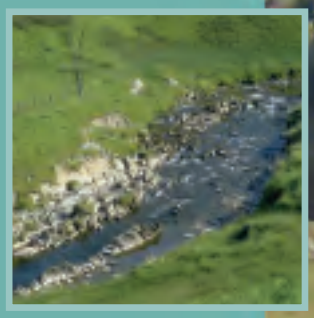
defra
Department for Environment Food and Rural Affairs

SEPA
Scottish Environment Protection Agency

Solway Tweed river basin characterisation

An economic analysis of water use



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Foreword

Water is a valuable resource. We all make use of it everyday in our homes or at work; many of us enjoy spending time alongside lochs, rivers and coasts. Solway Tweed is located largely in the Scottish borders region, and straddles the border between Scotland and England (although most of the river basin district (RBD) is located in Scotland). The economy of Solway Tweed depends on good quality water as a material input, to irrigate crops, to cool industrial processes and to dilute and carry wastes away. The enjoyment of good quality, clean, water is one of the reasons why so many tourists are attracted to spend their leisure time in the region.

Over the coming years, important decisions are going to be made about how we protect and improve the water resources we have. This will result from the implementation of the Water Framework Directive which was transposed into Scottish law by the Water Environment and Water Services (Scotland) Act of 2003. It established new and better ways of protecting, improving and using Europe's rivers, lochs, estuaries, coasts and groundwater.

In the pages that follow, we set out some important information about the ways in which water contributes to the economy that will help to inform those decisions. We have worked hard during the last two years to collect information that is informative and useful to stakeholders and decision makers. However, there is still much to be done in order to provide a comprehensive picture of the economic aspects of water use in Solway Tweed and further work is planned in the years ahead.

Throughout this document you will see references and electronic links to research reports and papers that have been produced in the course of carrying out this work. These provide more detail and technical information that you may find helpful. We will continue to collect and present information as it becomes available.

The work has been undertaken in consultation with Economics Stakeholder Groups in both Scotland and England who have provided SEPA and DEFRA with advice on the development of this report and the research projects upon which it is based. An important component of the report is the annex providing sector specific reports authored by these stakeholders.

SEPA is grateful for the input of stakeholders to the process. We intend to continue this participative approach throughout our work on the Directive as we monitor, assess, plan and take action to improve the water environment.

1 Purpose

This document is the summary report of the economic analysis of water use in the Solway Tweed river basin district, carried out under Article 5 of the Water Framework Directive.

The responsibility for overseeing general implementation of the Directive in the district falls jointly to the Secretary of State for Environment, Food and Rural Affairs and the Scottish Ministers. The primary responsibility for carrying out characterisation and pressures and impacts analysis lies with the Scottish Environment Protection Agency (SEPA) and the Environment Agency of England and Wales.

Responsibility for the economic analysis of water use rests with the Secretary of State and SEPA. This report includes a summary of the work done by DEFRA and SEPA in relation to the economic analysis of water. Work has been co-ordinated so as to ensure the requirements of the Directive have been met across the whole Solway Tweed River Basin District.

This work has been separately reported to the European Commission.

1.1 Introduction

The initial economic analysis of water use described in this report is the first step in integrating economic considerations into the planning process. It provides:

- a review of the quality and extent of existing data on the economic importance of the water environment in the Solway Tweed river basin district;
- an understanding of the relative contribution of different economic sectors to the pressures on the water environment and how these contributions may change over time;
- an initial analysis of the extent to which different pressures on the water environment may interact and hence the number of cases in which judgements about the most cost-effective combinations of measures may need to be made; and
- an assessment of the current extent of cost-recovery for the principal water services.

The results of this analysis provide the background needed to help identify, and prioritise the collection of the more detailed economic data that will be necessary in some cases to design the programmes of measures for the first river basin planning cycle. Specifically, the results show that:

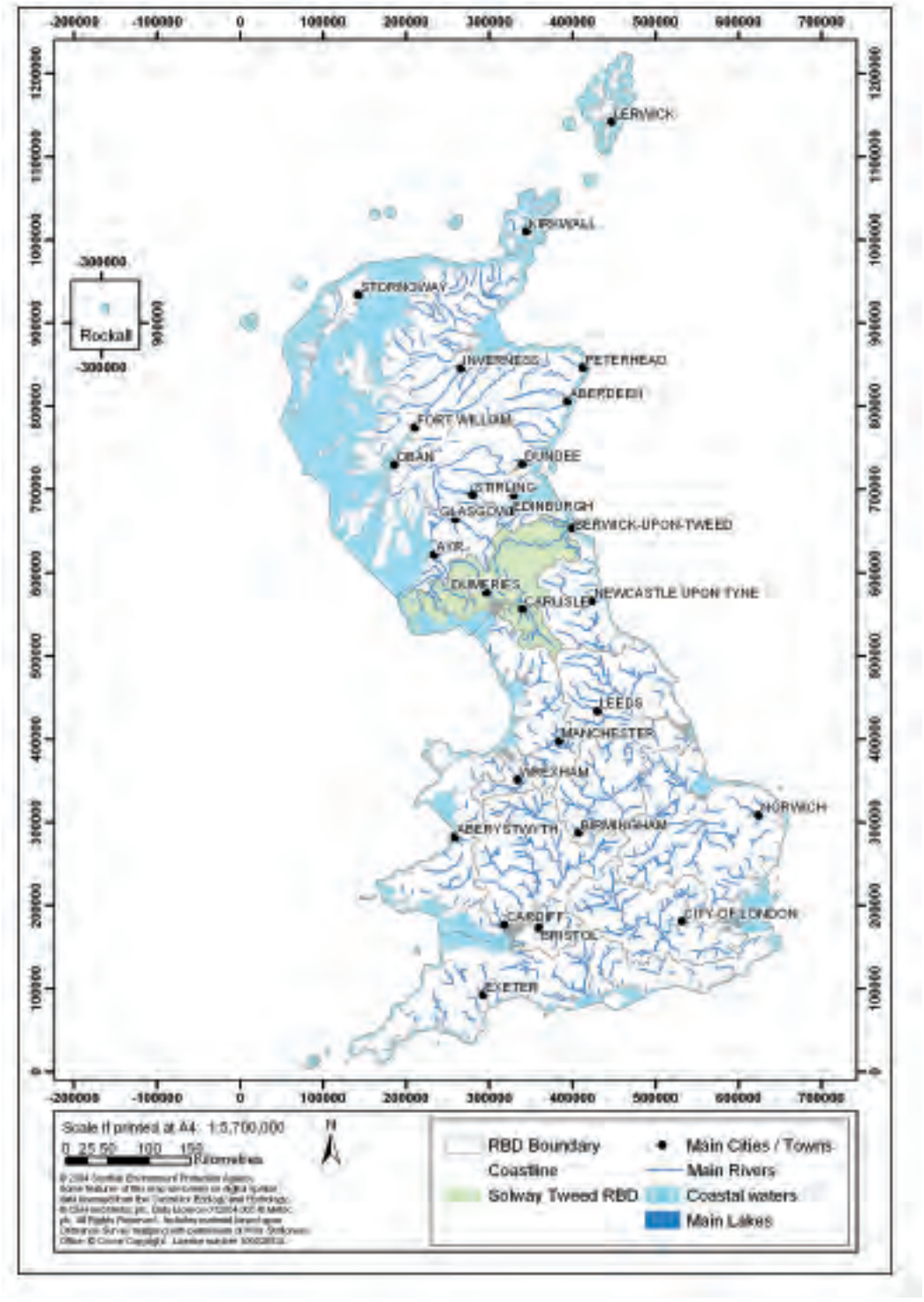
- the economic importance of the water environment to the Solway Tweed River Basin District is substantial. This will need to be properly taken into account in the setting of environmental objectives in the river basin planning process;
- the majority of significant pressures on the water environment are associated with only a small number of economic sectors: it will, therefore, be possible to prioritise further economic analysis to improve the information on these water uses and how they may be affected by environmental improvements; and
- there are likely to be relatively few cases where multiple pressures affect the same part of the water environment. This means that in most cases making judgements about the most cost-effective combination of measures for improving the water environment should not be complicated. SEPA and the Environment Agency will be able to use this information to help focus effort during the next stages of the planning process.

Further more detailed and specific economic information will be needed to inform the draft programme of measures for the first river basin planning cycle by December 2008 and ensure an adequate contribution to the costs of water services by 2010. The collection of this data for this work has already started but can only be completed once potential measures are identified and their implications understood. Economic analysis will therefore be an integral part of the process of developing the programmes of measures over the period 2005 to 2008.

1.2 The Solway Tweed river basin district

The Solway Tweed River Basin District crosses the border between Scotland and England. Responsibility for implementation of the Directive and for the characterisation process is shared by Scottish and English authorities, and therefore been necessary to modify the approach otherwise taken in both England and Scotland to ensure that the requirements of the Directive are applied in relation to the district as a whole in a coordinated way.

Map 1 shows the Solway Tweed river basin district



1.2.1 Characteristics

The Solway Tweed river basin district RBD covers an area from Stranraer on the west coast to Berwick upon Tweed on the east coast, to Peebles in the north, and Brough in the South. Around 450,000 people live in the district, most in the towns of Penrith, Carlisle and Dumfries.

Employment in the Solway Tweed RBD currently stands at almost 175,000 people, and is expected to decline slightly to approximately 162,000 by 2015. This is due to a predicted fall in population as well as demographic change, with more of the population retiring from the workforce than joining it. Output is expected to increase by a modest 1.3% per year.

The landscape is largely rural with an extensive coastline on the western side of the district. Solway Tweed covers much of the lowland region of Scotland and similar landscape in England, making it ideal for agriculture. However, the outbreak of foot and mouth disease, particularly in Cumbria, forced many farmers to diversify their activities, and tourism has increased in importance.

The most important water related environmental problem is diffuse pollution. This is related to the importance of agriculture in the region. Nevertheless, there are some other pressures on water bodies evident in the district.

The Solway Tweed river basin district has a reasonably high rainfall in relation to the rest of the UK, particularly in the west. The vast majority of water supplies come from surface waters, the remainder from groundwater.

The quality of the environment in the district attracts many tourists and supports particular industrial sectors. There are many excellent salmon rivers in the district and the generally clean water supports sectors such as fish farming and whisky manufacturers.

1.3 Summary of the roles of economics in the Water Framework Directive

Most environmental effects are the consequence of economic activity and in order to minimise these effects we need to understand more about the links between business (and household) activity and the water environment. The Directive has a flexible objective setting approach that recognises the important contribution that existing (and future) activity makes to the economic wellbeing of the people of Europe. A greater understanding of the potential economic choices and their consequences is an essential part of the implementation of the Directive.

If a body of water is found to be unlikely to achieve good status by 2015 it will be necessary to make decisions on the best actions to take to achieve the desired status. This report presents a picture of the extent of our current knowledge on the interactions between businesses (and households) and the water environment in the Solway Tweed. The evidence from this report will be built upon to enable us to rank potential measures in terms of their efficiency and to interpret how they would act in combination. This will inform the selection of the most cost-effective combination of measures that allows the development of businesses and also minimises any negative impact on the water environment. It is the intention to maintain an open, transparent and accessible approach and in this way to maximise the sustainable development of the Solway Tweed district.

The Directive does recognise that it may not be possible for all water bodies to achieve 'good status' by 2015 for a number of reasons. These include:

- remediation measures not being technically possible;
- suggested measures being too costly for the benefits achieved;
- measures not being able to deliver in time; and
- any combination of these.

In these cases the Directive provides the option of delaying the achievement of good status until 2021 or even 2027. If this is still not attainable it may be possible to set a lower objective. If a lower objective is being set we will present a clear case for doing so and this may include presentation of technical, economic and social arguments used to inform this decision.

Although good status is akin to a natural condition the Directive does make allowances for water bodies that have been heavily modified (by human activities) and those that are wholly artificial.

The evidence used in making judgements about the appropriate objectives for water bodies will include economic considerations and the information provided here and in the Solway Tweed RBD report will be taken into consideration alongside scientific and regulatory considerations, such as those presented in the environmental characterisation reports[1] . This evidence will be collected to provide the fullest information available in order to make the most effective and appropriate decisions.

[1] http://www.sepa.org.uk/wfd/characterisation.htm

1.3 Water usage

Water is used for a wide range of purposes in the Solway Tweed RBD. This is demonstrated in Section 3 which shows the scale of water use in Solway Tweed by key sectors and describes the value of their water use. This information is based upon a research and development (R&D) project and is linked to data from the parallel environmental pressures and impacts assessment process[2] undertaken and finalised by SEPA and others during 2004[3].

Information about the recovery of costs for water use in Solway Tweed is described in Section 4. This information allows a consideration of the level of cost recovery by private water companies in Solway Tweed. In setting environmental objectives we have to consider who will pay and how much it will cost. This will include a consideration and balance of which is more beneficial to both economy and environment; prevention or remediation.

In order to understand how water use will change over time we have commissioned research that suggests the most likely development of the economy and how this activity will impact on water use from the present to 2015. Information on the projected changes in water use can be found in Section 5 and on the SEPA website[4]. This information will be used to inform decision-makers about what economic activity is likely to create increasing pressures and how these pressures are expected to change over time. Importantly, further local knowledge will also be added to these predictions to inform local decision-making.

It will form a component to derive the most appropriate and cost-effective remediation necessary to achieve our objectives for Solway Tweed water environment. There will be many ways of ensuring that good status is achieved and economic information will provide the evidence to inform the decision-making process. By understanding the links between different measures and how efficient they are it will be possible to rank them and this will enable us to make informed choices.

[2] http://www.sepa.org.uk/wfd/easg.htm
[3] http://www.sepa.org.uk/wfd/characterisation.htm
[4] http://www.sepa.org.uk/wfd/easg.htm

2. Results of economic analysis

2.1 Background to the preparation of this report

The Solway Tweed RBD covers areas within both Scotland and England. As a result, administrations in both countries have undertaken detailed analysis and have collaborated to produce this report.

While similar approaches have been used, there are some differences in the work undertaken in Scotland and England. This largely reflects the different environmental and regulatory contexts in the two countries. This report presents as consistent a picture of the economics of water use in the Solway Tweed as is possible at present.

Underpinning these different assessments is a broad view of the similarities and differences of the economies north and south of the border. This provides a solid basis for understanding the implications of the different assessments that have been undertaken.

In October 2003 a UK wide steering group was set up to coordinate work on economic analysis for WFD. This group complemented Economic Advisory Stakeholder Groups already established in Scotland and in England.

In Scotland, detailed analysis of water use by industry has been a focus. As part of the economic analysis of water use, detailed work has been done on water use and economic importance for Scotland[5]. Three main pieces of research were commissioned to expand the understanding of the part that water and water services plays in the Scottish economy as follows[6]:

- the Economics of Water Use report;
- the Operation of the Scottish Water Market; and
- the Dynamics of Water Use.

This Economics of Water Use report identified which industries use water and the value that they derive from that use. The very different ways in which water is used and the quantities involved make direct comparisons of these values spurious however they do provide a clear indication of the importance of water for much of the Scottish economy.

The Operation of the Scottish Water Market report examined the legislative and administrative structure of water services provision in Scotland. It addresses the issue of cost recovery of water services and identifies gaps in current knowledge.

The Dynamics of Water Use report looked at the trends and drivers in water using sectors and suggested how they would be most likely to develop in the absence of the WFD. This provides a baseline that identifies how the pressures on Scotland's water are most likely to change.

Also, information gathered on pressures has been integrated with the economic analysis, and a picture of the likely complexity of the situation in Scotland regarding multiple pressures has been produced.

Some members of the Scottish Economic Advisory Stakeholder Group have also produced sector reports that can be found on the SEPA website.[7]

In England and Wales, three scoping studies were commissioned in 2003-04 to provide input to this report and further requirements under the WFD.[8] These reports are:

- Cost-Effectiveness Analysis and Developing a Methodology for Assessing Disproportionate Costs;
- Cost Recovery and Incentive Pricing; and
- Economic Importance and Dynamics of Water Use relevant to River Basin Characterisation (England and Wales).

[5] http://www.sepa.org.uk/wfd/characterisation.htm
[6] These reports can be accessed at http://www.sepa.org.uk/wfd/easg.htm
[7] http://www.sepa.org.uk/wfd/easg.htm
[8] These reports can be found at: www.defra.gov.uk/environment/water/wfd/economics/index.htm

The Economic Importance and Dynamics of Use report has provided information on the economic importance of water uses and their dynamics for this report. This report includes a comprehensive review of data sources relevant to the economic analysis of water use, profiles of the main sectors associated with pressures in water bodies and contextual information supplied by a number of interested stakeholder groups in the form of Stakeholder templates.

Economic forecasts for the most important activities related to water uses have been produced by Experian Business Strategies Limited, based on output and employment information from the Office of National Statistics (ONS). Full forecasts for the Solway Tweed river basin district are provided in Annex 2. Further information related relevant trends in the Agriculture sector has been provided in a study undertaken by the Environment Agency.

Information related to the Recovery of the Costs of Water Services has been taken from the report on Cost Recovery and Incentive Pricing[9] with updated information provided by Ofwat and the Environment Agency following the Final Determination of Water Prices for the period 2005 to 2010 for the water companies operating in the English part of the RBD.

Information relevant to the analysis of the cost-effectiveness of actions to be taken within the programmes of measures within river basin management plans has been taken from the report entitled Cost-Effectiveness Analysis and Developing a Methodology to Assess Disproportionate Costs[10]. This has been supplemented with a review of progress in implementing the collaborative research programme on RBMP Economics.

Overseeing these reports and the collaborative research programme in England and Wales has been the Economic Advisory Stakeholder Group (England and Wales). In Scotland, the Scottish Economic Advisory Stakeholder Group has also provided valuable assistance and direction. For the United Kingdom as a whole, the UK Economics Steering Group for the Water Framework Directive has overseen the work behind the production of this report and will take forward and guide the work of the Collaborative Research Programme.

Together the Economic Stakeholder Group (ESG) and the Scottish Advisory Stakeholder Group (EASG) and England and Wales group have guided the analysis in Scotland and England. This has been an important collaborative effort resulting in an integrated economic analysis for the Solway Tweed RBD. However, the work also reflects differences in approach, North and South of the border as reflected in the relatively greater focus on linking pressures in water bodies with economic activities in Scotland, while in England, there has been more emphasis on analysing the level of cost recovery.

[9] www.defra.gov.uk/environment/water/wfd/economics/index.htm
[10] www.defra.gov.uk/environment/water/wfd/economics/index.htm

2.2 Summary of economic context

On the whole the economy of the Solway Tweed RBD is very similar in size and output on either side of the border. Table 1 below shows the scale of the similarities using information derived from the Experian data [11]. The RBD has an economy with an output of some £4.4 billion divided almost equally between the Scottish and English parts of the district, with the Scottish part just ahead by less than £1,700, (an almost negligible percentage). The English part has just over 1,000 more employees, again less than 1% of the RBD workforce of over 175,000.

The combination of these two facts means that the average productivity (output per head) of workers in the Scottish part is a little higher but these differences can be seen as due to small differences in the industrial composition of the two economies, with slightly fewer high value add industries south of the border.

Table 1 Comparison between the English and Scottish parts of the Solway Tweed River Basin District

2002 current prices	English component	Scottish component	Solway Tweed total	% in the English component	% in the Scottish component	Absolute difference Eng – Scot and £2002
Total employees in employment (thou)	88.1	87.1	175.2	50.3%	49.7%	1,057 employees
total output (£2002m)	£2,180.8m	£2,180.8m	£4,361.5m	50.0%	50.0%	-£1,696
Output per employee £2002	£24,751	£25,051	£24,900	99.4%	100.6%	£-300.4
Average household size (persons)	2.28	2.27	2.28			

The Experian forecasts provide more detail and these structural differences are more apparent at greater levels of disaggregation. Although the Scottish part of the RBD has two-thirds of the employment in agriculture, the English part has two-thirds of the output. This is mainly due to increased cattle farming south of the border. More than three quarters of the pharmaceuticals and soap/detergent production is in the Scottish part but the English side dominates basic chemical manufacturing with four fifths of the activity in this sector. The Scottish Borders are internationally renowned for textile production and not surprisingly Scotland has more than 80% of activity in this area. There is a similar split in electricity generation but only one quarter of fish farming and of meat processing occurs north of the border.

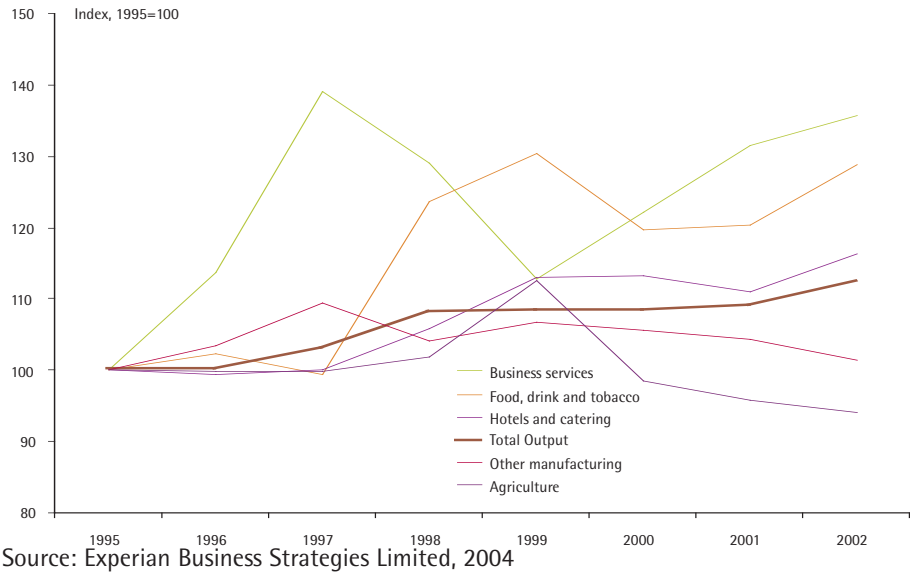
For the purposes of this report it is fair to assume that despite some differences, both sides of the border are broadly very similar indeed.

Figure 1 over shows the recent trends in output in Solway Tweed RBD as a whole, which measures the total output of goods and services in the economy. This information is presented as an index which is adjusted for inflation and allows direct comparisons. Although Solway Tweed's output has grown over the period the performance of different sectors varies considerably. The agricultural industry has generally declined in recent years, while the business services sector has grown in importance. The performance of manufacturing has been mixed, with food and drink increasing, while other manufacturing (for instance rubber and plastics) has declined. Hotels and catering, broadly reflective of the tourism industry, has shown steady growth (notwithstanding a dip in 2001).

Monetary values of GDP are difficult to produce accurately for UK regions and therefore, are often dated. Experian Business Services Limited, a private consultancy firm, has undertaken some forecasts of regional output, including estimating current levels of output in the Solway Tweed RBD [12]. In 2002, output for Solway Tweed (measured in gross value added terms) was estimated at £4.37 billion. Official estimates of sub regional GDP are not available.

Figure 1 Recent trends in Solway Tweed output

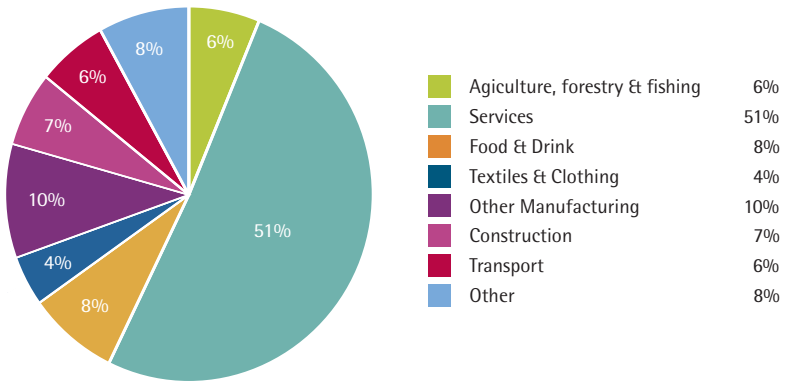
[11] The Experian forecasts are provided in Annex 2. These forecasts were not used in the Dynamics of Water Use research undertaken for Scotland where the forecasts used were from the Fraser Of Allander Institute refined by the Scottish Agricultural College. This means that throughout the report there may be minor differences in the numbers quoted depending what they are describing. This does not affect the validity of the conclusions drawn.
[12] Further information on these forecasts is found in Annex 2.



Source: Experian Business Strategies Limited, 2004

While an index enables clear comparisons of the performance of a sector it conceals the relative size of the contribution that the sector makes to the Solway Tweed economy. Figure 2 below shows a breakdown of the main sectors in value terms. It clearly illustrates the current dominance of the service sector, accounting for over one half of the Solway Tweed economy. However, it is the valuable contribution that the other areas produce that is of most interest to us here as their use of water makes a direct contribution to their output. Amenity and recreation uses are also valued however they do not have an industrial classification of their own. Section 2.4 discusses this and the significant contribution that tourism makes to the economy of the district. The following sections look at all of these water using industries in more detail.

Figure 2 Solway Tweed output by industry



Source: Experian Business Strategies Limited, 2004

2.3 Summary of current analysis of use

2.3.1 How water is used

This report examines four main water uses: abstraction, impoundment, discharge and engineering.

The main abstracting sectors are energy (using water for cooling) and water supply for domestic use and as part of a production process.

The same two sectors are also major impounders although for different purposes; energy is generated through hydropower and water is stored in reservoirs (other impoundments include flood defence and canals).

Over 90% of clean water used by households is discharged to mains sewers and many other water uses are non-consumptive with water being returned in an altered state and used to dilute pollution or to dissipate heat. Behind sewage and refuse disposal the next most significant sector for point source pollution is fish farming, along with manufacturing. Harbours, canals, flood defence, river straightening and alteration through towns etc. are all good examples of engineering activity.

2.3.2 How water use is valued

Due to the complexity of many industrial processes, placing a value on their usage of water is not straightforward. The most appropriate methods are discussed in the Water Use report[13] but, unfortunately, there is not sufficient data on the water use and non-water costs of businesses to be able to apply this model to Scotland (let alone to the Solway Tweed RBD). Therefore, it has been necessary to partly rely on estimates originally derived for Canadian industry and transfer the values to Scotland. No similar analysis has been undertaken in England but the value of this work will be considered in later phases of the economic analysis.

The results are given in **Table 2** and **Figure 3**. Inflation factors and exchange rates are applied to transfer the values to 2004 UK pounds.

Table 2 Industrial value of water use (p/m^3 *)

Manufacturing industry	1991 ($Can)	2004 values ($Can)	2004 values (£UK)
Food	0.017	0.30	0.125
Beverage	0.038	0.50	0.21
Rubber products	0.006	0.10	0.04
Plastic products	0.032	0.40	0.16
Textile products	0.005	0.10	0.04
Wood	0.020	0.30	0.125
Paper and allied products	0.031	0.40	0.16
Primary metal	0.107	0.13	0.055
Fabricated metal products	0.048	0.60	0.25
Transport equipment	0.025	0.30	0.125
Non-metallic mineral products	0.023	0.30	0.125
Refined petroleum and coal products	0.288	0.36	0.15
Chemical and chemical products	0.072	0.90	0.375

* p/m^3 = pence per cubic metre
Notes: inflation calculator: http://www.bankofcanada.ca/en/inflation_calc.htm
Prevailing £ -$Can exchange rate: http://www.x-rates.com/calculator.html

[13] The SNIFFER Economics of Water Use Report can be accessed at http://www.sepa.org.uk/wfd/easg.htm

The information available and the needs of the research meant that the focus was on particular methods and users. Table 3 summarises the values calculated. However, it should be noted that the values were calculated using different methods and based on different assumptions, and therefore the results for sectors are not directly comparable.

Table 3 Summary of the valuation techniques and results for sectors considered

Sector	Valuation technique	Key assumptions	Value
Households	Gibbons' willingness to pay formula	Assumes all consumers pay volumetric charges levied to metered customers in England, Wales and Scotland	0.102 - 0.244
		Includes value of both clean and dirty water	p/m^3
	Benefits transfer from stated preference study	Only considers value of supply of clean water	0.067 p/m^3
Agricultural irrigation	Net-back analysis	Assumes that the West Pfeffer catchment is representative of other areas where potatoes are irrigated	£5128/ha
		Value includes both naturally available water and water applied through irrigation	
	Transfer of net-back analysis	Data from England and Scotland combined despite different agricultural support arrangements and climate	23-138 p/m^3
Aquaculture	Net-back analysis	Uses average value for farmed trout	0.67 p/m^3
	Avoided cost	Considers value of water for waste disposal but not as medium for growth	1.86-13.89 p/m^3
Salmon angling	Benefits transfer of travel cost method study	Assumes salmon anglers in Donegal are representative of others throughout Scotland and Northern Ireland	£175/day
Industry	Benefits transfer from marginal productivity approach study	Industrial water use in Scotland and Northern Ireland assumed to be the same as for Canada	4-37.5 p/m^3
		Assumes no improvements in water efficiency since 1991	
Power generation	Avoided cost	Assumes generation from hydropower is comparable to generation from nuclear fuels, as this study does not consider environmental effects	0.03 p/m^3

* p/m^3 = pence per cubic metre
/ha = per hectare

Results are based on the information available and the techniques developed at the time. However, there are a number of areas in which understanding can and should be improved. In particular, the understanding of the volume of water supplied to and discharged from different sectors could be improved. In turn, this could help to identify issues of water use at a more precise geographic level in order to facilitate assessment of the Solway Tweed river basin district.

2.4 Economic sectors and their water use

This section provides an overview of the ways in which different sectors currently make use of water in Solway Tweed. In addition to this overview, some water users have provided their own sectoral analysis, and these are available on the SEPA website[14]. To date analysis has been received from the following groups:

Sector	Author
Agriculture:	NFU Scotland
Aquaculture:	The Federation of Scottish Aquaculture Producers
Coal:	Scottish Coal
Whisky:	Malt Distillers Association of Scotland
Tanning of Leather:	Scottish Tanning Industries (not relevant to the Solway Tweed RBD)
Paper and Pulp:	Confederation of Paper Industries
Hydro Power:	British Hydropower Association
Canals:	British Waterways Scotland (not relevant to the Solway Tweed RBD)

Water users were also invited to comment on water use for England, and the following groups made contributions[15]:

- Electricity Industry Joint Environment Programme (Powergen, RWE, Innogy, AEP, Drax Power Ltd, British Energy, EDF Energy, International Power, Scottish Power);
- British Ports Association and United Kingdom Major Ports Group;
- WaterVoice;
- British Hydropower Association;
- Royal Society for the Protection of Birds (RSPB); and
- British Waterways.

Further information on the economic importance of water uses and their dynamics has been taken from the report on the Economic Importance and Dynamics of Use in England and Wales.

This report includes a comprehensive review of data sources (available in England and Wales) relevant to the economic analysis of water use, profiles of the main sectors associated with pressures in water bodies and contextual information supplied by a number of interested stakeholder groups in the form of Stakeholder templates.

Sector profiles have been provided for:

- Power generation
- Petrochemicals
- Other Chemicals
- Metal Manufacturing
- Paper Industry
- Other Manufacturing
- Extractive Industries
- Quarries and Aggregates
- Transport
- Public Water Supplies
- Private Water Supplies
- Waste Water Treatment
- Recreation

[14] These reports can be viewed at: www.sepa.org.uk/wfd/EASG.htm
[15] These reports can be found in the Economic Importance and Characterisation of Water Use (England and Wales) report at: www.defra.gov.uk/enviornment/water/wfd/economics/index.htm

Official economic statistics are collected according to the Standard Industrial Classification (SIC) code of a business. This SIC code allocates a business to its predominant business activity. For current purposes this may not be the activity that is responsible for the environmental impact or pressure that we are concerned with. For this reason the SIC codes referred to in this report are used to describe the responsible activity and not necessarily the allocated code of the responsible business. However, in the vast majority of cases these will be the same.

The following sectoral analysis discusses the contribution that the main water using sectors make to the Solway Tweed economy and describes their water use. More detail is provided in the published reports and in the sector studies, all of which are available through the SEPA[16] and Defra[17] websites. The availability of a separate sector report written in the words of the author (company or sector body) is indicated in footnotes in the following sections.

In some cases it has not been possible to provide detailed information on the Solway Tweed economy, and in these instances, information for the wider region is provided to give an indicative picture of economic activity and land use in the RBD.

2.4.1 Agriculture and forestry[18]

There is a significant agricultural sector in the Solway Tweed river basin district, employing 7,600 workers. Agriculture and forestry account for almost 12% of gross value added to the Solway Tweed economy. Water is essential to the agricultural sector for irrigation, drinking water for livestock, cleaning etc.

Most irrigation needs are met by precipitation, however, when nature requires a helping hand the need is essential and the benefit substantial. Water also carries excess chemicals away from the land and transports them to other water bodies. Agriculture and forestry contribute significantly to diffuse pollution pressures in Solway Tweed.

2.4.2 Aquaculture[19]

Coastal waters, lochs (lakes) and rivers are used for a large amount of commercial fish and shellfish farming and depend on unpolluted water. In the Solway Tweed, fish farming was worth about £22.5 million in 2002 (in 2000 prices), and employment was estimated at approximately 400 people. Most of the employment and consequently value added occurs in the English part of the RBD. Many fish farms are part of large corporations but in contrast most shellfish producers are small enterprises.

[16] http://www.sepa.org.uk/wfd/easg.htm
[17] http://www.defra.gov.uk/environment/water/wfd/economics/index.htm
[18] Sector study by stakeholder available at : http://www.sepa.org.uk/wfd/easg.htm
[19] Sector study by stakeholder available at : http://www.sepa.org.uk/wfd/easg.htm

2.4.3 Mining and quarrying

Mining and quarrying is a relatively small concern, accounting for 0.6% of employment and 0.8% of the gross value added to the Solway Tweed economy, with the majority of this value attributable to quarrying. Water use in the mining sector consists of diverting groundwater and drainage with subsequent consented discharges from settlement tanks.

Mining is expected to decline in future years.

2.4.4 Oil and gas

There is no oil and gas activity in the Solway Tweed.

2.4.5 Food processing

Food processing in Solway Tweed is a diverse industry, although the main economic contribution from the sector is in meat and fish production. There is a notable lack of information on the nature, distribution and characteristics of the sector, and it has been recommended that the Scottish Executive establish a working group in this area in the light of Pollution Prevention and Control regulations.

The volume of water abstracted by organisations in the food processing sector was estimated as part of the study of abstraction in Scotland[20]. The study estimated the total mean use of water as 8,000m^3 for fish processing, 49,000m^3 for vegetable processing, 63,000m^3 for meat processing and 117,000m^3 for dairy processing. Of these, direct abstraction was most common for vegetable processors, with a mean of 45,000m^3, with limited abstraction in the other sectors.

2.4.6 Production of alcoholic beverages

Scotland is noted for its production of Scotch whisky[21], and the sector is important both economically and culturally.

While whisky production in the Solway Tweed is declining it is still produced in reasonable volumes.

The technical definition of water use for the whisky sector would include all water diverted for the purpose, however the sector's own definition would be merely the water abstracted from that diversion.

As the pure alcohol produced by the distillery is diluted with water to produce the final product, account must be taken of this water use as well. The SNIFFER report referred to earlier has the details of how this was estimated; however based on an estimated 856 million litres of whisky sold, the direct water component equated to 513,000 million litres.

2.4.7 Production of mineral waters and soft drinks

Mineral Water

The most significant bottled water production in the Solway Tweed takes place around Armathwaite in Cumbria where six different labels extract water. Bottled water is also produced in Dumfries.

The contribution of Solway Tweed to the UK bottled water market is uncertain. However, based on Scotland satisfying 35% of UK consumption, Scottish companies produced approximately 630 billion litres (630 million m^3) in 2002. This would be consistent with the estimated sector abstraction of 687 million m^3, as this larger figure would include process water and excess water discharged immediately.

[20] CJC Consulting, Evaluating the economic impact of abstraction controls on high and medium volume water users in Scotland. 2002.
[21] Sector study by stakeholder available at : http://www.sepa.org.uk/wfd/easg.htm

2.4.8 Manufacture of textiles and leather products[22]

Textiles and leather is a relatively important economic sector in Solway Tweed, accounting for 4.4% of gross value added. The vast majority of this output occurs in the Scottish area of the district. The industry is also important in terms of water use issues.

No longer active in this RBD the tannery sector is an intensive water user; with approximately 20m^3 of water required to process 1 tonne of raw hide into 300kg of saleable leather.

2.4.9 Manufacture of wood, pulp and paper products[23]

Wood, wood products, paper and pulp employ around 3,400 people and accounts for 2.4% of gross value added in Solway Tweed. Although the manufacture of paper is part of a chain from forestry through to manufacture, the industry is focused around the manufacture of paper, and most mills import treated woodpulp for raw material. One of the main areas of paper production in the Solway Tweed river basin district is Cumbria.

2.4.10 Chemicals

The chemicals sector is not a particularly significant water user in the Solway Tweed river basin district, in terms of volume used and the content of discharge. Processors may use large volumes of water for processing, generating steam for heating, cooling, and cleaning equipment and chemicals. Water may also be used to dilute effluent. Although there is reliance on mains water, sea water is often used for cooling and there is some abstraction in the sector in Scotland with grey water also used for cooling in some facilities. (In general, the chemicals sector across the whole of Scotland is a more significant water user.)

Water treatment may be necessary as a result of many of the processes involved in the manufacture of chemicals, from overflows of the storage tanks used for supplying the raw materials, through synthesis and product separation, to leakage from pipes during product storage. The types of pollutants from chemical production that may affect water bodies vary according to the type of chemical produced and are discussed in the background research[24].

2.4.11 Rubber and plastics

This is a relatively important manufacturing sector in Solway Tweed and comprises 2.6% of total output with broadly similar levels of activity north and south of the border. Similar to the manufacture of chemicals, some processes can be water intensive.

2.4.12 Other manufacturing

There are a number of other sectors within manufacturing operating in Solway Tweed, contributing 4.5% of the gross value added to the Solway Tweed economy. Within this, the contribution of the manufacture of metals and minerals are by far the most significant, accounting for almost half of the total contribution.

[22] Sector study by stakeholder available at : http://www.sepa.org.uk/wfd/easg.htm
[23] Sector study by stakeholder available at : http://www.sepa.org.uk/wfd/easg.htm
[24] http://www.sepa.org.uk/wfd/easg.htm.

2.4.13 Electricity non–hydro[25]

These facilities are all located on the coast and are dependent on marine water to use in through flow systems for cooling. In addition to water for cooling, fresh water is used to create steam to drive the turbines and for site use. Although net abstraction is insignificant, the significant change to the water is through the increased temperature of discharge. British Energy and BNFL report any changes in radioactive content of the water close to nuclear facilities. There is one nuclear power station in Solway Tweed – Chapelcross, in Dumfries and Galloway, which is now being decommissioned.

Future water uses in this sector may include wave and tidal power installations.

2.4.14 Electricity Hydro[26]

Hydropower schemes can be constructed on-line or off-line, depending on whether water is to be diverted from its original course. On-line schemes were popular some decades ago, but are no longer favoured, due to the impacts on migratory species and problems of siltation behind the structure. Off-line schemes divert the water and then return it back to the watercourse and this may have different problems, particularly due to the distance between abstraction and discharge. This may lead to low flows in a portion of the river. Hydropower schemes can also use dams to create a high reservoir and increase the distance over which the water falls. The reservoir also stores water so that the flow can be regulated over periods of different rainfall and different electricity demand. Some schemes also use pumps from a low reservoir to return the water to the high reservoir, from where it can be reused during periods of high demand. The power generated from hydroelectric schemes depends on the flow of water and the height over which the water is pressurised. Currently an estimated 3.355 billion m^3 of water are stored in reservoirs serving hydro schemes in Scotland as a whole.

While most hydro schemes were created in northern Scotland, there were also some constructed in Solway Tweed (for instance, the 83mw Galloway scheme was completed in 1936).

2.5 Amenity and recreation

There are a wide range of recreational and amenity uses of water resources. In order to consider a number of different areas, this category has been broken down into tourism and water-dependent visitor attractions, water-dependent recreation, non-water-dependent recreation, waterside amenity and navigation.

2.5.1 Tourism and water-dependent visitor attractions

Tourism is an important and growing source of employment and income in the RBD; expected to support (by 2015) over 10% of employees and generate under 6% of income. The natural beauty of the region is an important factor for tourists. In a survey of French, Spanish and German visitors, 47% of those surveyed stated that landscape, countryside and scenery were the main influence on their choice to holiday in Scotland, with 10% specifically mentioning lochs and rivers (Visit Scotland and SNH, 2002).

[25] Sector study by stakeholder available at : http://www.defra.gov.uk/environment/water/wfd/economics/index.htm
[26] Sector studies by stakeholders available at: http://www.sepa.org.uk/wfd/easg.htm and http://www.defra.gov.uk/environment/water/wfd/economics/index.htm .

2.5.2 Water-dependent recreation

There is a wide range of recreational activities that rely on water. This includes activities on water bodies, such as jet-skiing, kayaking, rafting, windsurfing and yachting, as well as activities that abstract and discharge water, in particular swimming pools. Although those taking part in many of these activities are not charged for water use, they can have an impact on the economy through spending. Angling is also a form of water-dependent recreation, although this was considered as part of the discussion of fishing, and therefore is not included again at this point.

Activities that use outdoor water bodies, either inland or coastal waters, are affected by a number of features of the water body. In particular, bathing and paddling are influenced by water quality. The blue flag standard is a symbol of environmental quality as well as sanitary and safety facilities at beaches and marinas in Europe and South Africa. Thus the award increasingly reveals more than just the quality of the bathing water, although it is imperative that water quality is compliant with the requirements of the EU Bathing Water Directive (76/160/EEC) concerning total contaminants. Of the 105 blue flag beaches and 12 marinas in the UK, three are in Solway Tweed (Kirkcudbright, Maryport and Whitehaven).

2.5.3 Angling

Within Scotland, there are 36,650km of river designated under the Freshwater Fish Directive, the vast majority (36,580km) of which is designated as salmonid fisheries. Of the salmonid designated rivers, 770km failed to meet water quality requirements in 2002, with no failures of cyprinid designated rivers. Angling contributed over £112 million to the Scottish economy in 2003, and is important in Solway Tweed. Recent estimates value this activity as contributing around £8 million annually to the Scottish Borders[27].

2.5.4 Navigation[28]

The only sizable port in Solway Tweed is Silloth. In 2002, this port accounted for just 0.03% of all cargo traffic in the United Kingdom. For the year, 121,000 tonnes of cargo was received through the port, while 12,000 tonnes left through the port. There were no ferry passengers through the port.

2.5.5 Non-water-dependent recreation and waterside amenity

Waterside amenity includes those individuals who chose to walk or spend time near to rivers, lochs or the coast because of the aquatic scenery. It also includes the higher value of property associated with a waterside location.

2.5.6 Ecosystem services

Life on earth depends on the ability of the environment to provide essential services, recycling wastes and nutrients, providing fresh water, clean air and so on. During 2002 estimates were made to quantify in monetary terms the benefits that the environment within Scotland provides. This work[29] generated an estimate of the annual value of approximately £17 billion, of which more than £3 billion was directly attributable to lakes, rivers and estuaries. In many cases the value of these benefits is utilised by industrial sectors and becomes embodied in their final products. In others the benefits are enjoyed by the population at large or by recreational users of the environment.

[27] Radford et.al. 2004, The Economic Impact of Game and Coarse Angling in Scotland. Scottish Executive
[28] Sector study by stakeholder available at: http://www.defra.gov.uk/environment/water/wfd/economics/index.htm
[29] Williams et al 2003 The Value of Scotland's Ecosystem Services and Natural Capital, European Environment, Vol 13, 67-78

3. Economics of water use and pressures on water bodies

Analysis of Impacts and Pressures has been undertaken separately in England and Scotland, (although both follow a common UK TAG approach) and hence different information on pressures and impacts is available for the Solway Tweed in relation to the Scottish and the English areas. Similarly, the background research for the economic analysis of water use has proceeded separately (albeit with coordination by the UK Economics Steering Group). As a result, different information is available in relation to the economic characteristics of water uses associated with the pressures. The following integrated analysis attempts to bring together the information available from the pressures and impacts analysis together with the economic analysis of water use to provide as clear a picture as possible. Gaps in the analysis are identified where relevant.

The sections first show the analysis of pressures by economic sector for the RBD. This is based on data for the Scottish area of the RBD but as noted above in most respects pressures in the Scottish part will be similar to those in the English part. Where significant differences are likely, given the economic analysis conducted in the English part of the RBD, these are noted.

The analysis focuses on the economic sectors identified as sources of potential pressure or risk of downgrading identified in the environmental characterisation work that has been undertaken in parallel with this economic analysis. This analysis considered all pressures collectively and does not separate them into rivers, lochs (lakes), transitional, coastal and groundwater as is the case in the separate environmental characterisation work. Instead this report is structured around the main pressure types of point source, diffuse, abstraction and impoundment and alteration to physical habitat. Each pressure is not scaled and it is important to remember that they will vary in magnitude considerably.

Then information related to the pressures for the English part of the RBD is presented. Where this analysis suggests a different conclusion than for the Scottish part, this is noted.

Finally, tables are presented showing the economic characteristics of the main activities causing pressures. Three measures are used. The first is taken from the English analysis of the whole of the Solway Tweed RBD and is reported in terms of Output (measured as Value Added). This facilitates a comparison with the other English RBD economic analysis results. The other measures are based on the value of water use (p/m^3*) and the volume of water use. These figures are based on the Scottish analysis of water use, facilitating a comparison with the Scotland RBD report.

Before presenting the results it is important to be clear about what is implied by an 'economic value of water use'. This analysis provides estimates for the contribution water makes to an industrial process. In undertaking this work with stakeholders it has become clear that there are differences in views about the range of values that should be considered in this analysis. For a full technical exposition of the methodologies and techniques used to establish the values presented please refer to the commissioned research[30].

The general approach taken is to recognise that water is one of a number of inputs into a process each of which make a contribution to the final value of the output of the process. In some cases water will become embodied in the product (such as soft drinks) in other cases water will be transformed, warmed, delayed, re-routed, or its assimilative capacity for wastes used. Indeed many processes make more than one use of water simultaneously. In some catchments the same volume of water may be used several times by the same or different kinds of users. There are some catchments, for example, with several hydropower generation facilities that make use of the potential energy of the water at several different points. There may be other examples where the same water is used for the public water supply, is returned to the water body and then used by one or more industrial process. A similar set of considerations can be appreciated when attempting to value recreational uses of water. So far the analysis has attempted to convert the value of water use to a value per litre (the tables are in m^3). In some cases this simply does not adequately illustrate the value of use in particular locations and for particular process. In these cases local knowledge and experience should be brought to bear. Over the coming years other means of illustrating the value of water use will be explored. For the time being we are fortunate in having a number of sector specific case studies and reports provided by sector representatives for both Scotland and England[31].

Table 4 shows how the economic activity of different sectors is associated with the risk of a water body failing to meet good status. Much of the risk is concentrated in certain sectors as can be seen from this table where the three sectors with the greatest number of impacts (highlighted in red) account for almost three quarters of all impacts. Of these three, the agriculture, forestry and fishing sector alone accounts for three out of ten risks (mostly associated with diffuse pollution and morphological changes to water bodies). This is followed closely by Energy and Water Supply with almost a quarter of all risks of failure, which are associated with abstraction and flow regulation. Around one in six risks are associated with sewage and refuse disposal and the vast majority of these are related to point source discharges.

* p/m^3 = pence per cubic metre

[30] http://www.sepa.org.uk/wfd/easg.htm
[31] http://www.sepa.org.uk/wfd/easg.htm and http://www.defra.gov.uk/environment/water/wfd/economics/index.htm

There are some risks for which it has not been possible to attribute to a particular sector. These have been allocated to a 'not identified' sector. The sector 'other' refers to identified pressures that are from the rest of the economy; these would include things such as flood defence walls, urban development and land claim.

Each type of pressure is dominated by particular sectors (highlighted in aqua). **Table 4** shows that most impacts from abstraction emanate from the energy and water supply sector, while most diffuse pollution risk comes from agriculture. Most flow regulation risk is associated with electricity generation and agriculture is the main source of physical alterations in the form of drainage and land reclaim. The largest cause of point source discharge is waste water treatment. The concentration of certain sectors within certain pressures suggests that the remediation of the pressure within those sectors will be an important early focus for identifying cost effective measures in affected water bodies.

Table 4 Number of pressures per sector by source for all water bodies at risk

Main Industrial Groups	Number of Pressures							
	Abstraction	Alien Species	Diffuse Source Pollution	Flow Regulation	Morphological Alterations	Point Source Pollution	Not Identified	Total
Agriculture, Forestry and Fishing	18	4	148	2	130	8	0	310
Construction	0	0	0	0	0	0	0	0
Energy and Water	47	0	43	48	17	4	0	159
Manufacturing	5	0	2	0	2	8	0	17
Mining and Quarrying	3	0	1	0	0	5	0	9
No identified	0	0	3	11	34	0	3	51
Other	3	3	10	1	1	0	0	18
Sewage and Refuse Disposal	0	0	17	0	0	96	0	113
Transport & Communications	0	0	2	0	6	0	0	8
Total	76	7	226	62	190	121	3	685

Note: This table covers the Scottish part of Solway Tweed only.

A further use of this analysis will be in helping to frame the tools we develop to assess the most cost effective combination of measures in water bodies. The more pressures of different types from different sectors faced in any particular water body the more complex the decision-making process is likely to become.

Table 5 considers the number of pressures on a water body and shows how many water bodies are affected by multiple pressures. The more pressures per water body the more potentially complex the likely solutions. If there are fewer pressures there will be a smaller number of possible measures that would combine to achieve the required status and the selection of the most cost effective combination is likely to be more straightforward.

Fortunately, the situation in Solway Tweed is that more than 70 percent of all water bodies face only three or fewer pressures. Indeed only two water bodies have more than 10 pressures.

Table 5 Total number of pressures per water body for all water bodies at risk (Scottish Rural Areas only)

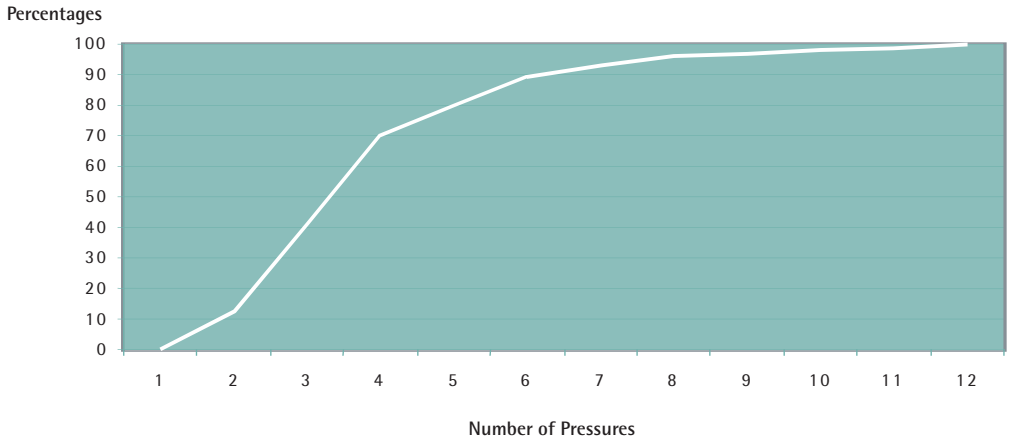
Number of Pressures	Number of water bodies	% of all water bodies with pressures	Cumulative % of water bodies with pressures	Cumulative number of water bodies with pressures
1	27	12.7	12.7	27
2	60	28.3	41.0	87
3	62	29.2	70.3	149
4	20	9.4	79.7	169
5	21	9.9	89.6	190
6 to 10	20	9.4	99.1	210
over 10	2	0.9	100.0	212
Total	212	100.0	100.0	212

Note: There are 212 identified water bodies in the Solway Tweed RBD and all of those are at risk or likely to be at risk in 2015

This distribution of pressures is also shown in Figure 4. This indicates that there are relatively few waterbodies which are subject to 'multiple pressures' (more than four or five). This increases the likelihood of a more straightforward solution.

There are a number of water bodies with multiple pressures emanating from the same sector. This implies that the means by which the pressure might be alleviated could come from the sector itself. Where, for example, a standard set of measures could be applied to reduce the number or complexity of the measures under consideration thereby making the assessment process more manageable. Also, as upstream pressures are mitigated this (to a certain extent) will lessen the seriousness of downstream impacts.

Figure 4 Cumulative percentage of water bodies with at risk pressures in the Scottish segment of the RBD



There is no similar analysis at present of the pressures in the English area of the RBD, however this work is planned to be undertaken in 2005 through the refinement of the river basin characterisation exercise.

The following sections analyse the economic use of water made by each of the sectors reported as being the sources of pressures and impacts on water bodies. The commissioned research further builds on this and can be accessed on the SEPA and DEFRA websites.[32]

[32] http://www.sepa.org.uk/wfd/easg.htm and http://www.defra.gov.uk/environment/water/wfd/economics/index.htm

3.1 Point source discharges

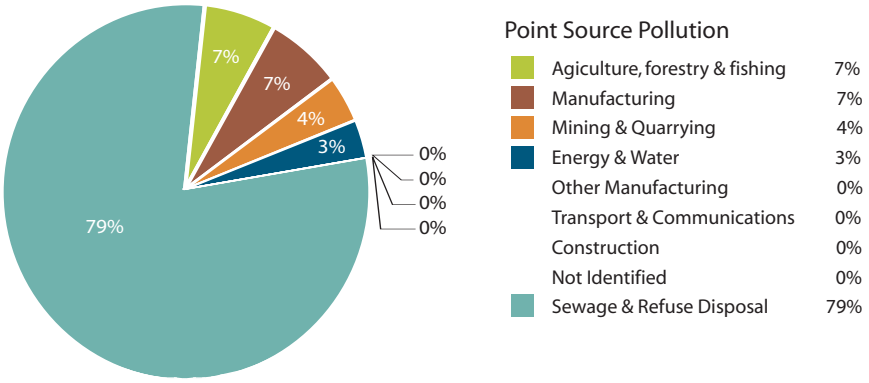
Point source pollution, such as effluent from urban wastewater treatment plants, waste management sites, industrial discharges and fish farm operations, has been controlled in Solway Tweed for many years and as a result we have a good understanding of the effects of such discharges.

Table 6 Point source pressures by sector for all water bodies at risk in the Solway Tweed RBD

Main Industrial Groups	Point Source Pollution
Sewage and Refuse Disposal	96
Agriculture, Forestry and Fishing	8
Manufacturing	8
Mining and Quarrying	5
Energy and Water	4
Construction	0
No identified	0
Other	0
Transport & Communications	0
Total	121

Note: Table 6 is based on analysis of the Scottish part of Solway Tweed only.

Figure 5 Point source pressures by sector for all water bodies at risk in the Solway Tweed RBD



Note: Figure 5 is based on analysis of the Scottish part of Solway Tweed only.

Figure 5 shows the industrial sectors that are the source of point source discharge pressures. Two thirds of all point source pollution is associated with waste water treatment (sewage) and waste management sites (domestic and commercial refuse disposal). The situation can be exacerbated under flood conditions when storm drains can cause sewers to overflow and discharge untreated sewage directly to water bodies. The category 'other' would include identified sectors that are not classified elsewhere, while the 'not identified' classification covers pressures where it has not been possible to identify the source or where the data is incomplete.

Although point source discharge creates 121 individual pressures the effects are felt in only 65 different water bodies (across the whole of the Solway Tweed river basin district).

Table 7 shows the number of consented discharges for the English part of the Solway Tweed river basin district. Most discharges relate to sewerage, although there are some industrial related discharges and some related to fish aquaculture, giving a broadly similar picture to the Scottish area.

Table 7 Number of Consented Discharges for the Solway Tweed RBD (English part)

Discharge	Number of Consents
Sewage – treated effluent	93
Sewage treatment works	55
Trade – treated effluent	7
Sewage – storm effluent	5
Trade – fish aquaculture	3

Source: Environment Agency, 2004

The following table illustrates (where data are available) three measures for each of these sectors. Output (in value added terms for 2002) has been estimated by Experian Business StrategiesLimited, and is specific to Solway Tweed (further information can be found in Annex 2). Estimates for the value and volume of water use cover the whole of Scotland and therefore there is only a very indirect link between the economic data and the water use information.

Table 8 Contribution to the Solway Tweed economy and value/volume of water use in sectors connected with point source risk

Point Source Sector	GVA 2001[33]	Sub sector	Value of use[34] p/m³	Volume of use million m³/year[35]
Agriculture, Forestry and Fishing	£98.6m	Agriculture	23-138	56.5
	£34.6m (fishing)	Aquaculture	0.13	1,582
Manufacturing	£25.4m	Chemicals	37.5	315.9
	£360.1m	Food & Drink	12.5-21	260.2
	£5.6m	Paper & Pulp	16	87.7
Electricity, Gas and Water Supply	Production and distribution of electricity £71.8m	Electricity		
	Sewerage and refuse £34.9m	Sewage Disposal	0.00-0.82[36]	Electricity generation cooling 3,783 Scottish Water 266
	£4,372.5m	Solway Tweed	n/a	n/a

* p/m³ = Pence per cubic metre

[33] http://www.statistics.gov.uk/downloads/theme_economy/Final_SIC_for_GVA_by_region_1989-2001.xls
[34] Irrigation benefits only http://www.sepa.org.uk/wfd/easg.htm
[35] http://www.sepa.org.uk/wfd/easg.htm 2004 estimate (from Dynamics of Use Report)
[36] Scottish and Southern Energy from personal correspondence consider this a significant underestimate with their internal calculations giving values up to 5.2p

3.2 Diffuse source discharges

Diffuse pollution is often difficult to attribute and many pressures remain unidentified.

Table 9 Diffuse pollution causing risk of failure in the Solway Tweed RBD

Main Industrial Groups	Diffuse Source Pollution
Agriculture, Forestry and Fishing	148
Energy and Water	43
Sewage and Refuse Disposal	17
Other	10
No identified	3
Manufacturing	2
Transport and Communications	2
Mining and Quarrying	1
Construction	0
Total	226

Note: Based on the analysis of the Scottish area of Solway Tweed.

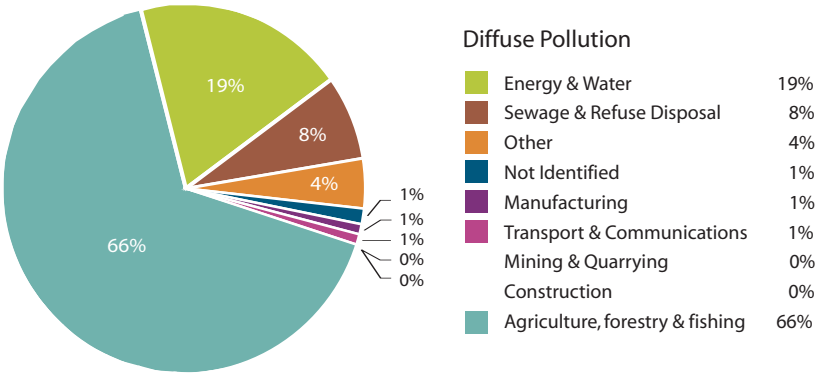


Figure 6 Percentage of failure risk caused by diffuse Pollution in the Solway Tweed RBD

Note: Based on the analysis of the Scottish area of Solway Tweed

Figure 6 and table 9 above show the breakdown for all water bodies at risk from diffuse sources of pollution in the Solway Tweed RBD.

The agriculture, forestry and fishing sector is by far the largest contributor to diffuse pollution in the Solway Tweed RBD. Agricultural diffuse pollution is caused by run off and seepage of fertilisers, weed killers and slurry. It is often problematic to identify the source of such pollution directly. With forestry, the main source of diffuse pollution is through acidification, caused by run off of rain water that has taken up acids from the needles and leaves of trees.

The sewage sector can be responsible for contamination of water from leaks and seepage while, roads can also be a source of diffuse pollution as cumulative leakage from vehicles is washed into surface water and drains and subsequently discharged. Diffuse pollution from the construction industry on the other hand is almost entirely due to spillage.

Table 10 below provides further information on some of the main sectors, illustrating (where data is available) the contribution that the sector makes to the overall Solway Tweed economy, the value it places on water use (Scotland wide) and the volume of water that is used (Scotland wide).

This table provides a good example of the differences in use of water. For example, agriculture will use a (relatively) small quantity of water (for irrigation) at a vital time of year to add considerable value to a crop, however electricity generators will use vast amounts of water all year round with each m^3 having a much lower value.

Table 10 Contribution to the Solway Tweed economy and value/volume of water use in sectors connected with diffuse pollution

Diffuse Sector	GVA 2001[37]	Sub sector	Value of use[38] p/m^3 *	Volume of use[39] million m^3/year
Agriculture, Forestry & Fishing	£98.6m	Agriculture	23-138 irrigation benefits only	56.5
Energy and Water Supply	Production and distance of electricity £71.8m	Electricity generation	0.00-0.82[40] Generation	3,783 cooling
Sewage and refuse disposal	Not available	Sewage and refuse disposal	n/a	n/a
Manufacturing	Food & Drink £360.1m	Food Processing Including Whisky and soft drinks	12.5 food 21 beverage	260
	£192.8m	Textiles	4	1.8
	£5.6m	Paper and Pulp	16	87.7
Transport/Storage and Comms	£262.3m	Transport/storage and comms	n/a	n/a

* p/m^3= pence per cubic metre

[37] http://www.statistics.gov.uk/downloads/theme_economy/Final_SIC_for_GVA_by_region_1989-2001.xls
[38] http://www.sepa.org.uk/wfd/easg.htm Economics of Water Use Report (tables 9.3 and 11.1)
[39] http://www.sepa.org.uk/wfd/easg.htm 2004 est(from Dynamics of use)
[40] Scottish and Southern Energy from personal correspondence consider this a significant underestimate with their internal calculations giving values up to 5.2p

3.3 Abstraction and flow regulation

Many manufacturing processes such as distilling, food processing and paper & pulp production need to abstract water to produce goods. Water flow is also regulated and abstracted to supply drinking water, to produce hydropower and for navigational purposes. These types of activities may impact on the water environment. The Directive recognises that the benefits of such uses need to be retained and allows water bodies to be designated as heavily modified water bodies (HMWB) where substantial physical alterations have been made to support these uses.

Compared to many other areas of Europe, the Solway Tweed district generally has sufficient supplies of water but the demand on water supplies continues to increase. Abstractions have not yet been comprehensively regulated in Scotland. An abstraction licensing regime already operates in England. As a result, limited quantitative information is available for the Scottish area of the Solway Tweed and the risk assessment has relied to a large extent on predicted impacts from water abstraction or flow regulation. Better information is available in the English area (see below).

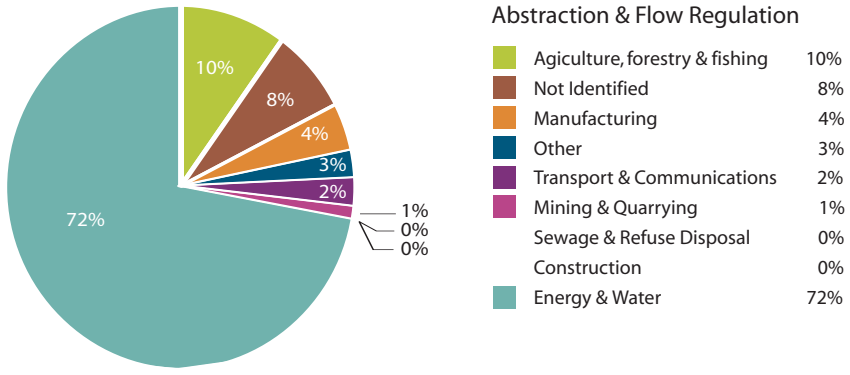
Figure 7 and Table 11 below show the distribution of pressures caused by abstraction and flow regulation for all water bodies at risk.

Table 11 Abstraction and flow risk sectors

Main Industrial Groups	Number of Pressures Abstraction	Flow Regulation	Total
Energy and Water	47	48	95
Agriculture, Forestry and Fishing	18	2	20
Not identified	0	11	11
Manufacturing	5	0	5
Other	3	1	4
Mining and Quarrying	3	0	3
Construction	0	0	0
Sewage and Refuse Disposal	0	0	0
Transport and Communications	0	0	0
Total	76	62	138

Note: Based on analysis of the Scottish area of Solway Tweed

Figure 7 Abstraction and flow risk sectors



Note: Based on analysis of the Scottish area of Solway Tweed

Table 12 below shows abstractions in Solway Tweed within the English area of the river basin district. In the English part as in the Scottish part, public water supply is a major source of abstractions, agriculture, mining and quarrying and manufacturing also feature.

Table 12 Solway Tweed RBD Abstractions (English Area)

SIC Section	Abstraction Source	Additional Information	Volume Abstracted (Ml/d)*
E41.00	Collection, purification and distribution of water	Public Water Supply (total abstracted)	293.70
D	Manufacturing	General Industry (Manufacturing)	11.42
A01	Growing of crops; market gardening; horticulture: Farming of animals	Spray Irrigation included	9.57
O92	Recreational, cultural and sporting activities	Recreation (including sports)	0.30
C	Mining and quarrying	Mining & Aggregates	0.16
P	Private households with employed persons	Other Potable Uses	0.04

Source: Environment Agency, 2001
Note: Excludes abstractions from tidal and transitional waters and also excludes returns to water courses.
*Ml/d = Million Litres per Day nb 1,000 litres = 1 cubic metre (m^3)

The following table illustrates (where data are available) three measures for each sector. Output (in value added terms for 2002) has been estimated by Experian Business Limited, and is specific to Solway Tweed. Estimates for the value and volume of water use cover the whole of Scotland and therefore there is only an indirect link between the economic data and the water use information.

Table 13 Contribution to the Solway Tweed economy and value/volume of water use in sectors connected with abstraction and flow regulation

Abstraction & Flow Regulation Sector	GVA 2001[41]	Sub Sector	Value of use[42] p/m³ *	Volume of use[43] Million m³/year
Agriculture Forestry and Fishing	£98.6m	Agriculture	23-138 irrigation benefits	56.5
	Fishing £34.6m	Aquaculture	only 0.011 to 0.126	1,582
Manufacturing	Food & Drink £360.1m	Food Processing Including Whisky and soft drinks	12.5 food 21 beverage	260
	£192.8m	Textiles	4	1.8
	£5.6m	Paper & Pulp	16	87.7
Energy and water supply	Coke/refining/ £0.3mnuclear	Oil	15 refined petroleum and coal	15
	Production and distribution of electricity. £71.8m	Electricity Hydro	0.00 to 0.82[44]	Est total through put 23,755 Est storage 3,355
	Production and distribution of electricity. £71.8m	Electricity non-hydro	n/a	Mains 6 Fresh 5 Sea 3,772 Total 3,783
	Water Supply	£13.1m	n/a	876 (Scotland) 293.7Ml/d (England)

* p/m³ = Pence per cubic metre

From this table it is clear that the volumes are considerable and that as a consequence of this, the per cubic metre value is low. Given the differing methodologies adopted (as a result of data limitations) it is not meaningful to attempt to work out a sector 'total' value of water use figure.

[41] http://www.statistics.gov.uk/downloads/theme_economy/Final_SIC_for_GVA_by_region_1989-2001.xls
[42] http://www.sepa.org.uk/wfd/easg.htm Economics of Water Use Report (tables 9.3 and 11.1)
[43] http://www.sepa.org.uk/wfd/easg.htm 2004 estimate (from Dynamics of Use report)
[44] Scottish and Southern Energy from personal correspondence consider this a significant underestimate with their internal calculations giving values up to 5.2p

3.4 Alterations to physical habitats

Morphological alterations (also referred to as physical alterations) to surface water bodies can cause significant ecological changes. Some examples of morphological alterations and possible effects on ecology are:

- land claim for ports or housing can lead to loss/damage of intertidal zones and therefore loss/damage of species supported by such habitats;
- structures for coastal protection or sea defence can interrupt coastal sediment transport leading to loss of sedimentary habitats and causing changes in species composition;
- river straightening or channelisation for agricultural, urban or flood defence purposes can result in loss/damage of habitats and loss/damage of species found in such habitats;
- weirs and impoundment structures can interrupt or prevent downstream movement of sediment leading to loss of sedimentary habitats and therefore changes in species composition.

Substantial man-made alterations to a water body for activities such as navigation, water storage, flood defence or land drainage may mean that it is not realistically possible for that water body to achieve good status. The Directive recognises that the benefits of such uses need to be retained and allows such water bodies to be designated as heavily modified water bodies (HMWB). The presence of physical alterations does not lead automatically to designation and nor does designation mean that mitigation measures will not be required. Designation enables objectives to be set that allow the benefits of the use to be maintained but ensure that other pressures can be managed and that, where possible, the adverse effects of the morphological alterations can be mitigated. The same principles apply to artificial water bodies (AWB). AWB are man-made surface water bodies, such as canals, which have been designed to serve a particular purpose but which can also support important aquatic ecosystems.

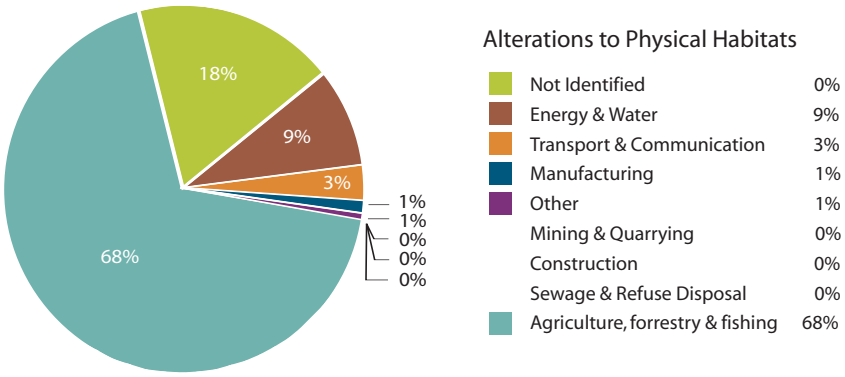
Figure 8 and table 14 below show the pressures from alteration to physical habitat for all water bodies at risk

Table 14 Alteration to habitat risk sectors

Main Industrial Groups	Morphological Alterations
Agriculture, Forestry and Fishing	130
No identified	34
Energy and Water	17
Transport & Communications	6
Manufacturing	2
Other	1
Construction	0
Mining and Quarrying	0
Sewage and Refuse Disposal	0
Total	190

Note: Based on analysis of the Scottish area of Solway Tweed

Figure 8 Alteration to habitat risk sectors



Note: Based on analysis of the Scottish area of Solway Tweed

No similar analysis is currently available for the English area of the RBD, although ongoing work will produce this information during 2005. However important sources of morphological pressures include activities associated with the operation of ports, navigation and flood defence structures.

The following table illustrates (where data are available) three measures for each of these sectors. Output (in value added terms for 2002) has been estimated by Experian Business Limited, and is specific to Solway Tweed. Estimates for the value and volume of water use cover the whole of Scotland and therefore there is only an indirect link between the economic data and the water use information.

Table 15 Economic statistics for pressures linked to Alteration to Physical Habitat

Alteration to Physical Habitat Sector	GVA 2001[45]	Sub sector	Value of use[46]* p/m^3	Volume of use[47] m^3/year
Agriculture, Forestry and Fishing	£98.6m	Agriculture	23-138 irrigation benefits	Irrigation 8.3 million m^3/yr
	Fishing £34.6m	Aquaculture	0.011 to 0.126	Fish farming 1,617million m^3/yr 4.4million m^3/day
	£128.7m	Forestry	n/a	1.7 million m^3/yr
Mining and quarrying	+ quarrying £37.1m	Mining	n/a	+ fuel extraction 7.9 million m^3/yr
Construction	£285.4m	Construction	n/a	383,250m3/day

* p/m^3 = pence per cubic metre

[45] Produced by Experian Business Strategies Limited. See Annex 2 for more detailed information.
[46] http://www.sepa.org.uk/wfd/easg.htm Economics of Water Use report (tables 9.3 and 11.1)
[47] http://www.sepa.org.uk/wfd/easg.htm 2004 estimate (from Dynamics of use)

4. Cost recovery

4.0.1 Approach to this section

The system for cost recovery in Scotland is different to that in England. Therefore, the Solway Tweed RBD is covered by two different cost recovery regimes and for that reason this report presents information on cost recovery in the Scottish and English parts of the RBD separately.

The information provided in the section covering the England part of the RBD is based on analysis undertaken by consultants ERM and Stone and Webster. The full report, referred to as CRIP (Cost Recovery and Incentive Pricing) is available to download from the Defra website[48].

Cost recovery in Scotland has been examined through a research report commissioned from ERM to establish the extent of cost recovery in Scotland (the Operation of the Scottish Water Market[49]). This report highlighted the paucity of our current knowledge in this area and led to the identification of gaps requiring further investigation and further work is ongoing.

In both countries there are significant technical issues associated with quantifying environmental and opportunity (resource) costs. These are discussed more fully in the respective sections.

4.1 English part of Solway Tweed - cost recovery

Defra's view, expressed in previous consultations on the WFD, is that there is no need to alter present pricing policies to meet the requirements of the Directive. The present arrangements deliver charges by water and sewerage undertakers that recover the costs of these services, both overall and by sector of customer. This system takes account of the principles and objectives of the Directive and the provisions of Article 9 in particular.

However, as revealed by the Cost Recovery and Incentive Pricing Report this is not the same as recovery of cost by broad user group (households, industry and agriculture). It is not currently possible, given existing data and bearing in mind the cost of additional data collection, to identify recovery of costs of water uses by these water user groups. In addition, some of the costs imposed by water uses (such as diffuse pollution from roads, agriculture etc) may not be adequately recovered from the relevant users but further research is required to establish this.

Additional work is planned in relation to the recovery of financial costs and in relation to environmental and resource costs ahead of the 2010 deadline for demonstrating an adequate recovery of costs of water services.

Article 5 requires that future pricing policies will be further informed by the economic analysis of water use undertaken in accordance with Annex III of the Directive. This section provides information on the current levels of the recovery of the costs of water services in the Solway Tweed RBD to assist in this process. The following sections outline:

- how water services are defined and how they relate to the Solway Tweed RBD;
- who provides and who contributes to the cost of water services (users and polluters) in the Solway Tweed RBD;
- the current level of financial cost incurred in providing these services;
- the current level of environmental and resource costs associated with providing the services;
- the revenues of water services and how costs are recovered;
- the overall level of financial cost recovery given the revenues and costs;
- how costs are allocated between broad user groups within this overall recovery of costs.

The information provided in this section is based on analysis undertaken by ERM and Stone and Webster. The full report, referred to as CRIP (Cost Recovery and Incentive Pricing) is available to download from the Defra website[50].

[48] http://www.defra.gov.uk/environment/water/wfd/economics/index.htm
[49] Operation of the Scottish Water Market report available at http://www.sepa.org.uk/wfd/easg.htm
[50] http://www.defra.gov.uk/environment/water/wfd/economics/index.htm

4.1.1 Water services in Solway Tweed (English area)

Water Services are defined by the Directive in Box 1.

Box 1 Definition of water services

"All services which provide, for households, public institutions or any economic activity:
(a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater;
(b) waste-water collection and treatment facilities which subsequently discharge into surface water."
Definition of Water Services, WFD Article 2 Paragraph 38

In England, the definition of water services encompasses the water industry together with activities providing similar services. For the sake of transparency, it is also important to consider self services in addition to water services.

Two water companies operate in the English area of the Solway Tweed RBD. The estimated proportions within the RBD of each company's total customer base are provided in brackets:

- United Utilities (2.7%)
- Northumbria Water Services (0.6%)

These companies also provide sewerage service. The estimated proportion within the Solway Tweed RBD of the total number of households serviced by each company is provided in brackets:

- United Utilities (2.7%)
- Northumbria Water Services (1.7%)

These figures reflect the fact that the water service areas of these companies do not coincide with the Solway Tweed RBD. The majority of United Utilities customers are within the North West RBD, with only a small proportion in Solway Tweed.

Figure 9 Water Company and Solway Tweed Boundaries

Ultimately the analysis of cost recovery needs to be undertaken at a river basin district scale, however for the purposes of this report it is only possible to report rates of cost recovery on the basis of water service areas. Hence in the following analysis of cost recovery in the Solway Tweed RBD, figures are presented for all water companies. In addition an indicative "RBD allocation" is provided. This is based on a simple pro-rata allocation and may not reflect well the actual costs and revenues associated with particular geographic areas. It is provided for indicative purposes only.

4.1.2 Water service providers, users and polluters

Service providers

United Utilities and Northumbria Water provide water services in the Solway Tweed RBD. Details of the services provided can be found in the CRIP report (water sources, treatment works, length of mains, sewage loads and facilities etc.). In addition information related to business plans, investments, costs and prices for the period 2005-2010 can be found in the Final Determination of Water Prices[51].

In addition to the water service companies in the Solway Tweed RBD listed above, there are a range of private water and sewerage services. Private water services cover any water service that is not supplied by a statutory water or sewerage undertaker, and can include self-service.

In the United Kingdom, private water supply services are governed by the Private Water Supplies Regulations 1991 which transpose the 1980 European Drinking Water Directive (80/779/EEC) in relation to private water supplies. These regulations place responsibilities on local authorities to monitor and improve private supplies to reflect the number of private water supplies in a particular area and the specific priorities of the local authority.

[51] http://www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/Content/pr04FD_CompanyLetters

Recent local authority surveys are inconclusive about the likely extent of private water supplies in England & Wales. The estimated number of supplies ranges between 50,000 to 100,000 and the population served between 300,000 to 1 million, with this concentrated in rural locations. A majority of supplies for domestic water use purposes (about 70%) serve single properties. Larger commercial uses of private supplies are concentrated in the Food & Drink manufacturing sector.

Recent analysis of the 2001 English House Condition Survey also suggests around 700,000 (3.3%) household properties in England are not connected to the mains supply for drinking water purposes. Based on typical household occupancy this would suggest a population of around 1.5 million do not receive mains water supply. No comparable estimates are currently available for the Solway Tweed RBD within England, nor is there a comparable Government Office Region which broadly matches this RBD. Analysis of data from this survey at local authority district level suggests only about 1% of household properties are not connected to the mains water supply.

Private sewerage services can involve either the collection of wastewater, the treatment of sewage effluents and the discharge of treated wastewater to water-courses and the safe disposal of sludge (waste products from treatment processes) or all of those services. It has been estimated that there are between 80,000 to 200,000 km of private sewers in England & Wales and nearly half of all household properties are served by private sewers or lateral drains. The vast majority of private sewer connections ultimately discharge wastewater to the public sewerage network.

Septic tanks and cesspools represent the most common form of private sewerage service for household properties that are not connected to the public network. It is estimated that around 400,000 (1.9%) household properties in England are served by either septic tanks, cesspools or private sewerage systems. No direct estimates are currently available for the Solway Tweed RBD, nor for a broadly equivalent Government office region. However, data at the level of local authority districts provides some evidence of relatively high concentrations of private sewerage connections within the Solway Tweed RBD. For example, based on the sample data for the districts of Carlisle, Allerdale, Eden, South Lakeland and Berwick upon Tweed which are wholly or partially in this RBD around 6.7% of properties (about 8,000) are estimated to have private sewerage connections.

Within the manufacturing and industrial sectors, private and in particular self-services are well established in respect of effluent treatment and disposal. One direct measure of this is provided by Environment Agency data on the direct discharge of effluent to watercourses (which requires authorisation by the Agency in the form of discharge consents. These are collectively termed trade discharges as opposed to discharges from treatment works operated by sewerage companies. About 30% of total consented discharges in England & Wales are made by trade sources. The concentration of trade sources is likely to be significantly lower in Solway Tweed given its largely rural characteristics. Consent compliance is lower for trade discharges.

Private suppliers, in the form of drink companies, have increasingly been selling bottled water to households. It is estimated that bottled water makes up almost 9 percent of average individual water consumption.

Further work on identifying the characteristics of private water suppliers is ongoing. In particular, the information collected is not currently at the correct geographical basis to provide more detailed information in this report. In general, the abstractions and discharges from industries other than the public water suppliers (see Tables 7 and 12) are related to private abstractions and discharges, including self service water users.

Water uses

Water uses are defined in Article 2 as: "water services together with any other activity identified under Article 5 and Annex II having a significant impact on the status of water." Article 9 of the Directive specifies that the water uses should be disaggregated into at least households, agriculture and industry.

An attempt is made as far as possible to report the information on water uses into these categories, however some uses cannot be disaggregated in this way and this will need to be subject of further analysis after the Article 5 report. This further work will also consider the appropriate sub-categorisation in the context of water pricing and programmes of measures. Current sub-categorisation is on the basis of the uses identified in the impacts and pressures analysis.

Some water uses, such as land reclamation, drainage etc. do not fit easily within the categories of households, industry and agriculture. As recognised in the reporting guidance it is necessary to include these 'other uses' which are identified on the basis of the river basin characterisation.

Households and non-households (commercial properties)

These are the customers of the licensed water undertakers (including some commercial, non-household), other providers and households with private water supply and wastewater systems.

Tables 16a and 16b below provide the number and population of households and non-households receiving water and sewerage services from the main water service providers, as well as the volume (Ml/day).

There are estimated to be 156,000 households and 11,000 non-households provided with water services by water companies in the English part of the Solway Tweed RBD.

Table 16a Characteristics of water services, 2003-04

	A: H/holds	B: Non-h/holds	C: Population (H/holds)	D: Population (non-h/hold)	E: Volume
Company	('000)	('000)	('000)	('000)	(Ml/day)
United Utilities	1,802	127	4,080	77	1,174
Northumbrian Water	1,788	120	4,142	63	481
Total	3,591	247	8,222	140	1,174
Allocated to Solway Tweed RBD	156	11	359	6	61

Source: Annual Returns submitted by water companies to Ofwat

There are estimated to be 92,000 households and 6,000 non-households provided with sewerage services by water companies in the Solway Tweed RBD.

Table 16b Characteristics of Sewerage Services, 2003-04

	A: H/holds	B: Non-h/holds	C: Population (H/holds)	D: Population (non-h/hold)	E: Volume
Company	('000)	('000)	('000)	('000)	(Ml/day)
United Utilities	2,718	173	6,581	62	1,393
Northumbrian Water	1,069	59	2,521	47	500
Total	3,787	232	9,102	109	1,893
Allocated to Solway Tweed RBD	92	6	221	2	46

Source: Annual Returns submitted by water companies to Ofwat

Industry: trade effluent and large users

These are the large user (water and sewerage) and trade-effluent customers (including some agriculture) of the licensed water undertakers, plus direct industrial dischargers and abstractors, plus the customers of other third party water services. Table 17a, 17b and 17c summarise the numbers of customers and volumes for large volume water users, trade effluent and large volume sewerage service users for each of the water services in the RBD. The tables also note the number of customers and volumes associated with special agreements. This information is provided on a water service area basis as an RBD allocation of trade effluent and large users is not possible given there is no currently adequate variable for apportioning data (unlike population in the case of households).

Table 17a Large Users (>50Ml pa) and special agreements water

Company	Customers	Water Delivered (Ml pa)	Special Agreement Customers	Special Agreements water delivered
Northumbrian Water	131	14,722	1	14,892
United Utilities Water	244	26,872	4	13,573

Table 17b Large Users (>50Ml pa) and special agreements trade effluent

Company	Customers	Trade effluent (ML pa)	Special Agreement Customers*	Special Agreements trade effluent (ML pa)*
Northumbrian Water	53	3,709	4	148
United Utilities	125	16,740	0	0

* Consumption per annum is not specified as above 50 ML for these customers.

Table 17c Large Users (>50Ml pa) and special agreements sewerage

Company	Customers	Sewerage collected (ML pa)	Special Agreement Customers*	Special Agreements sewerage collected (ML pa)*
Northumbrian Water	70	2,649	0	0
United Utilities	220	6,316	0	0

* Consumption per annum is not specified as above 50 ML for these customers.

Agriculture

These are the agricultural customers of the licensed water undertakers, as well as those that directly abstract water for agricultural purposes. Direct abstractions from the agriculture sector make up around 13 percent of all abstractions in England and Wales, with the fish farming sector accounting for most abstractions.

Other

These are users that do not fit into the above categories, such as transport, infrastructure etc.

4.1.3 Identification of the polluters

There are different types of pollution in the context of the WFD and it is useful to identify polluters who give rise to increased costs of providing water services. This is a technically difficult area and a large number of assumptions are required to arrive at an answer. The approach adopted is explained in the Report on Cost Recovery and Incentive Pricing (found at http://www.defra.gov.uk/environment/water/wfd/economics/index.htm).

Data reported by the water companies operating the English part of the RBD to Ofwat can be used to identify some osts that can be associated with polluting activities. In the case of water supply the company's costs reflect capital and operating expenditure on nitrate and pesticide removal, removal of other contaminants (metals, phosphates, soil, arsenic) and reducing the risk of cryptosporidium.

Table 18 summarises the capital and operating expenditure in terms of annualised costs. The table also provides an indicative estimate of how much of these annual costs are attributable to external sources, in this case the agricultural sector[52].

The estimates suggest that currently around £326.7m of annual remediation cost is incurred by water companies to deal with standards on nitrate removal, pesticide removal, other contaminants and cryptosporidium risks. This equates to about 10 percent of total public water supply costs in these companies. About £227.5m of this is attributable to the external impacts of the agricultural sector on raw water quality. Based on the population allocation procedure, around £0.6 million of these costs arise within the English area of the Solway Tweed RBD.

[52] Pretty (2000) provides the source for the assumptions on the shares attributable to this sector.

Table 18 shows that water treatment capital expenditure has been and continues to be a significant proportion of the total capital expenditure for water quality enhancements. The balance of this expenditure has been shifting from issues such as nitrate and pesticide removal to the reduction of cryptosporidium risks.

Table 18 Estimated annual costs in 2002-03 associated with external impacts on raw water quality

£m, 2002-03 prices	Annual costs borne by water company customers	Percent contribution due to external sources	Total annual remediation costs attributable to external sources	Allocated costs in the Solway Tweed RBD
Capital Costs				
Nitrates	18.1	80%	14.5	0.0
Pesticides	72.1	89%	64.2	0.2
Other parameters	126	50%	63.0	0.1
Cryptosproridium	37.2	90%	33.5	0.1
Total	253.4	-	175.1	0.5
Opex				
Deteriorating raw water quality	64.7	69%	44.6	0.1
Cryptosporidium	8.6	90%	7.7	0.0
Total	73.3	-	52.4	0.1
Total	326.7	-	227.5	0.6

Source: Cost Recovery and Incentive Pricing (CURIP) Report, Ofwat

For the sewerage service one of the key sources of pollution giving rise to elevated costs is diffuse run-off received at sewage treatment works, which contains hazardous substances. Hazardous substances may also be present in urban drainage and sewers where substances are inappropriately disposed of, or indeed released by households in their legitimate use of, for instance, cleaning products.

It is not presently possible to quantify the level of costs involved. The sectors responsible for these costs are domestic (disposal of household and DIY chemicals or use of products containing hazardous substances) manufacturing, transport and construction. These sectors contribute differently towards the recovery of those costs with households and industries that are customers of sewerage companies bearing the treatment costs.

Current level of financial costs of the water services

The financial costs of the water and sewerage service companies operating in the Solway Tweed RBD are summarised in **Tables 19 and 20**. These costs include the remediation costs identified above.

In 2003-04 the financial costs of the water and sewerage services were £14.4 million and £18.1 million respectively for the Solway Tweed RBD. These are based on population allocation.

Table 19 Solway Tweed RBD – Public water supply – total financial costs (£m, 2003-04 prices)

RBD: Solway Tweed		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Allocated Total Financial Costs		13.8	14.0	13.9	13.8	13.9	14.4
Water companies in RBD	**% of Pop in RBD**	**Total financial costs (£m)**					
United Utilities	2.7%	445.5	456.0	460.3	454.1	460.1	478.3
Northumbrian Water	0.6%	300.9	288.4	250.2	254.6	247.5	246.7

Source: Ofwat

Table 20 Solway Tweed – sewerage service – total financial costs (£m, 2003-04 prices)

RBD: Solway Tweed		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Allocated Total Financial Costs		19.9	21.6	18.0	17.8	17.7	18.1
Sewerage Companies in RBD	% of Pop in RBD		Total financial costs (£m)				
United Utilities	2.7%	603.1	649.6	551.4	539.9	535.9	550.6
Northumbrian Water	1.7%	211.0	236.1	184.5	189.8	187.5	187.9

Source: Ofwat

Tables 21 and 22 summarise the unit financial costs of the companies operating in the Solway Tweed RBD for the water and sewerage service. The tables show an indicative, population based allocation of these unit costs. In 2003-04 the unit water supply cost was £0.80 per m^3 and for the sewerage service £1.07 per m^3.

Table 21 Solway Tweed RBD – Public water supply – unit financial costs (£/m^3, 2003-04 prices)

RBD: Solway Tweed		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Allocated Unit Financial Costs		0.78	0.80	0.79	0.78	0.78	0.80
Water companies in RBD	% of Pop in RBD		Unit financial cost (£/m3)				
United Utilities	2.7%	0.79	0.81	0.81	0.80	0.80	0.82
Northumbrian Water	0.6%	0.75	0.73	0.64	0.66	0.65	0.64

Source: Ofwat

Table 22 Solway Tweed RBD – sewerage service – unit financial costs (£/m^3, 2003-04 prices)

RBD: Solway Tweed		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Allocated Unit Financial Costs		1.23	1.27	1.07	1.06	1.05	1.07
Water companies in RBD	% of Pop in RBD		Unit financial cost (£/m3)				
United Utilities	2.7%	1.27	1.28	1.09	1.07	1.06	1.08
Northumbrian Water	1.7%	1.09	1.23	0.96	1.00	1.01	1.03
Source: Ofwat							

Since privatisation (1989), water companies in England have incurred capital and operating expenditure in order to mitigate the environmental impacts of the sewerage services and to investigate and alleviate the impacts of their abstractions on the aquatic environments. Ofwat has analysed the sewerage services costs on a RBD level and **Table 23** illustrates the Solway Tweed results[53].

Column 1 shows the percentage of the water companies costs which are attributed (on an indicative basis) to the NW RBD. Column 2 shows the capital expenditure recorded as being spent on environmental mitigation of sewerage services. In United Utilities Water Plc, these have amounted to £2.4 billions between 1989 and 2003. Column 3 shows the incremental annual costs associated with operating these assets (operating expenditure and capital charges). Column 4 and 5 show the figures on the basis of the Solway Tweed RBD. As the table shows, the capital expenditure incurred in the Solway Tweed RBD is in the region of £83 million. Taken together with the operating expenditure this means that around £3 million of the water service providers' costs are associated with mitigating environmental impacts per annum.

[53] Note that the results are sensitive to the assumptions that Ofwat adopted in its analysis.

Table 23: Environmental mitigation expenditure/costs in the Solway Tweed RBD

Company	% of company costs allocated to RBD	Capex (1989-2003) -£m	Cost pa-£m (Capital charges + operating expenditure)	Capex (1989-2003) -allocated-£m	Cost pa-allocated -£m
	1	2	3	4 = 1*2	5 = 1*3
United Utilities Water Plc	3%	2,394	209.23	65	6
Northumbria Water	2%	1,052	96	18	2
		Total	83	7	

4.1.4 Revenues and financial cost recovery

The identified water service providers recover the costs of providing water services from customers within their water service areas.

The structure of charges in the water companies varies. Where metering is in place, tariffs (for both water and sewerage services) have two components: a standing charge which is irrespective of consumption and is the same for all customers on the tariff; and a volumetric charge, which varies according to how much water is consumed.

Unmeasured tariffs (for both water and sewerage services) usually comprise a fixed charge, which includes the customer related costs of supply; and a rateable value (RV) related charge (based on the value of the property). The structure varies with the Water Company and zones or geographical districts they operate in. In all cases, the amount customers pay is not related to levels of water consumption. Detailed information on these tariffs for the relevant water companies operating in the Solway Tweed RBD can be found in the Ofwat Tariff Structure and Charges 2004 – 2005 report [54].

The breakdown of metered and non-metered households is given in **Table 24** below. This table presents metering information for all water and sewerage companies operating in the English area of the Solway Tweed RBD, rather than for all households and non-households in the Solway Tweed RBD. As such, the table below provides indicative information only on the level of metering in the RBD.

Table 24 Percentage of water and sewerage customers taking metered supplies: 2003-04

Solway Tweed RBD	United Utilities (%)	Northumbrian Water (%)
Water		
Household	15.1	9.6
Non-household	89.6	78.5
Sewerage		
Household	15.1	9.2
Non-household	87.7	63.1

Source: Ofwat, Tariff Structure and Charges 2004-05.

Revenue in the companies arises from the provision of a range of services which make up the overall water service. These include measured and unmeasured charges for:

- water consumption;
- sewerage and trade effluent;
- surface water and highway drainage; and
- connection.

There is also a variety of other minor charges discussed in the CRIP report. For each of the charges, the cost recovery mechanism is slightly different in each case but for each source of charge income, prices are generally cost reflective.

[54] Available at www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/AttachmentsByTitle/tariff_report04.pdf/$FILE/tariff_report04.pdf

Tables 25 and 26 are based on work done for the CRIP report, which found that cost recovery was generally around 100 percent[55]. These tables have been updated for more recent data collected by Ofwat in annual water company returns.

Table 25 Public water supply – cost recovery for Solway Tweed RBD (£m, 2003-04 prices)

Cost Component	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Total revenues (£m)	13.8	14.0	13.9	13.7	13.8	14.3
Subsidies (£m)	0.0	0.0	0.0	0.0	0.0	0.0
Total Financial Costs (inclusive of taxes) (£m)	13.8	14.0	13.9	13.8	13.9	14.4
Cost Recovery Rate	100%	100%	99%	100%	100%	99%

Note: For English area of the Solway Tweed RBD only. Total financial costs do not exactly match total revenues, as the costs shown here are expressed gross of minor (negative) accounting adjustments for the impact of general inflation on the real value of working capital.

Table 26 Sewerage service – cost recovery for Solway Tweed RBD (£m, 2003-04 prices)

Cost Component	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Total revenues (£m)	19.9	21.5	18.0	17.8	17.6	18.0
Subsidies (£m)	0.0	0.0	0.0	0.0	0.0	0.0
Total Financial Costs (inclusive of taxes) (£m)	19.9	21.6	18.0	17.8	17.7	18.1
Cost Recovery Rate	100%	100%	100%	100%	100%	99%

Note: For English area of the Solway Tweed RBD only. Total financial costs do not exactly match total revenues, as the costs shown here are expressed gross of minor (negative) accounting adjustments for the impact of general inflation on the real value of working capital.

In any specific year, because of five-year cycle of the regulatory regime, water companies total costs and total revenues do not always match exactly. However, the balance between costs and revenues is necessarily achieved over a longer time horizon in the economic regulatory regime in England. The licensed providers of water and sewerage services are totally financed by revenues from customers. Further information is provided in the Economic Analysis Supportive Document.

Water companies (and other abstractors and dischargers) pay abstraction and discharge fees for the water they abstract to use and on-sell and the discharges they make to water bodies and courses. The Environment Agency (EA) administers the abstraction and impoundment licensing system for all water users, including the water and sewerage service companies. The EA levies administrative charges to recover its costs of managing water resources in line with the Water Resources Act 1991.

Abstraction charges are calculated according to the total volume authorised by the license, adjusted for:

- the season of authorised abstractions;
- the 'loss factor' (or degree to which water is returned directly to the environment); and
- the degree of environmental 'support' provided to the source of abstraction.

In addition, there is an annual charge and an application charge for every new or varied licence application (with the exception of a simple reduction in volume).

The discharge consents scheme includes an application charge and an annual charge. The annual charging system gives greater weight to larger volumes, more sophisticated effluents (since higher monitoring costs are incurred due to greater complexity) and the complexity of monitoring given the nature of receiving waters (sampling and analytical problems being most associated with estuaries).

The EA also recovers part of its costs in dealing with water pollution incidents from some polluters.

[55] Defined as revenues less subsidies divided by costs

4.1.5 Current level of environmental and resource costs

This section uses the available information to assess the environmental costs of current water pollution and abstraction in England and Wales. This provides contextual information indicating the importance of the environmental and resource costs of water use and highlights the need for their careful and serious consideration. This contextual information **cannot and should not** determine any specific measures since this will require careful appraisal of feasibility, scope and costs and benefits of reducing the environmental impacts of water use.

Environmental and resource costs arise where water uses affect water bodies and contribute to water bodies failing to achieve good status. As there is no definition of good status nor a classification scheme for it at present, it is difficult to measure the gap between current and good status and hence the level of environmental and resource costs. However, it is still possible to infer their significance.

In England it is possible to use the available assessment methods and information from the Overall Benefits Assessment for the current Periodic Review of Water Prices (PR04) to indicate the significance of environmental and resource costs; but it should be recognised that further work is needed to update the assumptions in the existing studies.

After the implementation of the environment programme recently agreed in the periodic review of the water industry (PR04), the remaining quantified environmental damage costs caused by water pollution and abstraction in England and Wales will be about £1bn - 1.5bn pa. The water industry and agriculture contribute equally to about 85 percent of this total. Other diffuse and point sources such as diffuse urban pollution, landfill sites and contaminated land account for the remaining 15 percent[58].

These estimates do not include:

- impacts of water pollution (other than eutrophication) on lakes;
- impacts for fishing and recreation of abstraction in causing low flow problems in rivers and lakes;
- and impacts of abstraction on the quantity of groundwaters.

These impacts are likely to be significant. They will be assessed as far as possible as part of the appraisal of options affecting such water bodies for the draft River Basin Management Plans in 2008/9.

These estimates do not relate fully to the issues to be addressed in the Water Framework Directive. It does not include important issues and environmental pressures identified by the river basin characterisation exercise as affecting risks of achieving good status (e.g. morphology pressures such as flood risk management, impacts on coastal and transitional waters and lakes, and release of priority hazardous substances). These issues are likely to be significant and they will be considered as far as possible as part of the appraisal of options for the draft River Basin Management Plans in 2008/9.

Due to the above factors regarding the scope of the estimates, they might under-estimate the environmental and resource costs of water use. But on the other hand there are countervailing methodological and empirical reasons why they might be over-estimates; as well as further reasons why they might be under-estimates. More work is needed on this subject.

These estimates provide contextual information that highlights the importance of this subject and the need for its careful and serious consideration. However, on their own, they **cannot and should not** determine any specific measures since this will require careful appraisal of the feasibility and scope for reducing these environmental impacts, for which the potential costs could rise significantly to achieve greater reductions. Moreover it will require careful appraisal of the costs and benefits of the options to determine the cost-effectiveness of options across all sectors and whether the options are disproportionately costly. Being based on a pre-WFD approach to the assessment of the impacts of environmental pressures, this assessment should only be seen as an initial marker.

Collaborative research programme

In this vein, various government departments, agencies and stakeholders in the UK are carrying out research to develop the economic analyses and appraisal techniques for efficient implementation of the Water Framework Directive. In particular, this includes a current study to develop methods to assess the costs and effectiveness of options. This will build on a recent report for Defra on "Cost Effectiveness Analysis and Developing a Methodology for Assessing Disproportionate Costs", which can be found at http://www.defra.gov.uk/environment/water/wfd/economics/index.htm.

This research will assess the environmental and resource costs to aid in the assessment of disproportionate costs as part of drawing up the programmes of measures and to aid the examination of pricing policies and the adequacy of the recovery of costs, including consideration of environmental and resource costs.

[56] For information on these estimates and the methodology applied to derive them, see Environment Agency (2004) "The Environmental damage costs of current water quality and flows in England and Wales and the contribution of PR04 in reducing them". Forthcoming on www.environment-agency.gov.uk/economics

4.2 Scottish part of Solway Tweed - cost recovery

Cost recovery in Scotland has been examined through a research report on the operation of the Scottish Water Market[57]. There is generally less information available in relation to Scotland than to England and further work is ongoing. Work to date is summarised in the following.

The research commissioned to establish the extent of cost recovery in Scotland (the Operation of the Scottish Water Market), highlighted the paucity of our current knowledge in this area and led to the identification of gaps requiring further investigation.

Further information will be published on the SEPA website (http://www.sepa.org.uk/wfd/economics.htm) in the near future.

Steps are being taken to harmonise the presentation of cost recovery data between Scotland and England; comparability will improve in future.

4.2.1 Recovery of direct financial costs

The vast majority of users of the water environment are private individuals or organisations that are not funded by government. While little is known about the costs incurred by these private users, it is clear that they pay the direct financial costs of their water use.

Scottish Water, the publicly owned water utility, is the sole provider of water services in the Scottish area of the Solway Tweed RBD. Scottish Water charges and capital expenditure are determined by Scottish Ministers through a cycle of investment planning, called Quality and Standards (Q&S). The current investment cycle, Q&SII, runs from 1st April 2002 to 31st March 2006. This planning process is supported by a strategic review of charges, carried out by the Water Industry Commissioner, to assess the effectiveness of Scottish Water proposals against comparable water companies and set out the likely effect on customer charges. Recommendations from the review are used to inform the final determination by Scottish Ministers and set a ceiling on the total level of annual expenditure, borrowing, charges and operating efficiency to which Scottish Water must conform. This process is similar in many respects to the Periodic Review process operating in England.

Scottish Water is subject to economic regulation by the Water Industry Commissioner who has published a large amount of information on Scottish Water's costs and revenues. From this information it can be concluded that by meeting published efficiency targets Scottish Water would recover their direct financial costs from their customers.

4.2.2 Recovery of environmental and opportunity (resource) costs

Point source discharges are currently regulated by SEPA under the Control of Pollution Act 1974 or the Environment Agency under the Water Resources Act 1991. Both agencies impose charges on dischargers so as to recover direct regulation costs.

While this regime prevents some environmental costs being incurred as a result of point source pollution and covers the direct costs of enforcing this regulation it does not amount to cost recovery of environmental costs for point source discharges. For diffuse pollution, abstraction, impoundment and engineering works there are currently few, if any, controls and no recovery of environmental costs.

Put another way, currently some users of the water environment are restricted in the environmental damage they can impose in some activities and they pay for the costs of being regulated. However, they do not pay for the environmental costs that they cause. While it is not possible to reliably quantify this cost the environmental Pressures and Impacts[58] report shows the extent of the pressures caused by water users.

Opportunity (resource) costs are particularly difficult to assess and are often caused by abstraction for which there is very limited data. The lack of comprehensive regulatory or market mechanisms to ensure that opportunity costs are paid indicates that this cost is not recovered from polluters. Given the limited data available it is not possible to assess how large these costs are and hence how significant an issue this is. However, as Scotland is a water rich and sparsely populated country it can be inferred that, compared to the rest of Europe, opportunity costs of water use are likely to be low.

[57] Operation of the Scottish Water Market report available at http://www.sepa.org.uk/wfd/easg.htm
[58] http://www.sepa.org.uk/wfd/easg.htm

5. How pressures on water use are predicted to change over time (dynamics)

Current research has expanded our knowledge of how water is currently used and what the resultant pressures are on the water environment. Over time this use will change as technology and the underlying economic structure responds to local, national and international pressures. By forecasting the most likely industrial drivers, tying this in with demographic trends and knowledge from sectoral experts, it is possible to generate a view of the most likely future scenario for (in this case) 2015, based on currently available knowledge. Of course, there is no crystal ball and it is impossible to predict random events; these projections must be seen as indicative. They are 'if nothing alters' projections but the reality is that nothing stays the same! As a result of this the margins of error must be seen as increasing the further we move from the base year.

This section examines the sources of increasing pressure on water use in the absence of constraints from the implementation of the Water Framework Directive. In reality of course users will be continuing in their efforts to reduce the use of raw materials including water, and pressure will be brought to bear on existing and new water uses. The growth and structural change of the economy to 2015 might suggest the changes illustrated in the table but these are not predictions of what will actually happen. If we were to predict the actual level of water use many sectors would have much lower rates of growth of use, stable levels of use and in some cases declines in water use.

What the table is intended to illustrate is the source of future pressures. It is important to understand not just how water use has occurred in the past or where water use is occurring at the present but where pressures for access to water might occur in the future. Understanding something about the sources of pressure for the future allows thought to be applied to how potential problems might be overcome before they become insurmountable. At the moment there has been no attempt to separate out these effects on a regional basis, or to relate these increases in pressure to specific water bodies. This will be explored in the coming years.

This section is based upon an R&D report on the dynamics of water use which is available on the SEPA website[59] and therefore, is for Scotland as a whole. This information has been used in conjunction with information from the report on the Economic Importance and Dynamics of Use report prepared for Defra[60]. Where additional information is available for the Solway Tweed river
basin district, this has been included.

This section concentrates on significant water users in terms of volume. Table 27 below provides an overview of how water use could change by 2015.

Table 27 Summary of the predicted changes in water use for selected large volume users

Sector	Sub Sector	Water use (m^3/yr) 2004	2015	% change
Industry	Electrical & Instrument Engineering	519.6	604.1	16%
	Chemical industry	315.9	397.2	26%
	Food and drink	260.2	279.5	7%
	Paper	87.7	105.3	20%
	Other industry	917.3	1,053.8	15%
Electricity Gas & Water Supply	Electricity - cooling	27,537.9	33,854.0	23%*
	Hydro - Impoundment	3,355.4	4,143.8	23%*
	Household water supply	266.0	272.3	2.4%
Ag, For & Fish	Agriculture	56.5	49.8	-12%
	Fish farming	1,582.4	1,771.3	12%

Note: This table covers the geographical area of Scotland.
m^3/yr = cubic metres per year
* It is the considered opinion of the Economic Advisory Stakeholder Group (EASG) that this figure is overly optimistic.

[59] http://www.sepa.org.uk/wfd/easg.htm
[60] http://www.defra.gov.uk/environment/water/wfd/economics/index.htm

The most significant user in Scotland in volume terms is the electricity generation sector, which is expected to increase its demand for water by 23% over the 11 year period. (The level of water use by this sector for the Solway Tweed river basin district is uncertain). Hydro power sector experts, however, cast doubt on this assumption and it is worth restating that these figures represent the views of the consultant, based on their knowledge at the time of writing. Despite considerable uncertainty regarding the likely electricity mix in 2015; due in part to the lack of any clear decision as to how to fill the gap created by the decommissioning of the ageing power stations at Cockenzie, Longannet and Chapelcross; **table 28** shows the assumed likely mix of generating capacity.

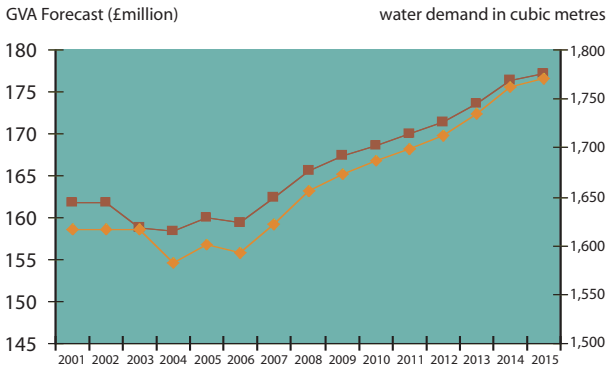
Table 28 Predicted energy mix in Scotland in 2015

Type	% of electricity generated
Nuclear	36
Combined- Cycle Gas Turbine (CCGT)	18
Non CCGT gas (i.e. Peterhead)	11
Combined Heat and Power (CHP)	5
Wind	15
Hydro	10
Biomass	4
Other renewables	1

The assumptions[61] underlying these projections are examined in the Dynamics of Water Use report

The next most significant user of water is fish farming/aquaculture, which is mostly direct abstraction. This sector is expected to increase its water usage by 12% in the period to 2015. **Figure 10** shows the projected growth of gross value added (output) in the sector and the resultant increase in water demand.

Figure 10 Forecast gross value added and water demand for fish farming

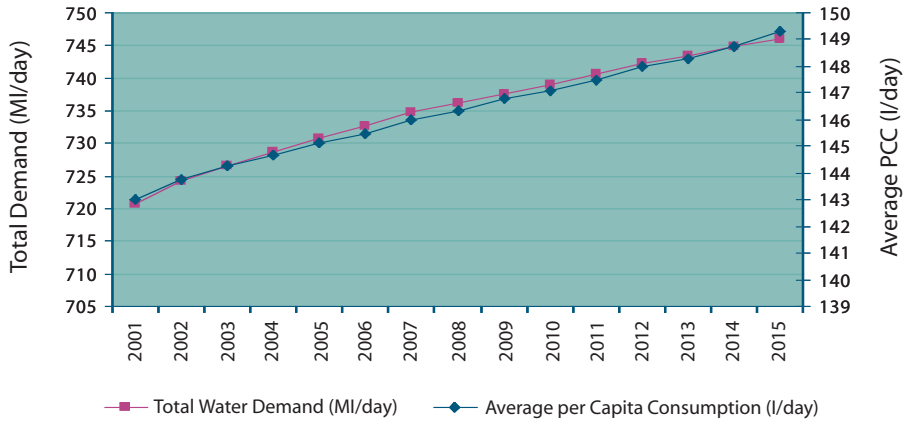


However, forecasts undertaken by Experian suggest that GVA for fish farming will decline slightly in Solway Tweed over this period (see Annex 2). If a similar relationship is evident between fish farming output and water use in Solway Tweed, then this would suggest that water demand is not likely to increase in Solway Tweed.

Household demand is also a highly significant use which is expected to increase by 2.4%. The population is forecast to continue its slow decline; however the number of households is set to increase as recent demographic trends predict more single parent families and smaller household sizes. This is true for both Scotland as a whole and the Solway Tweed river basin district. Technological improvements in the efficiency of many white goods, although significant, fail to offset this trend. This increase in water usage is depicted in **figure 11** over the page.

[61] These assumptions should in no way be taken to represent SEPA's desired or preferred situation.

Figure 11 Forecast total and average per capita water demand 2001 to 2015



Agriculture is the only large sector that is forecast to decrease its use of water. Demand is expected to fall by 12% over the period as a result of reforms made to agricultural support mechanisms within the Common Agricultural Policy (CAP), associated intervention price adjustments and world price expectations. For the purpose of this analysis, the models used to forecast future agricultural land use (livestock and cropping numbers) were calibrated to reflect the following policy and market scenario[62]:

- A fully decoupled Single Farm Payment (SFP) system replacing the Arable Area Payment, Suckler Cow Premium, Beef Special Premium, Slaughter Premium and Sheep Annual Premium Schemes;
- A SFP based on historic average claims during a 2000-2002 reference period;
- Intervention price reductions by 2008 for beef, cereals and milk as laid out by the European Commission in CAP reforms texts;
- Average world price forecasts to 2010 provided by OECD[63] and FAPRI[64] for wheat, barley, beef, milk and sheepmeat.

The Experian forecasts for the Solway Tweed river basin district also suggest a decline in agricultural output from Solway Tweed over the period to 2015. This is broadly based, with declines in output from cropping and livestock (see Annex 2 for more information).

The effects of these assumptions can be seen in **Table 29** over. Figures are for Scotland as a whole.

[62] These assumptions should in no way be taken to represent SEPA's desired, or preferred situation.
[63] Organisation for Economic Co-operation and Development
[64] Food and Agricultural Policy Research Institute.

Table 29 Basic water demand result for the Agriculture sector

Sub-sector (unit of output)	Present activity level	Activity level 2015	Annual water use per unit of output/ activity (litres/yr)	Water use 2002 (m^3/yr)	Water Use 2015 (m^3/yr)
	1,000 head	1,000 head			
Beef cows (hd)	700.6	700.6	12,775	9.0	9.0
Ewes (hd)	5,251.0	4,439.2	991	5.2	4.4
Crops (ha)	1,718.8	1,671,454	2,100	3.6	3.5
Dairy cows (hd)	214.0	214.0	71,540	15.3	15.3
All other cattle (hd)	1,461.2	883.4	10,038	14.7	8.9
Pigs (hd)	483.0	483.0	10,558	5.1	5.1
Poultry (hd)	38,562.0	38,562.0	94	3.6	3,.6
Total				56.5	49.8

(Note: Pigs and Poultry numbers assumed unchanged)
* m^3/yr= cubic metres per year

An in-depth agriculture business as usual study for the Water Framework Directive was undertaken by Cambridge University. The full report can be found at: www.environment-agency.gov.uk/economics. The study provides quantitative percentage changes of key agricultural activities to 2015 at a national level and at a regional level for Government Office Regions in England and for Wales (see Tables 16-18 ibid.). The report used a top down approach, essentially looking at overall changes in England and Wales and adjusting these based on knowledge of the region and expert opinion to reflect regional changes. The Solway Tweed RBD is within the North West and North East Government Office Regions. The key projected trends for major commodities in these areas:

- removal of set-aside brings land into arable production;
- small increase in cereal production (particularly wheat and maize) due to set aside changes;
- continued decline of dairy herd as yields increase;
- decline in beef and sheep herds; and
- a continued decline in horticultural crops (especially potatoes).

Overall a small fall in overall agricultural area is predicted. However, this may hide potentially significant changes in the structure and intensification of the industry and how businesses are managed. This may have impacts on water quality. For instance, more intensive cropping through greater use of fertilisers may impact on diffuse pollution.

Estimates have been produced for various industrial uses (specifically electrical and engineering, fibres and food & drink) but it is necessary to be cautious about the data underlying these estimates and it is not possible to spell out a definitive ranking. An important point with all industrial processes is the distinction in terms of public supply and that from private abstraction. The latter raises questions about the location-specific impacts and failure to meet quality targets if abstraction demand increases. Although water use in agriculture is forecast to decline by an eighth there will be significant spatial differences and water demand may increase in certain parts.

6. Further work

This is SEPA and Defra's first report on the economics of water use for a cross border RBD. Over the next three years we will develop further our understanding of the issues and enhance the quality and robustness of the available information through co-ordinated work. This will inform our assessment of the significant Water Management Issues report in 2007.

This report has focused on the uses of water which have been identified as having an environmental impact. Of immediate concern will be to work with stakeholders to develop the means by which economic data can be used to determine the most cost effective combinations of measures in water bodies at risk.

One area which needs particular development is the provision of better estimates of benefits of water use as well as estimates of the values associated with leisure and recreational uses. In Scotland it is the intention to develop tests to identify where measures may be disproportionately expensive in time for the start of the Controlled Activities Regulations in April 2006. The Collaborative Research Programme will also be scoping the disproportionate cases over this period.

Over the period to 2010 there will be further work towards providing more information on the issues around recovery of costs of water services and providing a harmonised assessment for the entire RBD.

It is not intended to use any of the data contained in this report as the only means by which licensing decisions should be made. However, there is a strong desire to ensure that as the data quality improves it will become increasingly helpful in ensuring an acceptable balance between environmental protection and actions by water users.

As work is undertaken the results will be made available to stakeholders and interested parties via the SEPA and Defra web pages.

Collaborative Research Programme

A major area of future collaborative effort between SEPA and Defra will be participation in the Collaborative Research Programme on River Basin Management Planning Economics.

The CRP builds on the three scoping studies that Defra commissioned in 2003/04 on:

- Cost-Effectiveness Analysis and Developing a Methodology for Assessing Disproportionate Costs;
- Cost Recovery and Incentive Pricing; and
- Economic Characterisation and Dynamics of Water Use.

Each of these reports identified a list of actions. These actions have been prioritised, and the CRP is taking forward those that are most important for implementing the WFD.

The collaborative research programme identifies and justifies the need for research, outlines the key collaborative requirements and prioritises and schedules the research in the light of the time and likely resources available. A key feature of the process is the collaborative involvement of a wide range of stakeholders from the start.

The collaborative research programme has the following sequential tasks:

1. To set out an initial identification and illustration of the issues related to the economic analysis and its role in the decision-making for programmes of measures under the Water Framework Directive. (2004)
2. To determine how to assess costs and economic impacts for each of the main types of options affecting the major different sectors that will need to be appraised in River Basin Management Plans (RBMPs) in an even handed manner. (2004-05)
3. To scope and characterise the potentially disproportionately costly cases in RBMPs and the main gaps in information to draw up an appropriate process for assessing them and making best use of original and existing work to fill these gaps. This will include exploring alternative assessment methods. (2005-06)
4. Focus group analyses to specify clearly environmental damages of concern in these cases. (2006)
5. Development, trial and refinement of guidance on benefits assessment for RBMPs. (2006-2008)
6. New studies to provide better assessments and related demand information of the major environmental benefits of RBMPs. (2006-2008)

A more detailed summary of the projects is available from the Defra website[65]. Also important for future work will be improved integration of the Scottish and English data and information for the Solway Tweed river basin district.

[65] http://www.defra.gov.uk/environment/water/wfd/economics/index.htm

7. Annexes

Annex 1 – Stakeholder Input

As mentioned previously, several sectors took the opportunity to provide studies of their own sector; these studies are available on the SEPA website[66]. These studies are published online as they were submitted by stakeholders and are therefore, produced in the writers own words and are not necessarily the views and opinions of SEPA or the Scottish Executive.

As follows:

Sector	Author
Agriculture:	NFU Scotland
Aquaculture:	The Federation of Scottish Aquaculture Producers
Coal:	Scottish Coal
Whisky:	Malt Distillers Association of Scotland
Tanning:	Scottish Tanning Industries (not relevant to the Solway Tweed RBD)
Paper and Pulp:	Confederation of Paper Industries
Hydro Power:	British Hydropower Association
Canals:	British Waterways Scotland (not relevant to the Solway Tweed RBD)

Stakeholders in England were also invited to comment on water use, and the following groups made contributions:

- Electricity Industry Joint Environment Programme (Powergen, RWE, Innogy, AEP, Drax Power Ltd, British Energy, EDF Energy, International Power, Scottish Power);
- British Ports Association and United Kingdom Major Ports Group;
- WaterVoice;
- British Hydropower Association;
- Royal Society for the Protection of Birds (RSPB); and

  British Waterways. (not relevant to the Solway Tweed RBD)

The reports produced by the stakeholders can be accessed through the Defra Website[67]

Annex 2 – Experian Forecasts

The following table summarises the population, household, employment and output forecasts undertaken by Experian Business Strategies Limited for the Solway Tweed RBD. Employment and output forecasts have been undertaken for 30 standard SICs[68] as well as a number of disaggregated categories that have some link to water status.

Actual and forecast output is measured in constant price terms (based on 2002 prices). Prices are assumed to remain constant within the forecasts, so that forecast changes in output are net of price movements. Output is defined as a value added measure of production (i.e. net of input costs).

Experian's industry forecasts for RBDs in Great Britain are summations of ward level forecasts. These forecasts are informed by two key sources of information. The first is historic estimates of employment by industry at the ward level between 1995 and 2002. The second is Experian forecasts for employment and output for industry categories or local/unitary authority districts. The first step is to forecast ward level employment for each industry by using the past relationship in employment in the ward compared to its wider district. The second step is to estimate output in each industry for each ward by applying district level productivity trends to the employment forecast. These ward level forecasts are then aggregated to the relevant RBD boundaries.

For employment and output, data are presented for 30 standard SIC codes, as well as for a number of disaggregated SIC codes. These disaggregated categories were chosen on the basis of the impacts and pressures analysis and as being he most relevant in terms of the risk assessment.

[66] http://www.sepa.org.uk/wfd/easg.htm
[67] www.defra.gov.uk/enviornment/water/wfd/economics/index.htm the Economic Importance and Characterisation of Water Use (England and Wales) report
[68] SIC codes are Standard Industrial Classification codes, used to uniquely describe an economic activity.

POPULATION AND HOUSEHOLDS				Share of economy			Annual Average Growth	
(thousands)	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
	(000s)	(000s)	(000s)	%	%	%	%	%
Total population	447	448	440				0.0	-0.1
Total households	183	196	215				1.0	0.7

EMPLOYEES IN EMPLOYMENT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
(thousands)	(000s)	(000s)	(000s)	%	%	%	%	%
Standard 30 categories								
Agriculture, forestry & fishing	10.0	7.6	6.1	5.8	4.3	3.7	-3.9	-1.7
Oil & gas extraction	0.0	0.0	0.0	0.0	0.0	0.0		
Other mining	0.7	1.0	0.5	0.4	0.6	0.3	5.2	-5.7
Gas, electricity & water	1.2	1.1	0.7	0.7	0.6	0.4	-0.4	-4.1
Fuel refining	0.0	0.0	0.0	0.0	0.0	0.0	-23.7	-9.6
Chemicals	0.3	0.4	0.4	0.2	0.3	0.2	7.9	-1.3
Minerals	1.1	1.3	1.3	0.6	0.8	0.8	2.9	-0.2
Metals	3.1	2.0	0.9	1.8	1.2	0.6	-5.7	-5.8
Machinery & equipment	0.9	0.9	0.6	0.5	0.5	0.4	0.3	-3.7
Electrical & optical equipment	2.0	0.9	0.9	1.2	0.5	0.5	-11.5	0.0
Transport equipment	0.3	0.9	0.7	0.2	0.5	0.4	15.1	-1.7
Food, drink & tobacco	8.5	10.3	9.9	5.0	5.9	6.1	2.9	-0.3
Textiles & clothing	6.6	5.7	4.5	3.9	3.2	2.8	-2.1	-1.8
Wood & wood products	1.2	1.8	2.3	0.7	1.0	1.4	6.0	2.1
Paper, printing & publishing	1.9	1.6	1.2	1.1	0.9	0.8	-2.4	-1.9
Rubber & plastics	4.7	4.0	3.4	2.7	2.3	2.1	-2.3	-1.1
Other manufacturing	1.0	0.6	0.6	0.6	0.3	0.4	-7.5	-0.2
Construction	7.8	9.5	7.9	4.6	5.4	4.8	2.7	-1.4
Retailing	20.2	19.7	16.6	11.8	11.3	10.2	-0.3	-1.3
Wholesale & distribution	10.9	11.5	8.9	6.4	6.6	5.5	0.9	-2.0
Hotels & catering	12.9	15.5	16.5	7.6	8.8	10.2	2.6	0.5
Transport	8.0	7.4	4.6	4.7	4.2	2.9	-1.1	-3.5
Communications	2.0	2.4	2.4	1.2	1.4	1.5	3.1	0.0
Banking & insurance	3.8	3.1	2.0	2.2	1.8	1.3	-2.8	-3.1
Business services	8.4	10.0	9.3	4.9	5.7	5.7	2.5	-0.6
Other financial & business services	2.4	2.8	2.3	1.4	1.6	1.4	2.5	-1.5
Public administration & defence	11.1	10.0	8.2	6.5	5.7	5.0	-1.4	-1.5
Education	8.2	11.9	12.8	4.8	6.8	7.9	5.4	0.6
Health	23.8	23.1	26.0	13.9	13.2	16.0	-0.4	0.9
Other services	8.0	8.1	10.9	4.7	4.6	6.7	0.1	2.4
Total employees	170.6	175.2	162.4	100.0	100.0	100.0	0.4	-0.6

	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
Disaggregated categories	(000s)	(000s)	(000s)	%	%	%	%	%
Electricity, gas, steam & hot water supply (SIC40)	1.0	0.9	0.5	0.6	0.5	0.3	-0.4	-4.0
Production & distribution of electricity (SIC40.1)	0.9	0.9	0.5	0.5	0.5	0.3	-0.3	-4.0
Manufacture of gas (SIC40.2)	0.1	0.1	0.0	0.0	0.0	0.0	-2.4	-4.0
Steam & hot water supply (SIC40.3)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Collection, purification & distributionof water (SIC41)	0.2	0.2	0.1	0.1	0.1	0.1	-0.4	-4.4
Manufacture of basic chemicals (SIC24.1)	0.0	0.1	0.1	0.0	0.1	0.0	20.3	-2.1
Manufacture of pesticides & other agro-chemicals (SIC24.2)	0.0	0.0	0.0	0.0	0.0	0.0	17.4	1.5
Manufacture of paint varnishes etc. (SIC24.3)	0.0	0.0	0.0	0.0	0.0	0.0	33.9	-1.9
Manufacture of pharmaceuticals (SIC24.4)	0.0	0.1	0.1	0.0	0.1	0.1	15.9	0.9
Manufacture of soaps & detergents (SIC24.5)	0.2	0.2	0.2	0.1	0.1	0.1	1.8	-2.3
Manufacture of other chemical products (SIC24.6)	0.0	0.0	0.0	0.0	0.0	0.0	17.1	1.5

EMPLOYEES IN EMPLOYMENT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
Manufacture of man made fibres (SIC24.7)	0.0	0.0	0.0	0.0	0.0	0.0	7.0	-3.5
Manufacture of basic metals (SIC27)	0.3	0.2	0.1	0.2	0.1	0.0	-5.5	-8.7
Manufacture of pulp, paper & paper products (SIC21)	0.2	0.2	0.1	0.1	0.1	0.1	-1.1	-1.4
Mining of coal & lignite (SIC10)	0.1	0.4	0.1	0.1	0.2	0.1	20.3	-10.0
Mining of uranium & thorium (SIC12)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Mining of metal ores (SIC13)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Other mining (SIC14)	0.6	0.6	0.4	0.4	0.4	0.2	0.8	-3.9
Sewage & refuse disposal (SIC90)	1.0	1.1	1.3	0.6	0.6	0.8	1.2	1.6
Agriculture, hunting & related activities (SIC01)	3.3	2.9	2.3	2.0	1.7	1.4	-2.0	-1.7
Growing of crops (SIC011)	1.0	1.0	0.8	0.6	0.6	0.5	0.0	-1.1
Growing of cereals (SIC0111)	0.7	0.8	0.7	0.4	0.5	0.4	1.3	-1.0
Growing of vegetables (SIC0112)	0.3	0.2	0.1	0.2	0.1	0.1	-4.3	-2.0
Growing of fruits, nuts & spices (SIC0113)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Farming of animals (SIC012)	1.0	0.7	0.6	0.6	0.4	0.3	-4.1	-1.9
Farming of cattle (SIC0121)	0.4	0.3	0.2	0.2	0.2	0.1	-3.7	-2.1
Farming of sheep, goats etc. (SIC0122)	0.2	0.1	0.1	0.1	0.1	0.1	-4.4	-1.7
Farming of swine (SIC0123)	0.0	0.0	0.0	0.0	0.0	0.0	-6.8	-6.8
Farming of poultry (SIC0124)	0.3	0.2	0.2	0.2	0.1	0.1	-4.3	-1.7
Other farming of animals (SIC0125)	0.0	0.0	0.0	0.0	0.0	0.0	-4.9	-2.3
Growing of crops combined with farming of animals (SIC013)	0.5	0.4	0.3	0.3	0.2	0.2	-2.8	-2.1
Agricultural & animal husbandry service activities, except veterinary (SIC014)	0.9	0.8	0.6	0.5	0.4	0.4	-1.6	-2.0
Hunting, gaming & game propagation (SIC015)	0.1	0.0	0.0	0.0	0.0	0.0	-4.6	-1.7
Forestry, logging & related activities (SIC02)	5.5	3.8	3.2	3.2	2.2	2.0	-4.9	-1.4
Fishing (SIC05)	1.2	0.8	0.6	0.7	0.5	0.4	-4.7	-2.7
Fishing (SIC0501)	0.5	0.4	0.3	0.3	0.2	0.2	-3.5	-1.3
Operation of fish hatcheries & fish farms (SIC0502)	0.7	0.4	0.3	0.4	0.3	0.2	-5.6	-4.2
Production, processing and preserving of meat (SIC151)	2.1	2.4	2.4	1.2	1.4	1.5	2.5	-0.3
Processing and preserving of fish (SIC152)	2.1	2.9	2.7	1.2	1.7	1.7	4.7	-0.5
Manufacture of dairy products (SIC155)	0.6	0.8	0.7	0.3	0.4	0.4	4.7	-0.4
Manufacture of beverage products (SIC159)	0.2	0.2	0.2	0.1	0.1	0.1	4.0	0.3
Production of mineral waters and soft drinks (SIC1598)	0.1	0.1	0.1	0.0	0.1	0.1	6.0	-0.2
Manufacture of rubber products (SIC251)	2.1	1.7	1.5	1.2	1.0	0.9	-3.0	-1.0
Manufacture of cement, lime and plaster (SIC265)	0.0	0.0	0.0	0.0	0.0	0.0	1.6	-0.4
Manufacture of articles of concrete, plaster and cement (SIC266)	0.6	0.6	0.6	0.4	0.4	0.4	-0.2	-0.2
Manufacture of of basic iron and steel and ferro-alloys (SIC271)	0.1	0.1	0.0	0.1	0.0	0.0	-10.4	-6.5
Manufacture of basic precious and non-ferrous metals (SIC274)	0.2	0.1	0.0	0.1	0.1	0.0	-2.6	-9.8
Manufacture of parts and accessories for motor vehicles and engines (SIC343)	0.2	0.6	0.5	0.1	0.3	0.3	16.7	-1.2
Manufacture of aircraft and spacecraft (SIC353)	0.0	0.0	0.0	0.0	0.0	0.0		
Camping sites and other provision of short-stay accommodation (SIC552)	0.9	1.1	1.2	0.5	0.6	0.7	2.9	0.8
Sporting activities (SIC926)	1.5	1.6	2.1	0.9	0.9	1.3	0.2	2.3
Manufacture of industrial gases (SIC2411)	0.0	0.0	0.0	0.0	0.0	0.0	17.6	1.7
Manufacture of dyes and pigments (SIC2412)	0.0	0.0	0.0	0.0	0.0	0.0		
Manufacture of other inorganic basic chemicals (SIC2413)	0.0	0.0	0.0	0.0	0.0	0.0		
Manufacture of other organic basic chemicals (SIC2414)	0.0	0.0	0.0	0.0	0.0	0.0	6.5	-3.2
Manufacture of fertilizers and nitrogen ompounds (SIC2415)	0.0	0.1	0.1	0.0	0.0	0.0	28.0	-2.2

EMPLOYEES IN EMPLOYMENT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
Manufacture of plastics in primary orms (SIC2416)	0.0	0.0	0.0	0.0	0.0	0.0	8.5	-1.0
Manufacture of synthetic rubber in primary forms (SIC2417)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Casting of light metals (SIC2753)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Casting of other non-ferrous metals (SIC2754)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Sea and coastal water transport (SIC6110)	0.5	0.4	0.2	0.3	0.2	0.1	-3.2	-6.3
Inland water transport (SIC6120)	0.0	0.0	0.0	0.0	0.0	0.0	0.7	-1.9
Washing and dry cleaning of textile nd fur products (SIC9301)	0.2	0.2	0.3	0.1	0.1	0.2	0.8	3.1
Construction of water projects (SIC4524)	0.0	0.0	0.0	0.0	0.0	0.0	3.8	-1.5

OUTPUT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
(£million, 2000 prices)	(000s)	(000s)	(000s)	%	%	%	%	%
Standard 30 categories	0.0	0.0	0.0					
Agriculture, forestry & fishing	278.3	261.9	221.4	7.1	6.0	4.3	-0.9	-1.3
Oil & gas extraction	0.0	0.1	0.0	0.0	0.0	0.0		-100.0
Other mining	30.5	37.0	24.4	0.8	0.8	0.5	2.8	-3.1
Gas, electricity & water	72.3	89.2	93.9	1.9	2.0	1.8	3.0	0.4
Fuel refining	1.2	0.3	0.1	0.0	0.0	0.0	-19.7	-10.5
Chemicals	11.0	25.4	34.6	0.3	0.6	0.7	12.7	2.4
Minerals	37.5	47.6	58.4	1.0	1.1	1.1	3.5	1.6
Metals	76.7	56.4	26.9	2.0	1.3	0.5	-4.3	-5.5
Machinery & equipment	25.7	26.9	20.9	0.7	0.6	0.4	0.6	-1.9
Electrical & optical equipment	53.2	28.5	59.2	1.4	0.7	1.1	-8.5	5.8
Transport equipment	9.6	22.5	30.6	0.2	0.5	0.6	12.9	2.4
Food, drink & tobacco	279.4	360.1	442.6	7.2	8.2	8.6	3.7	1.6
Textiles & clothing	151.0	192.8	212.5	3.9	4.4	4.1	3.6	0.8
Wood & wood products	40.2	52.8	88.9	1.0	1.2	1.7	3.9	4.1
Paper, printing & publishing	62.2	51.8	47.0	1.6	1.2	0.9	-2.6	-0.7
Rubber & plastics	130.2	112.7	145.9	3.3	2.6	2.8	-2.0	2.0
Other manufacturing	25.1	14.5	18.4	0.6	0.3	0.4	-7.5	1.8
Construction	242.8	285.4	366.0	6.2	6.5	7.1	2.3	1.9
Retailing	264.9	306.1	358.5	6.8	7.0	6.9	2.1	1.2
Wholesale & distribution	279.7	330.5	362.5	7.2	7.6	7.0	2.4	0.7
Hotels & catering	204.8	238.4	298.3	5.3	5.5	5.8	2.2	1.7
Transport	237.3	262.3	208.0	6.1	6.0	4.0	1.4	-1.8
Communications	47.8	94.4	188.9	1.2	2.2	3.7	10.2	5.5
Banking & insurance	91.4	99.3	102.1	2.3	2.3	2.0	1.2	0.2
Business services	166.3	225.5	347.5	4.3	5.2	6.7	4.5	3.4
Other financial & business services	96.7	109.8	128.5	2.5	2.5	2.5	1.8	1.2
Public administration & defence	244.4	219.9	185.1	6.3	5.0	3.6	-1.5	-1.3
Education	187.8	222.1	259.2	4.8	5.1	5.0	2.4	1.2
Health	348.8	383.5	522.4	9.0	8.8	10.1	1.4	2.4
Other services	198.4	214.9	310.6	5.1	4.9	6.0	1.1	2.9
Total Output	3895.5	4372.5	5163.4	100.0	100.0	100.0	1.7	1.3

Disaggregated categories								
Electricity, gas, steam hot water supply (SIC40)	61.1	76.0	80.7	1.6	1.7	1.6	3.2	0.5
Production & distribution f electricity (SIC40.1)	56.9	71.8	76.3	1.5	1.6	1.5	3.4	0.5
Manufacture of gas (SIC40.2)	4.3	4.3	4.4	0.1	0.1	0.1	0.1	0.2
Steam & hot water supply (SIC40.3)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Collection, purification & distribution of water (SIC41)	11.2	13.1	13.2	0.3	0.3	0.3	2.3	0.1
Manufacture of basic chemicals (SIC24.1)	1.3	5.9	7.6	0.0	0.1	0.1	23.8	2.0

OUTPUT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
Manufacture of pesticides & ther agro-chemicals (SIC24.2)	0.3	1.3	2.3	0.0	0.0	0.0	23.1	4.9
Manufacture of paints varnishes etc. (SIC24.3)	0.0	0.1	0.1	0.0	0.0	0.0	37.4	2.2
Manufacture of pharmaceuticals (SIC24.4)	1.6	5.9	10.3	0.0	0.1	0.2	20.9	4.4
Manufacture of soaps & detergents (SIC24.5)	7.4	11.3	13.0	0.2	0.3	0.3	6.3	1.1
Manufacture of other chemical roducts (SIC24.6)	0.1	0.4	0.7	0.0	0.0	0.0	22.9	4.9
Manufacture of man made fibres (SIC24.7)	0.3	0.6	0.6	0.0	0.0	0.0	9.4	0.2
Manufacture of basic metals (SIC27)	8.1	6.0	2.1	0.2	0.1	0.0	-4.2	-7.9
Manufacture of pulp, paper & paper products (SIC21)	6.3	5.6	5.4	0.2	0.1	0.1	-1.8	-0.3
Mining of coal & lignite (SIC10)	3.4	13.7	4.0	0.1	0.3	0.1	22.3	-9.0
Mining of uranium & thorium (SIC12)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Mining of metal ores (SIC13)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Other mining (SIC14)	27.2	23.3	20.4	0.7	0.5	0.4	-2.2	-1.0
Sewage & refuse disposal (SIC90)	30.1	34.9	47.1	0.8	0.8	0.9	2.1	2.3
Agriculture, hunting & related activities (SIC01)	93.1	98.6	81.0	2.4	2.3	1.6	0.8	-1.5
Growing of crops (SIC011)	23.2	28.8	25.8	0.6	0.7	0.5	3.2	-0.8
Growing of cereals (SIC0111)	16.4	22.0	20.8	0.4	0.5	0.4	4.3	-0.4
Growing of vegetables (SIC0112)	6.7	6.8	5.1	0.2	0.2	0.1	0.1	-2.2
Growing of fruits, nuts & spices (SIC0113)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Farming of animals (SIC012)	28.4	26.2	21.5	0.7	0.6	0.4	-1.2	-1.5
Farming of cattle (SIC0121)	12.2	11.0	9.1	0.3	0.3	0.2	-1.5	-1.4
Farming of sheep, goats etc. (SIC0122)	5.8	5.0	4.9	0.1	0.1	0.1	-2.1	-0.2
Farming of swine (SIC0123)	0.3	0.4	0.1	0.0	0.0	0.0	0.3	-6.9
Farming of poultry (SIC0124)	9.1	8.9	6.6	0.2	0.2	0.1	-0.3	-2.2
Other farming of animals (SIC0125)	1.0	0.9	0.7	0.0	0.0	0.0	-0.9	-1.8
Growing of crops combined with farming of animals (SIC013)	13.3	14.2	10.3	0.3	0.3	0.2	0.9	-2.4
Agricultural & animal husbandry service activities, except veterinary (SIC014)	26.4	27.9	21.7	0.7	0.6	0.4	0.8	-1.9
Hunting, gaming & game propagation (SIC015)	1.9	1.6	1.6	0.0	0.0	0.0	-2.5	0.2
Forestry, logging & related activities (SIC02)	148.7	128.7	116.0	3.8	2.9	2.2	-2.0	-0.8
Fishing (SIC05)	36.5	34.6	24.4	0.9	0.8	0.5	-0.8	-2.7
Fishing (SIC0501)	13.2	12.1	12.3	0.3	0.3	0.2	-1.2	0.1
Operation of fish hatcheries & fish farms (SIC0502)	23.3	22.5	12.1	0.6	0.5	0.2	-0.5	-4.7
Production, processing and preserving of meat (SIC151)	66.5	85.4	106.1	1.7	2.0	2.1	3.6	1.7
Processing and preserving of fish (SIC152)	68.7	96.3	114.1	1.8	2.2	2.2	4.9	1.3
Manufacture of dairy products (SIC155)	19.7	27.7	33.1	0.5	0.6	0.6	5.0	1.4
Manufacture of beverage products (SIC159)	7.2	8.9	11.5	0.2	0.2	0.2	3.0	2.0
Production of mineral waters and soft drinks (SIC1598)	2.1	3.3	4.1	0.1	0.1	0.1	6.5	1.7
Manufacture of rubber products (SIC251)	60.4	49.3	64.8	1.6	1.1	1.3	-2.9	2.1
Manufacture of cement, lime and plaster (SIC265)	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.4
Manufacture of articles of concrete, plaster and cement (SIC266)	23.3	23.4	28.6	0.6	0.5	0.6	0.1	1.6
Manufacture of of basic iron and steel and ferro-alloys (SIC271)	3.4	1.8	0.9	0.1	0.0	0.0	-8.2	-5.7
Manufacture of basic precious and non-ferrous metals (SIC274)	4.4	3.7	1.1	0.1	0.1	0.0	-2.4	-9.0
Manufacture of parts and accessories for motor vehicles and engines (SIC343)	6.1	17.0	24.7	0.2	0.4	0.5	15.8	2.9
Manufacture of aircraft and spacecraft (SIC353)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Camping sites and other provision of short-stay ccommodation (SIC552)	14.7	17.4	22.7	0.4	0.4	0.4	2.5	2.1

OUTPUT	1995	2002	2015	1995	2002	2015	1995-2002	2002-2015
Sporting activities (SIC926)	37.2	40.9	58.8	1.0	0.9	1.1	1.4	2.8
Manufacture of industrial gases (SIC2411)	0.0	0.1	0.1	0.0	0.0	0.0	23.4	5.0
Manufacture of dyes and pigments (SIC2412)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Manufacture of other inorganic basic hemicals (SIC2413)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Manufacture of other organic basic chemicals (SIC2414)	0.2	0.3	0.3	0.0	0.0	0.0	8.8	0.4
Manufacture of fertilizers and nitrogen compounds (SIC2415)	0.6	4.3	5.5	0.0	0.1	0.1	31.4	1.8
Manufacture of plastics in primary forms (SIC2416)	0.5	1.1	1.6	0.0	0.0	0.0	12.4	2.7
Manufacture of synthetic rubber n primary forms (SIC2417)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Casting of light metals (SIC2753)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Casting of other non-ferrous metals (SIC2754)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Sea and coastal water transport (SIC6110)	16.2	16.8	7.9	0.4	0.4	0.2	0.5	-5.6
Inland water transport (SIC6120)	0.3	0.4	0.4	0.0	0.0	0.0	2.6	0.6
Washing and dry cleaning of textile and fur products (SIC9301)	5.1	5.6	8.8	0.1	0.1	0.2	1.1	3.6
Construction of water projects (SIC4524)	0.2	0.3	0.4	0.0	0.0	0.0	4.6	1.9

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