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7. AGRICULTURAL PRODUCTIVITY AND THE NITRATE DIRECTIVE

7.1 Introduction

The Nitrate Directive is aimed at reducing the pressure on the water environment from the use of nitrogen in farming. Nitrogen is a productive input on farms being an essential component of fertilisers used to improve crop yields and foodstuffs for raising livestock. Problems arise where the nitrogen balance on farms leads to excess nitrogen that can leach from soils and enter water bodies leading to elevated nitrate levels. Excessive nitrogen inputs can lead to the eutrophication of water bodies and contaminate drinking water supplies.

7.2 The nature of the link between policy and cohesion

As outlined in Section 3 the Nitrate Directive is likely to have an impact on social and economic cohesion through two mechanisms.

1. The imposition of a limit on the use of animal manure on farms that will lead to increased operational costs and reduced incomes through the necessary changes in agricultural practices.

2. Improvements in sectoral productivity through the promotion of codes of good agricultural practice aimed at better managing the inputs and outputs of nitrogen on EU-15 farms.

The first mechanism will affect those farms operating in areas sensitive to the leaching of nitrate and who presently generate large amounts of surplus nitrogen (in excess of crop and livestock requirements). The second mechanism applies more generally to farms where the surplus is less pressing, the land less sensitive to nitrate leaching but where there is still a substantial amount of inefficiency in the use of nitrogen.

Reducing inefficiency of nitrogen use on farm is likely to impact on social and economic cohesion in a number of ways. Savings resulting from improved nitrogen utilisation on farm will lead to higher farm incomes and help to narrow the growing gap between economic and social opportunity in the agriculture versus other sectors. Secondly, increased agricultural incomes will improve economic conditions in rural areas and hence reduce the present disparities of opportunity between rural and urban areas. Finally, more intelligent farming in relation to nitrogen inputs is likely to have positive spill-over effects into other parts of the farm management system as changes in nitrogen management tend to be seen in terms of changes in whole farm management practices.

Addressing the more structural problems on farms where reducing nitrogen problems requires measures which go beyond good agricultural practice will lead to cost increases and income losses for farms experiencing these conditions.

7.3 Information and measurement

To understand the link between the Nitrate Directive and social and economic cohesion it is first necessary to understand the farm nitrogen balance. A characterisation of a farm nitrogen balance is given in Figure 7.1.

Nitrogen inputs to the farm include atmospheric deposition, purchased mineral fertiliser and animal feed. Outputs of nitrogen include the nitrogen in crops and livestock products. Surplus nitrogen either leaches from the farm into water bodies or is emitted to the atmosphere.

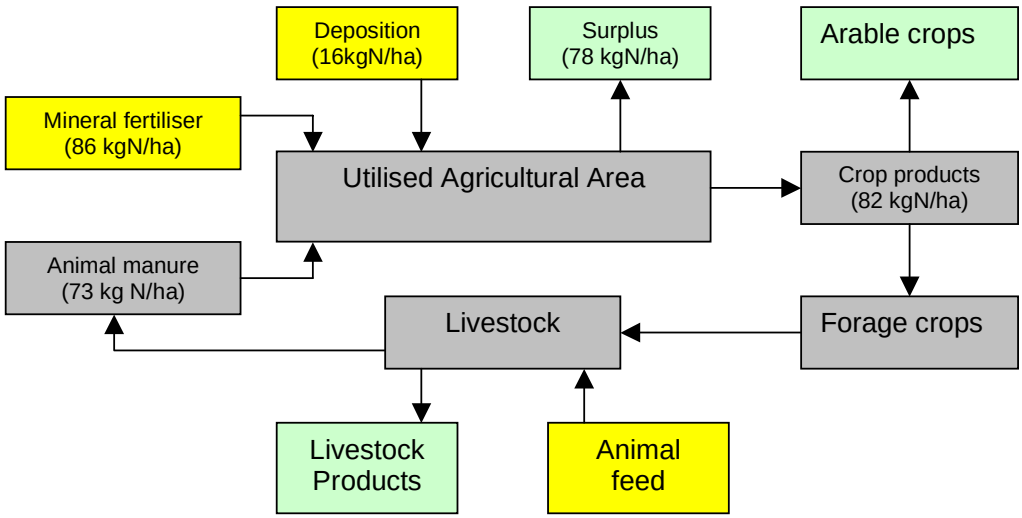

Figure 7.1 Farm Nitrogen Cycle with EU-12 balances on average farms

Table 7.1 illustrates the soil surface nitrogen balance for Member States in 1995.

As can be seen from Table 7.1 the nitrogen balance varies significantly between EU-15 Member States. Atmospheric deposition is highest in Northern Member States reflecting climatic conditions (prevailing winds etc.) as well as the distribution of economic activity, which is the main source emission to the atmosphere. The distribution of inputs via livestock manure and fertiliser varies between countries according to the type and intensity of farming. Relatively extensive forms of agriculture like cattle rearing and low input arable production tend to be more common in the South than in the North.

The variation in nitrogen inputs is paralleled by a variation in nitrogen outputs (in crops, and animal products) and it is clear from the table that a more balanced use of nitrogen would still involve a wide variation in patterns of nitrogen use across Member States. This is largely the result of differences in latitude and topography and hence physical limitations on the types of agricultural activities that can take place in different areas of the EU. In particular a contrast can be drawn between the highly intensive agricultural systems in Netherlands and Belgium and the more extensive Mediterranean systems in Spain, Portugal and Greece. The more extensive agricultural systems in the Cohesion Countries, which arise as a result of natural

conditions and traditional practices, allow a more balanced use of nitrogen because of the greater availability of land on which to utilise manure.

Table 7.1 EU-15 soil surface nutrient balance (1995)

Member State	Nitrogen inputs (kg/ha)				Nitrogen output (kg/ha)	Nitrogen balance (kg/ha)
	Atmospheric deposition	Livestock manure	Biological nitrogen fixation	Mineral fertiliser		
A	20	48	5	37	94	16
B	33	206	5	110	251	103
D	32	65	7	103	106	102
DK	18	72	11	107	136	72
E	6	28	8	36	40	37
EL	7	47	4	96	96	58
F	20	54	9	85	110	57
FIN	5	32	4	84	74	51
I	12	45	11	63	55	76
IRL	10	109	4	98	159	62
L	27	114	5	143	168	121
NL	31	282	2	195	297	213
P	4	39	5	35	60	22
S	5	39	5	70	80	38
UK	18	65	6	81	129	40
EU-15	16	57	7	75	95	60

Source: CEC (1999)

As noted above the impact of the Directive on social and economic cohesion depends on the relative force of two mechanisms. Firstly, the improvements in agricultural practice resulting from better information and education of farmers in relation to nitrogen management. Secondly, where nitrogen surpluses are severe the use of an application standard for animal manure to be spread on farmland. Both mechanisms are likely to lead to changes in farm practice, in the first case however; the changes are likely to be beneficial both to farmers and the environment by removing a substantial degree of inefficiency with respect to farm use of nitrogen. In the second case there are likely to be costs to farms (both from increased operating costs and lost income) where the nitrogen surplus is such that it is necessary to go beyond good agricultural practice to alleviate the pressure on the environment. In the following sections these issues are discussed in turn.

7.3.1 Codes of good agricultural practice

A principal component of the measures required for the Nitrate Directive is the development of codes of good agricultural practice. The information value of these codes and associated measures is considered to have a positive impact on farm efficiency with regard to the balancing of nitrogen on farm.

Farms adopt management strategies based on profitability, risk minimisation and from the traditions of past practice. There is substantial evidence of inefficient use of nitrogen on-farm. Vedeld (1998) found a large variation in total nitrogen use on Norwegian arable farms that could not be explained by differences in crop, climate or soil properties. Niewenhuize *et al*

(1995) found that two fifths of Dutch diary farms could increase profits by reducing fertilisation levels and that almost all could reduce feed input without financial loss. Study groups of farmers are reported to have reduced their nitrogen surplus by up to 25% on a voluntary basis (De Hann and Van Zeijts, 1995). In Finland, Pirtttijärvi (1998) demonstrated that farms with the lowest nitrogen surpluses also had the highest profits.

To understand the possible inefficiencies of nitrogen use on farm it is necessary to understand the relationship between nitrogen and farm output. In arable farming nitrogen is essential to plant growth and the nitrogen lost to the plants must be replaced to retain soil fertility. In the livestock sector nitrogen is an essential component of animal feeds and in growing fodder. A complex relationship exists between nitrogen inputs and farm outputs and a number of factors lead to possible inefficiencies:

- ***Poor understanding of nitrogen content of manure***. Where crops receive recycled animal manures and chemical fertilisers, there is strong evidence that farmers take insufficient account of the nitrogen available in the manure which acts as a substitute for the nitrogen in chemical fertilisers.

- ***Poor understanding of natural deposition.*** Nitrogen is available from natural deposition. The level of natural deposition varies across the EU but can vary from over 30 kg N/ha in the Netherlands and Belgium to less than 5 kg N/ha in Greece, Spain, Portugal and Southern Italy. Evidence suggests that farmers pay very little attention to the nitrogen available from this source.

- ***Poor understanding of the nitrogen from past crops.*** Nitrogen is available from past crops and there is evidence that farmers do not make sufficient allowance for this source of nitrogen. When crops are harvested not all of the plants are removed from the soil and as such much nitrogen will remain which can contribute to the fertility of the following crop.

- ***Risk aversion***. Risk minimisation is an important strategy affecting a farms use of nitrogen. Excessive quantities of nitrogen fertilisers are applied because the perceived costs of insufficient nitrogen use (yield losses) are thought to be greater than the costs of excessive nitrogen use (20-30 Euro/ha). Farmers see excessive nitrogen use as a cheap form of crop insurance, but one that is obviously inefficient.

- ***Structural conditions.*** The nitrogen content of animal manure can give rise to productive trade between farms where there is a surplus of manure and farms where manure is in short supply. However, often it becomes infeasible to undertake such trade and redistribution of manure because of high transport costs. In such circumstances farms with a surplus of manure will have an incentive to treat manure as waste and to apply more manure to their land than is necessary for crop requirements leading to increased leaching from soils to water bodies.

- ***Insufficient storage capacity.*** Similar to the problem outlined above, farms that lack sufficient storage capacity to store manure from periods when it is generated to periods when it can be used productively on farm, have an incentive to use their land as a means of disposing of the excess manure. Investment in storage capacity is often profitable but can have a payback period that is not attractive to farmers without an additional incentive.

In order to examine the first order and final effects of the Nitrate Directive in terms of enhancing the productivity of farms where nitrogen use is presently inefficient it is necessary to know:

1. the extent of present levels of nitrogen inefficiency and its distribution between farming types and regions of the EU;

2. the value of the savings that might be made through changes in farm management practices;

3. The impact this might have on the disparity between incomes in the agricultural sector and elsewhere.

Nitrogen surpluses and their distribution between farming types and regions of the EU

An understanding of the scale and distribution of nitrate inefficiency can be gained by comparing the distribution of farm nitrogen surpluses between similar farms. A large range in surpluses is indicative that some farms are using nitrogen inefficiently and therefore of potential cost savings. The following table summarises by Member States and farming type the mean nitrogen surplus and its standard deviation in 1990/91 (i.e. prior to the adoption of the Nitrate Directive).

Table 7.2 Nitrogen surplues kg N/ha and standard deviation by farming type in 1990/91

	Cereal	Cropping	Dairy	Dry-stock	Granivore	Mixed
Mixed farming systems						
Germany	96 (17)	115 (20)	129 (25)	126 (31)	224 (46)	132 (38)
Ireland	51 (11)	50 (15)	79 (26)	52 (30)	. (.)	69 (45)
France	79 (32)	74 (29)	76 (35)	47 (248)	427 (a)	82 (48)
United Kingdom	55 (12)	68 (17)	108 (38)	35 (41)	909 (a)	79 (42)
Intensive farming systems						
Belgium	. (.)	103 (22)	162 (42)	178 (1195)	1591 (a)	184 (121)
Denmark	68 (12)	83 (19)	165 (47)	. (.)	273 (1494)	139 (50)
Luxembourg	. (.)	. (.)	123 (19)	110 (79)	. (.)	117 (31)
Netherlands	. (.)	333 (66)	337 (78)	455 (1890)	2335 (.)	488 (305)
Mediterranean systems						
Greece	27 (22)	30 (40)	161 (616)	308 (9621)	6282 (a)	78 (1191)
Italy	4 (24)	1 (26)	72 (151)	25 (69)	1239 (2181)	30 (468)
Portugal	0 (8)	4 (31)	40 (598)	3 (42)	470 (a)	14 (410)
Spain	6 (5)	9 (15)	76 (1086)	43 (7592)	1024 (a)	36 (5703)
EUR12	32 (37)	57 (64)	114 (214)	48 (2533)	688 (a)	85 (1934)

Source: Brouwer *et al* (1995) (a) greater than 10,000 kg N/ha

For cereal farming the average nitrogen surplus was 32 kg N/ha. This tends to be higher in the predominately mixed farming systems of Germany, Ireland, France and the UK and much lower in Mediterranean agriculture. Little cereal farming takes place in the intensive farming systems in Belgium, Denmark, Luxembourg and the Netherlands. Within the Mediterranean agriculture Greece and Italy stand out as having either comparatively high surpluses or wide ranges of surplus seen on farm (as evidence by a large standard deviation). A similar pattern is seen for cropping farms, although the surpluses and their ranges tend to be higher.

Surpluses tend to be highest in the intensive farming systems (especially the Netherlands) and lowest in the Mediterranean agriculture. The range of surpluses, however, tends to be higher in the Mediterranean than mixed farming systems. This pattern is even clearer in the case of dairy farming, with very high standard deviations seen in Greece, Portugal, Italy and Spain. Dry-stock and granivore farming see some of the highest surpluses and also the greatest range. Once again, this range tends to be highest within the Mediterranean countries. For mixed farming the highest surpluses are seen in the intensive agricultural systems. Generally lower surpluses are seen in Mediterranean and mixed farming systems but with the former again displaying significantly larger variation in surpluses across farms.

These data indicate the degree to which Nitrogen surpluses can vary across and between farming types. The general pattern that emerges is of comparatively low surpluses in Mediterranean agriculture (because of the more extensive form of agriculture) with higher surpluses in mixed farming systems and much higher surpluses in the intensive farming systems. A wide range of surpluses is seen within the same countries for similar farming types, indicating the degree of inefficiency of nitrogen use on farms. These ranges, however, tend to be greatest in Mediterranean agriculture suggesting higher potential efficiency gains despite the relatively low levels of surplus experienced on average.

Savings available from more efficient Nitrogen management

The various sources of inefficiency in nitrogen management were outlined above. There is no comprehensive overview of what the removal of these inefficiencies might mean in terms of farm savings, although a number of farm and crop specific examples exist.

Webb and Wilkinson (1998) reported two examples of savings that may arise in the UK for winter wheat and main-crop potatoes. Their analysis was only possible given the very detailed data available on actual farm fertiliser use from the British Survey of Fertiliser Practice. By comparing actual use with recommended use it was concluded that little or no account was being taken of the nitrogen available from previous crops (i.e. left in the soil after harvesting) or from the nitrogen available from manure applications.

Savings from manure applications

It was estimated that the average amount of N available from manure applied to wheat was 40 kg N/ha, but that farmers reduced purchased fertiliser applications by only 22 kg N/ha in response to these applications. As a result it is estimated that further reductions in purchased fertiliser of 18 kg N/ha could be achieved without reducing yields. In the UK this would save some 4000 tonnes of fertiliser representing a cost saving to the industry at around £1.3M. Similar calculations for main-crop potatoes indicated potential savings of £0.3M. The authors conclude that it is not possible to extrapolate these findings to the EU level although it is likely that similar savings could be achieved within northern and western European countries.

Savings from residual nitrogen from crops

In the case of wheat following break crops (oil seed rape) it is estimated that the previous crop supplies around 25 kg N/ha of the next crops nitrogen needs. Farmers, however, only allow for 10 kg N/ha from this source, suggesting a potential saving of 15 kg N/ha. Such savings would translate into a potential reduction of 15,000 tonnes of fertiliser, which would have cost almost £5M. Similar calculations for winter barley following break-crops suggest a saving of 750 tonnes and another £0.2M per annum. The authors conclude that these results are very

applicable to the situation across Northern Europe (especially Germany and France) and that the savings would in fact be higher because of the generally higher cost of fertilisers in these countries.

7.3.2 Limits on the application of manure

In addition to disseminating codes of good agricultural practice the Nitrate Directive also sets a limit on the land application of nitrogen from animal manure of 170 kg/ha in areas regarded as being sensitive to nitrate (Nitrate Vulnerable Zones). This limit, aimed at reducing the potential for nitrate leaching, will lead to substantial changes in farm management practices particularly for intensive livestock farms because of the limited potential to dispose of the excess manure in an environmentally sound manner.

A recent review of information on the costs of the Directive revealed only a very limited number of assessments of the total costs of the Directive, most of which are associated with high uncertainty (WRc, 2000). There is substantially more information on costs at farm level – associated with various investigations of changed management practices including comparisons with a possible tax on the use of nitrogen. Comparison of the global cost estimates range from around 0.5 Euro per ha in the UK to 125 Euro per ha in the Netherlands. Analysis of the farm scale data suggests costs ranging from around 45 Euro to 658 Euro/ha/yr for different farming types. Using information on the number of farms affected it was estimated that annual costs of the Directive would be in the region of 600 M Euro per annum for the EU as a whole (WRc, 2000).

These costs are not evenly distributed across the EU-15 Member States. The costs tend to be highest in those countries where livestock intensity is greatest (because there is less room for the environmentally sound disposal of manure) and where waters are regarded as being sensitive to nitrate leaching. This tends to concentrate costs in a number of countries with intensive farming systems and where waters are particularly sensitive (such as the North Sea and Baltic). The most affected countries are the Netherlands, Belgium and Denmark. The Cohesion Countries practice a much more extensive form of agriculture and are therefore much less affected by the limit on the application of manure. Although high surpluses can arise, there is generally much more land available to dispose of the manure without breaching the standard. In other Member States, who generally operate a much more mixed form of agriculture, combining cropping with livestock husbandry, the implications of the Directive are more mixed.

Table 7.3 summarises the area of land on which the existing nitrogen surplus may give rise to the need for measures to meet the application standard. As can be seen the surplus on cereal and cropping farms are such that it is estimated that no land would be affected by the application standard. In most countries granivore enterprises would be affected. The percentage of the countries agricultural areas affected varies considerably from <1% in Portugal to over 75% in Belgium.

While there will be a potential to remove the pressure on these land areas through better agricultural practices (without additional costs) it is more likely that some costs will be encountered because of the need to go beyond good agricultural practice. This will either involve costs of changing management practices (e.g. reformulating foodstuffs) or reduced incomes (e.g. because of lower livestock densities).

Table 7.3 Agricultural areas (ha) requiring measures to address a nitrogen surplus from manure production (1991)

	Cereal	General crops	Dairy	Dry-stock	Granivore	Mixed	Total	Total
Austria	:	:	:	:	:	:	:	:
Belgium	0	0	417,049	201,385	18,609	432,740	1,069,783	77%
Denmark	0	0	549,270	0	148,520	0	697,790	26%
Germany	0	0	0	0	77,703	0	77,703	1%
Greece	0	0	18,428	243,348	1,097	0	262,872	9%
Spain	0	0	844,682	0	158,749	0	1,003,431	4%
Finland	:	:	:	:	:	:	:	:
France	0	0	0	0	225,878	529,468	755,346	3%
Ireland	0	0	0	0	0	0	0	0%
Italy	0	0	394,545	208,082	52,287	0	654,914	4%
Lux	0	0	0	0	0	0	0	0%
Neth	0	0	1,046,762	85,495	42,495	158,095	1,382,848	71%
Portugal	0	0	0	0	20,118	0	20,118	0%
Sweden	:	:	:	:	:	:	:	:
UK	0	0	2,513,961	0	53,930	0	2,567,892	14%
EU-15	0	0	5,784,697	738,310	799,387	1,120,303	8,988,029	0

Source: WRc (2000)

7.4 Assessment

The Nitrate Directive is considered to affect social and economic cohesion in at least two important ways. Firstly, the imposition of an application standard for nitrogen from animal manure is likely to increase costs and reduce agricultural incomes in a number of countries, especially those with highly intensive livestock enterprises. The Cohesion Countries, due to their relatively more extensive agricultural systems will be much less affected. Hence the application standard is likely to reduce agricultural incomes in the relatively productive northern agricultural regions leading to a form of negative cohesion as incomes are reduced closer to those prevailing in the Mediterranean agriculture. Such developments would suggest a possible shift of agricultural activity from the intensive North to the extensive South, although this will be limited by climatic and other conditions.

At the same time, on farms where the environmental pressures are less intense there is evidence that the codes of good agricultural practice, which are part of the Directive, can lead to substantial cost savings through better nitrogen management. Although nitrogen use efficiency could be improved throughout the community evidence suggests the largest gap is in the Mediterranean agricultural systems – where very wide variations in the nitrogen surplus are in evidence for similar farming types. This is likely to have a positive impact on cohesion by improving the efficiency of EU farming in general and making it more competitive on world markets and by enhancing efficiency most in the less developed regions.

It is difficult to judge the net impact of these effects, which will depend, in part upon the success or otherwise of the information programmes in modifying farmer behaviour in relation to nitrogen management.

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8. SITUATION IN ACCESSION COUNTRIES

8.1 Introduction

This report has concentrated on the situation in the EU-15. An EU of 27 members is likely to see growing disparities in terms of social and economic cohesion. Judging by the experience of the Cohesion Countries, the Accession Countries will see considerable acceleration in economic growth and in the long term this faster growth will reduce disparities in social and economic opportunity. Potentially, the increase in economic development will increase the pressures placed on the environment and without the approximation of the environment-water *acquis*, deterioration in water quality would be expected.

The Accession Countries face considerable requirements for the approximation of EU environment-water legislation. The countries also present a variety of initial conditions that will condition the impact of the implementation of these policies. This section reports on the situation in the Accession Countries, in general terms and in terms of the specific mechanisms through which environment-water policies impact upon social and economic cohesion.

8.2 The overall situation

It is common to view the Accession Countries as being in transition to EU-15 standards of environmental-water management but perhaps better to view both the EU-15 and the Accession Countries as in transition to sustainable water management but beginning at very different starting points. A number of general points have to be made in relation to the environment-water policies of Accession Countries relative to the EU-15.

Perhaps the most obvious difference is the significant orientation of Accession Countries' environment policies towards human health objectives. While obviously of great importance in EU-15 countries there is relatively more emphasis on amenity related environmental issues. This reflects the fact that life expectancies in the Accession Countries are considerably lower than average EU-15 rates and have been significantly affected by the transition process.

A second difference is the importance of raising environmental awareness. Low awareness of environmental issues is a particular problem in many Accession Countries, while awareness in the EU-15 countries is relatively higher. As many environment-water problems stem from a poor understanding of the impact of activities on the environment this suggests that raising environmental awareness is one of the key instruments to more sustainable water-environment policies and one that is relatively inexpensive when compared to more technological solutions.

It is recognised in many Accession Countries that the technological profile of the economy is one of the major factors contributing to environmental-water problems. The prevalence of out dated manufacturing technologies is a principle explanatory factor behind the phenomenon of low consumption/production combined with high environmental pressures. This has lead to the development of specific policies towards the replacement of out dated technologies and the promotion of newer and cleaner production methods. This issue is of particular importance in relation to cohesion as building-in clean technologies, as the economies expand, is much less expensive than converting/retrofitting old technologies. The possibility for the alignment of

environmental and technological investment is one of the principle opportunities for combined economic and environmental productivity improvements.

Inherited environmental problems are a major contributor to the overall environmental burden in many Accession Countries and this has lead to the adoption of specific policies towards cleaning up past environmental problems. Inherited environmental problems are an important aspect of the transition process because unlike other environmental pressures they require special policies to promote the presently latent economic potential of damaged resources.

In the following sections specific mechanisms through which environment-water policies may impact on economic and social cohesion in Accession Countries is examined.

8.3 The management of water resources

Perhaps the central issue in relation to the Accession Countries is in resolving the problem of high investment needs and presently low levels of cost recovery in the context of maintaining a level of affordability of water services.

Like the Cohesion Countries the extent of cost recovery of water services from users is considered to be low. Water prices have tended to be administered by central or local governments with a significant social objective, such that although the operating costs may be largely recovered, the investment costs tend to be financed through direct subsidy arrangements. In addition there is a tendency for household water charges to be subsidised by industry through the practice of charging industry a higher volumetric price for the water they receive.

Coupled with the relatively low level of user cost recovery, all of the Accession Countries face very high expenditure requirements in relation to the management of water resources. A large part of this investment is needed to achieve EU-15 standards of drinking water quality, wastewater collection and treatment. However, further expenditures are also needed to improve existing systems, which have traditionally been poorly maintained in part because of the lack of suitable financial arrangements and the supply orientated approach to provision. The down-turn in economic activity following the transition recession (and later with the period of growth reversal) together with structural changes in the composition of output has meant that much of the water infrastructure is not only out dated but too large to serve current needs efficiently.

A best-order-of-magnitude evaluation of the costs of approximating EU water legislation estimated expenditures in the region of 50 B Euro for the ten Central and Eastern European Countries (EDC/EPE, 1997). The majority of this expenditure is for wastewater treatment (33 B Euro) with the remaining on water supply investments. Such high investment requirements reflect generally low levels of connection to water supply and wastewater collection infrastructure and low rates of wastewater treatment.

As a result of concerns over affordability it is widely expected that much of the required investments will be met through the public finances rather than directly from users. As in the Cohesion Countries this raises the question as to whether such investment will adequately reflect the need to manage water as an economic resource and make use of available demand management measures in meeting environment-water policy goals. The high expenditure requirements, changing economic circumstances and concerns over affordability increase the need for a shift in the provision model away from the supply orientated approach

towards the management of water as an economic resource. The implementation of the Water Framework Directive in this regard will be an important pillar of the new approach.

8.4 The quality of drinking water

The key cohesion impact investigated in the context of the EU-15 was the impact of improvements in the quality of drinking water on health and economic productivity. In the case of lead contamination it was demonstrated that while having positive cohesion impacts overall such policies also have a proportionately greater impact on the most economically disadvantaged social groups (as a consequence of existing health inequalities).

Serious health related water problems exist in the Accession Countries. There is evidence of a large and avoidable burden of water related disease in many Central and Eastern European countries. As noted by Bartram and Thyssen (1999) the immediate concern is for micro-biological contamination that can affect large numbers of people. Micro-biological contamination can easily be reduced through disinfection of waters and good management of supply (including ensuring supplies are continuous). However, the standard of treatment and disinfection of drinking water in many Accession Countries is inadequate, particularly following the political and economic changes that have led to a deterioration of infrastructure and severe financial constraints on water suppliers.

A robust estimate of the extent of avoidable water related disease is hampered by the lack of reliable data on the quality of waters and as a result of poor reporting and surveillance mechanisms. Even in countries where disease surveillance practices are more advanced there is generally a substantial under-reporting of disease – particularly for the milder but more frequent water related diarrhoeal diseases[9]. A rough estimate would be that there are approximately 30 million cases of avoidable water related disease in the Eastern WHO region (Central and Eastern Europe and the Newly Independent States) (Bartram and Thyssen, 1999). This burden covers the spectrum of water-related diseases ranging from the relatively mild cases of non-acute gastro-enteritis to the more severe problems of Hepatitis A and Typhoid. A further disease burden arises from hygiene and chemical related water quality problems.

The consequence of this disease burden in terms of economic and social cohesion is obviously substantial. The benefits of improvements in the quality and reliability of drinking water provision are therefore likely to be very significant, not only in terms of the quality of life of the affected population but also in terms of reducing the wasted expenditures on medical care and reduced loss of working (and other productive) time. Labour productivity and reduced health sector costs are therefore likely to be two of the most important cohesion consequences of improvements in the quality of drinking water provision.

Finally, as in the case of lead contamination in the EU-15, there is evidence that improvements in drinking water quality disproportionately benefit the more disadvantaged social groups. The private and small public supplies, which predominate in rural areas, are identified by many countries as the most liable to receive insufficient treatment or protection. Incidences of waterborne disease outbreaks occur predominately in areas where

[9] Archer and Kvernberg (1985) estimate the ratio between actual and diagnosed (where medical attention is sought) cases are between 25:1 and 100:1 for all diarrhoeal disease. Hauschiled and Bryan (1980) (reported in Archer and Kvernberg) put the ratio of reported to actual waterborne illness in the US as 29.5:1.

infrastructure is poor and/or supply is discontinuous as a result of financial constraints on operators.

8.5 Expenditure on urban wastewater treatment

In the case of the EU-15 the impact of the UWWT Directive was shown to have positive cohesion effects because of the addition of the expenditures in the Cohesion Countries. These expenditures stimulate demand in a number of related sectors (chemicals, energy and construction) as well as providing employment opportunities directly in the wastewater eco-industry.

The Accession Countries face very large investment requirements as a result of the Urban Wastewater Treatment Directive. Recent estimates put the investment cost at around 30 B Euro (EDC/EPE, 1997), compared to 150 B Euro for the EU-15. Like the Cohesion Countries these expenditures will tend to stimulate demand and provide income and employment opportunities but there are serious questions about affordability given the generally lower *per capita* incomes in some countries. To illustrate the extent of this affordability gap, Table 8.1 summarises the estimated investment requirements as a proportion of *per capita* GDP in the EU-15, cohesion and Accession Countries.

The total investment cost of the Directive across a Europe of 24 members (excluding Slovenia, as no data is available) is approximately 183 B Euro. This represents around 290 Euro *per capita* and approximately 2% of the *per capita* GNP. Expenditure *per capita* varies significantly, between Member States. In aggregate the expenditure *per capita* in the Accession Countries is around 330 Euro, which is below the average cost in the EU-15 but above the costs expected in the Cohesion Countries. There are, however wide variations in affordability. Investment expenditure on the Directive as a proportion of *per capita* GNP ranges from 1%-2% for most EU-15 countries to 15%-30% for a number of Accession Countries (Baltics and Bulgaria/Romania). In aggregate the expenditure as a proportion of GNP in the Accession Countries represents around 9% of *per capita* GNP compared to 2% in the EU-15.

As a result inter-regional transfers will be an important source of financing in the Accession Countries. As in the case of the Cohesion Countries the extent of inter-regional transfers will increase the additionality of the expenditures – stimulating demand and employment and providing a positive impetus to cohesion.

Table 8.1 Expenditure and affordability of the UWWT Directive in the EU-15 and Accession Countries

Country	Population (Million) [(a)]	Gross National Product *per capita* (Euro) [(a)]	UWWT Directive Investment expenditure (B Euro) [(b)]	UWWT Directive expenditure *per capita* (Euro)	UWWT Directive Expenditure as % of *per capita* GNP
Denmark	5	36456	1.30	260	1%
France	59	26724	12.04	204	1%
UK	59	25768	12.53	212	1%
Greece	11	13396	1.50	136	1%
Sweden	9	28500	2.90	322	1%
Finland	5	27066	1.55	310	1%
Italy	58	22433	17.9	309	1%
Belgium	10	27897	3.90	390	1%
Spain	39	15934	10.87	279	2%
Ireland	4	21807	1.63	408	2%
Netherlands	16	27680	8.30	519	2%
Czech Republic	10	5759	1.10	110	2%
Portugal	10	12065	2.39	239	2%
Germany	82	28853	64.17	783	3%
Austria	8	29558	9.79	1,224	4%
Slovak Republic	5	4086	0.90	180	4%
Hungary	10	5293	3.10	310	6%
Poland	39	4507	13.70	351	8%
Romania	22	1730	6.30	286	17%
Lithuania	4	2982	2.27	568	19%
Bulgaria	8	1571	2.70	338	21%
Latvia	2	2811	1.60	800	28%
Estonia	1	3961	1.38	1,380	35%
EU-15	375	24,729	150.77	402	2%
C-4	64	15,261	16.39	256	2%
AC-9	101	3,751	33.05	327	9%
Total	476	20,278	183.82	386	2%

Source: a = World Bank (2000), b = WRc (2000) for EU-15 and EDC/EPE (1997) for AC-9

8.6 Agriculture and water quality

Agriculture in Accession Countries is very diverse. The extent of agriculture (% of land area) ranges from just 1% in Slovenia to over 30% in Poland. In comparison to Western Europe, farms tend to be large, contribute a higher share to overall economic activity, and are very labour intensive. As with industry, the transition process saw a reduction in agricultural output although this was relatively less severe. Agricultural support policies operate in all Accession Countries although at generally low levels prior to transition (e.g. as measured in terms of Producer Subsidy Equivalents). These declined rapidly as a result of the transition but have generally recovered since then.

The environmental impact of agriculture pre-transition was dominated by the large-scale (collectivised), input and heavy machine intensive form of activity (this does not apply to Poland where smaller private farms using traditional practices dominated). As a result of transition there was a rapid (50%) reduction in the use of artificial fertiliser from levels

comparable to the EU-15. Pesticide use represents a similar situation (measured in terms of kgs of active ingredient per ha). Livestock densities also declined rapidly between 1989 and 1995. Data from the FAO (2000) indicate the following relative changes in livestock numbers:

- Cattle down 22%;
- Chickens down 12%;
- Pigs down 13%; and
- Sheep down 35%.

The decline in livestock numbers is explained by a variety of factors:

- the move from collectivised/intensive farming towards smaller privatised farming units with lower input intensity. This involved the liquidation of collectivised farms and the allocation of livestock units to employees. This process led to the liquidation of many livestock units and is not conducive to the re-establishment of herds;
- the over-development of the agricultural sector pre transition – concentration on livestock numbers at the expense of quality. The post transition state will involve fewer livestock numbers but greater quality;
- the declining living standards and a decrease in demand for livestock products.

Post transition, livestock numbers are expected to grow but not to levels pre-transition. It will take many years to re-establish production levels given the liquidation of stocks. As a result low intensity farming is now common in the Accession Countries. This is, however, motivated by economic rather than environmental reasons. As economic growth continues it would be expected that the intensity of agricultural production will inevitably increase. However, the transition process has offered considerable opportunities for widespread changes in farming practices. As such it would be anticipated that moves towards more environmentally friendly farming practices (for example through the adoption of codes of good agricultural practice under the Nitrate Directive) will help to foster increased agricultural efficiency both in economic and environmental terms.

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9. SUMMARY AND CONCLUSIONS

This report is produced in the context of a Study entitled *The Impact of Community Environment Water Policy on Economic and Social Cohesion*. The report presents the results of investigations into the linkages between environment-water policies and the groups for which cohesion objectives apply (Member States, regions, sectoral and social groups). The report provides background material and a general introduction to the issues, giving a succinct overview of the relevant pressures and policies. Causal relationships are identified between environment-water policies and cohesion and a number selected for detailed examination:

- Cost recovery, incentive pricing and the Water Framework Directive,
- Health and productivity and the Drinking Water Directive,
- Employment and the Urban Waste Water Directive,
- Agricultural productivity and the Nitrate Directive.

Cost recovery, incentive charging and the Water Framework Directive

The Water Framework Directive is a very important piece of legislation in terms of EU environmental policy in the sphere of water. The Directive has a number of important impacts on social and economic cohesion mainly through two processes: firstly the targets set for good water status and secondly in terms of the way in which water is managed.

In terms of good status it is presently impossible to predict the impact on cohesion, as there is as yet only limited progress on defining operational parameters for good status. In terms of management there are likely to be significant cohesion benefits in terms of more cost effective and integrated solutions to water quality and quantity problems. Of significant importance however is the requirement to adequately recover the costs of water services from users. Presently cost recovery from users is low, especially in the Cohesion Countries and from agricultural water users. Increasing the level of cost recovery will have significant impacts and there is an evident need to ensure that the goals of cost recovery are integrated with the need to promote greater economic and social cohesion.

Health and productivity and the Drinking Water Directive

The Drinking Water Directive is aimed at providing wholesome water that does not adversely affect the health of the population. The Directive covers a wide variety of parameters that may contaminate water supplies and have impacts on health. Lead provides an example that clearly has impacts both upon the cognitive development of children and hypertension related disease. A reduction in contamination from lead has a number of important effects on health and the quality of life and consequently on social and economic opportunity. Improved cognitive development in children increases IQ, years of schooling, working wages and workforce participation leading to higher lifetime earnings from a more productive population. Reduced hypertension related disease reduces treatment resource costs and increases and extends the quality and length of life leading to greater productivity.

While these impacts are likely to be beneficial in terms of general social and economic cohesion a further positive impact arises because of the inequitable pattern of exposure to other sources of lead and health inequalities generally. For a number of reasons high exposure tends to be associated with low incomes, disadvantaged social classes and poor living conditions. A reduction in the exposure from drinking water is likely therefore to have a disproportionate and positive effect on these cohesion groups.

Employment and the Urban Waste Water Directive

The UWWT Directive calls for substantial investment in wastewater collection and treatment. There are significant differences in the estimated costs of the Directive between Member States as a result of differences in the starting point of the countries (some MS were more advanced in the provision of sewage services when the Directive was adopted) and the state of the natural environment. The first factor tends to push up the costs in the Cohesion Countries because the requirements are higher, while the second factor tends to reduce costs in these countries because of the relatively high assimilative capacity of the receiving environment. The outcome of these factors is that the Cohesion Countries face generally lower *per capita* costs than those faced in northern Member States.

The large scale of investments associated with the UWWT Directive mean real potential for stimulating income and employment opportunities. The extent to which possible income and employment opportunities translate into actual opportunities depends on two factors, the degree to which the investments are additional and the degree to which they are met through home market supply and not through imports. In the Cohesion Countries and East Germany much of the investment is additional because of the use of EU transfers. Most of the Cohesion Countries, however, also see a large degree of leakage because of the presently small scale of the domestic wastewater eco-industries. As a result the cohesion impact of the expenditures is likely to be strongly positive, however, it could be improved further by encouraging supply side and import substitution for the main wastewater goods and services.

Agricultural productivity and the Nitrate Directive

The Nitrate Directive is considered to affect social and economic cohesion in at least two important ways. Firstly, the imposition of an application standard for nitrogen from animal manure is likely to increase costs and reduce agricultural incomes in a number of countries, especially those with highly intensive livestock enterprises. The Cohesion Countries, due to their relatively more extensive agricultural systems will be much less affected. Hence the application standard is likely to reduce agricultural incomes in the relatively productive northern agricultural regions leading to a form of negative cohesion as incomes are reduced closer to those prevailing in the Mediterranean agriculture.

At the same time, on farms where the environmental pressures are less intense there is evidence that the codes of good agricultural practice, which are part of the directive, can lead to substantial cost savings through better nitrogen management. Although nitrogen use efficiency could be improved throughout the Community evidence suggests the largest gap is in the Mediterranean agricultural systems – where wide variations in the nitrogen surpluses are in evidence for similar farming types. This is likely to have a positive impact on cohesion by improving the efficiency of European farming in general, making it more competitive on world markets and by enhancing efficiency most in the less developed regions.

Throughout this report particular attention is paid to a number of important horizontal issues:

Regional differences in implementation costs of existing and proposed directives on water policy. It is clear that there are large differences in the implementation costs of environment-water policies across Member States. A very general characterisation is that costs tend to be elevated in the Northern Member States because of the higher level of development and hence pressures. In addition, however, for a number of pressures, the assimilative capacity of the receiving environment is also considerably lower in northern countries and comparatively higher in the Cohesion Countries. The final consideration, however, is the state of development of the countries environmental infrastructures at the time the directives are adopted. Despite generally lower pressures and a more assimilative environment, Cohesion Countries tend to lack the environmental infrastructures seen in northern Member States consequently increasing the scale of the investments required.

The impact of the directives on the environmental situation. The distribution of costs associated with the directives gives only a partial picture of the impact on social and economic cohesion because it does not indicate the relative distribution of benefits. In the water sector, however, unlike the air sector, the benefits of improvements in water quality tend to occur in close proximity to the activities being carried out. The possible exceptions to this are eutrophication of marine and coastal areas where the improvements are seen considerable distances from the point at which the investments take place.

Possible impacts on the location of activities given different degrees (strictness) of application of regulations. There is no evidence of large-scale movements of activities in relation to differences in the strictness of application of regulations. However, there is some evidence of movements in production as a result of differences in the assimilative capacity of the environment. This has been observed in the case of the Nitrate Directive, which is leading to the redistribution of activities within the countries most affected (e.g. in Belgium and Netherlands) and from these countries to parts of the region where current farming practices are less intensive and the environment less sensitive.

Accession Countries. This report has concentrated on the situation in the EU-15. An EU of 27 members is likely to see growing disparities in terms of social and economic cohesion:

- In relation to the management of water resources and the Water Framework Directive, perhaps the central issue is in resolving the problem of high investment needs coupled with inadequate levels of cost recovery from users and the need to maintain an affordable water service.

- No data is available on the extent of contamination of drinking water supplies by lead in the Accession Countries. However, these countries have long standing problems with the continuous supply of wholesome water and evidence from previous studies suggests that there are likely to be very large benefits from improved health and productivity, particularly through reduced incidence of water related microbiological disease.

- The Accession Countries face very large investment requirements as a result of the Urban Wastewater Treatment Directive. Recent estimates put the investment cost at around 30 B Euro, compared to 150 B Euro for the EU-15. Like the Cohesion Countries these expenditures will tend to stimulate demand and provide income and employment opportunities but there are serious questions about affordability given the generally lower *per capita* incomes in some countries.

- Partly as a result of the transition process, low intensity farming is now common in the Accession Countries and is in stark contrast to the output orientated and input intensive agricultural systems that dominated pre-transition. The transition process has offered opportunities for wholesale changes in farming practices that will allow an easier transition to more environmentally friendly and economically efficient farming practices.

APPENDICES

Appendix 1 – Summary of Related Work in the First Report on Economic and Social Cohesion

APPENDIX 1 – SUMMARY OF RELATED WORK IN THE FIRST REPORT ON ECONOMIC AND SOCIAL COHESION

Chapter 4 of the *First Report on Economic and Social Cohesion (1996)* is devoted to an examination of policies of the European Union, other than those aimed specifically at cohesion, to determine how and to what extent they have helped to further cohesion aims and under what conditions they could further this end without diverting from the primary objectives. The focus of attention is on agricultural policies, policies aimed at competitiveness, network policies and policies aimed at improving the quality of life. Within this last category are policies aimed at environmental protection and improvement.

The report recognises that the EU environmental policies have a compliance cost which is off set in social and economic terms by the benefits generated but that neither the costs nor the benefits may be evenly distributed across the European Union. The report refers to a 1994 study which demonstrated that the implementation of all environmental policies would give rise to significant environmental gains and any adverse effects on cohesion could be mitigated through a suitably designed combined package of fiscal measures and charges – resulting in an overall improvement in GDP, employment and the environment. This study noted that impacts on individual MS would depend on their particular circumstances.

The report concludes by noting that there are significant problems facing the Cohesion Countries in trying to pursue a development strategy aimed at raising GDP and productive potential, without unduly damaging the environment and that these problems need to be taken into account both in environmental policies and cohesion policies.

Reference is made to the UWWT Directive the fact that the Cohesion Countries face substantial requirements for investment. It is also noted that the impacts of policies depend on the prevailing structure of economic activity and the countries' competitiveness in producing goods and services that stand to benefit from the measures taken (i.e. the state of development of the eco-industries). However, the report does not explicitly examine the impact of any individual piece of environment-water policy and the mechanism through which they may impact on cohesion objectives.

The overall conclusions were threefold:

1. There is a generally lower level of environmental pressure in the Cohesion Countries both in *per capita* terms and in terms of economic activity,

2. The Cohesion Countries have high investment requirements for a wide range of environmental policy goals,

3. Environmental objectives can be met with gains in environmental quality, employment and income with an appropriate package of fiscal measures, charges and public expenditure.