

# State of the Environment 2001

The Environment Agency's contribution  
to a better environment in the South East



ENVIRONMENT  
AGENCY



# FOREWORD

The environment of South East England is beautiful, unique and one of the jewels in the nation's crown. It is also fragile, vulnerable and in many places under threat. If predicted climate changes really start to bite, nowhere in this country will see the effects more closely or more dramatically than in the South East. Development pressures including the demands for thousands more homes are also more intense than in most parts of the UK.

In the years since its creation the Agency, working with its partners, has made many major strides forward in promoting, protecting and enhancing the environment. The Agency has ensured that beaches and rivers are cleaner now than for more than a hundred years, improvements have been made to air quality and industry is working towards greener and in many cases more efficient solutions.

In order for the Agency to understand what has happened, what is happening and what could happen in the future it has closely measured and analysed key "indicators". Salmon in the Medway for the first time in a generation speaks volumes about the improvements that we are seeing. We need the facts and figures to understand the pressures on the environment and the effect of Agency action.

Our first State of the Environment Report for the South East, which we published in June 2000, highlighted some remarkable achievements. It also sounded a number of warning bells. We have now updated this highly acclaimed document in order to capture the new information that has become available. In particular we have concentrated on revising three topics:

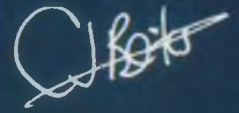
- *Managing water resources*
- *Managing waste*
- *Risk of flooding*

This is all part of the Agency's continuing and intense programme of working with its partners to ensure the sustainable development of the South East.

We hope you will take the time to consider some of the issues this update highlights. We look forward to working with you to solve some of the problems, deliver the solutions and continue to ensure that the South East remains a place which is fit for the millions who live, work and play within this sensitive area.



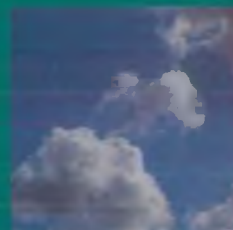
**David Jordan**  
Regional Director -  
Southern Region



**Chris Birks**  
Regional Director -  
Thames Region

March 2002

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# EXECUTIVE SUMMARY

The South East Region has many distinct qualities that set it apart from other Regions. However, the environment of the Region is constantly changing due to competing demands on space and natural resources, as well as a range of natural forces.

This report sets out information on the current state of the environment of the South East of England, and the issues affecting it, for which the Environment Agency has a key role and responsibility. We see this report as making an important contribution to the sustainable development agenda in the South East.

The geographical boundaries of the South East Region used throughout this report correspond to the area covered by the Government Office for the South East. This encompasses the counties and unitary authorities between Kent in the south east, Hampshire in the south west and Buckinghamshire in the north but excludes the Greater London area.

The Region's geographical position as the 'Gateway to Europe' and also the hinterland of London, confers significant economic advantages. However, many aspects of the environment, one of the Region's greatest assets, are under increasing pressure.

One of the most significant pressures on the South East is the increasing population and its changing characteristics. The population of the Region is growing faster than in any other English Region, four per cent between 1991 and 1997, double the UK average. The predicted increase in the number of households in the Region is also greater than any other Region, nearly 20 per cent between 2001 and 2021.

This report identifies a range of environmental issues that we consider to be of particular importance for the South East, these are summarised below.

**Improving air quality** - the South East has relatively few major industrial processes, however there are local hotspots and significant emissions from other sources, such as road transport.

- emissions of all pollutants measured since 1990 have fallen in the South East, however Nitrogen Oxide levels may present a particular problem in the future with predicted increases in traffic. The relatively high concentrations of Particulates and Ozone in the South East are partially a result of the proximity of mainland Europe.

- a higher proportion of households in the Region own three or more cars than any other Region - *approximately one in twelve in the South East*. After London, the Region has the second highest daily traffic flow - *in the South East each person on average travels 6,900 miles by car per year, further than any other Region*.

**Protecting and enhancing water quality** - the quality of the water needs to be maintained to ensure it can support both a diverse ecosystem and a range of human uses. Rivers in the Region are predominantly of good and fair water quality, however there are several river systems that still have considerable scope for improvement.

- the quality of the Region's rivers and Bathing Waters is improving - *approximately 90 per cent of rivers in the Region are of good or fair water quality. There is also an increasing compliance with EC Bathing Water standards. Approximately 90 per cent of the EC Bathing Waters complied with the standards for the last three years compared with 40 per cent twelve years ago*.

**Maintaining and enhancing biodiversity** - the wildlife habitats and the plants and animals that depend on them are under particular pressure in the South East Region from development pressure and recreation.

- the high quality of the natural environment within the Region is reflected in the large areas of land designated for amenity or intrinsic value - *almost a third of the Region is designated as an Area of Outstanding Natural Beauty and the Region's 700 Sites of Special Scientific Interest cover nearly six per cent of the land*.

**Managing water resources** - water resources in the South East are already constrained. Demand is growing due to the increasing number of households and demands for non-essential uses of water. The pressure for development and the potential effects of climate change represent major challenges for the future.

- the Region consumes more water per person than any other Region, but receives one of the lowest amounts of rainfall - *in some parts of the Region the average consumption per person is as high as 197 litres per day*.

Managing waste - the total amount of waste generated in the South East Region is increasing and the Region is a net importer of waste for disposal. Significant changes in the management of waste in the Region are required.

- each year the amount of waste generated in the UK increases by approximately three per cent. In 1998/99 13 million tonnes of waste was produced in SE of England. 85 per cent was landfilled. Landfill space is running short and the Landfill Directive requires massive diversion of waste away from landfill towards more sustainable technologies. Action is needed now to reduce waste production and to make some use of the waste that is produced.

Risk of flooding - a significant number of properties in the South East Region are at risk from coastal and river flooding. The pressure for development and the potential effects of climate change represent major challenges for the future management of flood risk in the Region.

- over 230,000 properties in the Region have been identified as being at risk from flooding - *during Autumn 2000 continuous heavy rainfall caused significant flooding throughout the South East with 1746 Flood Watches, 621 Flood Warnings and 78 Severe Flood Warnings being issued between September 2000 and March 2001.*

- the effects of climate change are uncertain, but are likely to be significant for the Region - *predicted effects include that annual rainfall is expected to increase by between zero and 10 per cent by 2050 and there will be a relative sea level rise of 6mm per year.*

For each of these issues, we have detailed as far as possible, the current state and pressures on the environment, future targets and actions. Each issue has been ascribed a series of indicators to enable us to monitor the future state and assess pressures on our environment.

These issues can only be tackled through action by a range of organisations in partnership with the Environment Agency. This report therefore is aimed at a number of audiences. We hope that it will be used to inform future revision of a range of strategies, action plans and initiatives, including in particular the Regional Sustainable Development Framework (RSDF), Regional Planning Guidance (RPG) and Regional Economic Strategy (RES).

This updated report forms part of the Agency's developing input into the evolving debate on sustainable development. By working in partnership with other organisations it is hoped that the integration of ideas and information will help to deliver a more balanced and sustainable environment. An essential component of realising this vision will be an ongoing process of monitoring and review.



# INTRODUCTION

## Background

The Environment Agency has responsibility to 'compile information on' and to 'form an opinion on' the state of the environment. Our first national overview, *The Environment of England and Wales - a snapshot*, was first published in 1996 and is now available, regularly updated, on the Agency's website which can be found at <http://www.environment-agency.gov.uk>. In addition, a series of detailed assessments of the environment have been published. These reports in the State of the Environment series cover fresh waters, coasts, the land and the atmosphere.

It is not the purpose of this regional report to provide a comprehensive assessment of all aspects of the environment in the South East. Rather, it aims to identify those aspects of the environment for which the Environment Agency has a responsibility and which we consider to be important in terms of contributing to a better quality of life in the South East Region. Naturally, in some instances we have identified one or two areas for which other bodies are responsible in order to help in providing effective solutions.

This report presents data and a selection of indicators for a number of issues of importance to the Environment Agency and relating to our statutory functions and duties. These include air quality, water quality, biodiversity, water resources, waste and its management, and flooding.

By setting out baseline conditions and trends over time, we can identify and quantify how the state of the environment, and factors affecting it, have changed over recent years. This also helps us to identify why these changes have occurred, to think about how we want things to change in the future, and to manage and monitor that change. It is intended that this report will be updated periodically on a topic by topic basis and this version is the first update of the original report produced in June 2000. The sections on managing water resources, managing waste and the risk of flooding, in particular, have been updated in this version.

We see this report as making an important contribution to the South East of England's environmental agenda. In particular, it should inform and influence implementation and future review of the following:

- **The Regional Sustainable Development Framework (RSDF)** - the RSDF *A Better Quality of Life in the South East* was adopted in June 2001 and sets out a vision for sustainable development in the region including a series

of objectives and associated indicators. The RSDF provides a common sustainable development context for Regional Planning Guidance and the Regional Economic Strategy (see below). A number of the issues and associated indicators identified in this report should be relevant to the RSDF, particularly those concerning water quality, waste, and water resources.

- **Regional Planning Guidance (RPG)** - implementation of RPG policies, in particular the proposed levels and pattern of development, will have a significant effect on many of the issues identified in our report. In April 2001 responsibility for preparing the RPG passed from SERPLAN to the South East England Regional Assembly. This State of the Environment Report will explain and clarify some of the key environmental issues and concerns in the Region and will be an important resource for use in preparing future RPG<sup>1</sup>.
- **Regional Economic Strategy (RES)** - the RES and action plans produced by South East England Development Agency (SEEDA) will potentially have an effect on a number of the issues identified in our report. The RES is currently under review and a consultation draft is due to be published in April 2002. This report will be of use in monitoring the impact of the revised RES and its associated action plans on sustainable development within the Region.

In addition, this report also has the potential to be used to inform local plans, strategies and initiatives. The Environment Agency will be attaching greater priority to reporting on environmental outcomes of its work. Therefore, the report will be important in enabling us to monitor and report on our own performance and contribution to the quality of the environment, and the quality of life, in the South East England Region as a whole. This will include reporting against the national sustainable development objectives and 'Headline' indicators.

## The South East Region

The South East Region runs in an arc around London from Kent in the south east along the south coast to Hampshire, Southampton and Portsmouth in the south west, and then to Milton Keynes and Buckinghamshire in the North. It covers a total of 19,400km<sup>2</sup>, encompassing 19 counties and unitary authorities and 54 district authorities.

<sup>1</sup> Note that the recently published Green Paper on Planning: *Delivering a fundamental change* proposes replacing RPG with Regional Spatial Strategies (RSSs).





**Figure 1: The South East Region**

The Region's population of nearly eight million people makes up some three million households. Economically the Region is strong, accounting for more than 15 per cent of UK GDP, the largest contribution of any of the English Regions. The Region's economy is closely linked to that of London, and also significantly influenced by its proximity to mainland Europe. However, there is considerable variation within the Region, with areas of deprivation.

There is an extensive network of national and international transport links in the Region, although congestion is an increasing problem. The Region includes the UK's second busiest airport, Gatwick, with the busiest, Heathrow, just outside the Region. The Channel Tunnel, and the forthcoming Channel Tunnel Rail Link, and ports such as Dover, Ramsgate and Portsmouth provide access to mainland Europe. Southampton and Sheerness provide deepwater facilities for international maritime traffic.

The South East Region's environment is one of its key assets. About 40 per cent of the Region is subject to some form of protective designation (e.g. Area of Outstanding Natural Beauty, Green Belt or Site of Special Scientific Interest). However, there are considerable pressures on the Region's environment arising out of the

demand for new development, particularly on areas of flood plain, increasing demand for domestic water and energy supplies, congestion and the generation of waste. These pressures are related to the size of the population, decreasing average household size and the scale of economic activity in the South East. The relatively low rainfall in the South East and the effects of climate change on weather patterns and sea levels are also vital considerations.

The South East Region includes all of the Environment Agency's Southern Region and a major portion of the Environment Agency's Thames Region. However, some of the information presented in this report is based on the river catchments, and because river catchment areas do not always respect administrative boundaries, some of the 26 catchments within the South East Region extend beyond the boundary of the South East Region.

It is important to consider these catchments as a whole, as activities outside the Region could be affecting the environment within it and vice versa. Catchments are an important unit for environmental management and are one of the basic geographical units used by the Environment Agency for delivering local action.



# KEY ISSUES FACING THE SOUTH EAST FROM AN ENVIRONMENT AGENCY PERSPECTIVE

## Background to the Key Issues and Indicators

The Environment Agency published *The Environmental Vision* in 2001. This states our long-term goals for the environment and a sustainable future. Our Corporate Strategy is expected to be released in Autumn 2002.

Along with our work nationally and regionally on state of the environment reporting, we are in the process of developing a national set of environmental indicators. These include the relevant indicators from the UK government's sustainability indicators in *Quality of Life Counts*. We need indicators to show progress towards our vision of a better environment and to show how we are contributing to the objective of sustainable development of which the environment is a key aspect.

The environmental indicators will help the Agency to identify the most significant changes in the condition of the environment and identify increasing pressures caused by stresses and strains on the environment. This will provide a means of focusing resources for both internal purposes and external influencing. They will also provide consistent information about the environment to external bodies for their reporting purposes and to monitor their performance, whether these links are at a local, regional or national level.

A state-pressure-response framework is being used to present the indicators in this report:



'state' indicators measure the quality and stock of natural resources;



'pressure' indicators measure the negative forces on the environment which are usually caused by human activities, but may include measures of pressures caused by natural processes;



'response' indicators assess the normally beneficial impacts of activities which aim to address environmental problems.

In the past we have produced a variety of information to our own regional boundaries. However, this report sets out information on aspects of the quality of the environment of the South East of England, and the issues affecting it, for which the Environment Agency has a key role and responsibility.

The issues we have identified to be particularly important for the South East Region and essential for strategic initiatives such as the Regional Sustainable Development Framework

(RSDF), Regional Planning Guidance (RPG) and Regional Economic Strategy (RES), to consider include:

- **improving air quality** - the South East Region has relatively few major industrial processes, however there are local hotspots and significant emissions from other sources, such as road transport;
- **protecting and enhancing water quality** - the quality of the water needs to be maintained to ensure it can support both a diverse ecosystem and a range of human uses. Rivers in the Region are predominantly of good and fair water quality, however there are several river systems that still have considerable scope for improvement;
- **maintaining and enhancing biodiversity** - the wildlife habitats and the plants and animals that depend on them are under particular pressure in the South East Region from development and recreation;
- **managing water resources** - water resources in the South East are already constrained. Demand is growing due to the increasing number of households and demands for non-essential uses of water. The pressure for development and the potential effects of climate change represent major challenges for the future;
- **managing waste** - the total amount of waste generated in the South East Region is increasing and the Region is a net importer of waste for disposal. Significant changes in the management of waste in the Region are required;
- **risk of flooding** - a significant number of properties in the South East Region are at risk from coastal and river flooding. The pressure for development and the potential effects of climate change represent major challenges for the future management of flood risk in the Region.

Each of these issues are discussed in detail in the following sections. We have selected a limited number of key indicators to monitor these issues based on a number of criteria, including:

- the importance of the indicator to illustrate a key aspect of the Region's environment;
- the ability of the indicator to record environmental change in a meaningful way;
- the availability of data for the indicator; and
- the regularity with which the data for the indicator is updated.



The indicators selected under each of the issues are listed in Table 1. This shows the current trend for each indicator (i.e. whether it is

increasing, decreasing, stable, variable or unknown). We have also described the direction we would like each indicator to go in the future.

**Table 1: Summary of Current and Future Trends**

ISSUES AND INDICATORS	INDICATOR TYPE	CURRENT AND LIKELY TREND	FUTURE DIRECTION AND AIM
<b>IMPROVING AIR QUALITY</b>			
• Air pollution from major industrial processes	P	▼ • industrial sources of air pollution are generally decreasing.	• the aim is for this trend to continue.
• Days when air pollution is moderate or higher	S	▼ • the number of days when air pollution is moderate or higher are generally decreasing in urban areas. ~ • the number of days when air pollution is moderate or higher is variable in rural areas.	• the aim is for this trend to continue. • the aim is for the number of days to decrease.
<b>PROTECTING AND ENHANCING WATER QUALITY</b>			
• River and estuarine water quality	S	▲ • there has been an overall improvement in chemical river quality (1991/93 to 1998/00), but between these two dates there has been variation. The two main variables are improved quality of discharges and amount of water in rivers. ■ • estuary water quality has stayed relatively constant (1985-00). ? • there is not sufficient data to identify trends in biological river quality.	• the aim is for improvements in the quality of discharges to continue and for overall improvements in chemical and biological river quality and estuary water quality. Water quality inevitably decreases during drought years.
• Compliance with the Bathing Waters Directive	S	▲ • compliance with the Bathing Waters Directive is increasing.	• the aim is for this trend to continue.
<b>MAINTAINING AND ENHANCING BIODIVERSITY</b>			
• Distribution of key species (e.g. otters, water voles, southern damselfly, white-clawed crayfish)	S	▲ • otters are becoming more frequent and widespread across the Region. ▼ • water voles have been lost from three quarters of their previously known sites during the last decade. ▼ • the range of the southern damselfly has contracted over the last thirty years, with a stronghold remaining in the New Forest. ▼ • white-clawed crayfish are rare and declining across the Region.	• the aim is for this trend to continue in line with the BAP target. • the aim is to maintain and restore populations in line with the BAP target. • the aim is to enhance the current status of the species in line with the BAP objective. • the aim is to maintain and increase populations in line with the BAP target.
• Numbers of salmon and sea trout	S	▼ • numbers of salmon have generally decreased, with a few rivers showing an increase. ~ • the number of sea trout have fluctuated significantly over recent years.	• the aim is to see a recovery of the existing salmon stocks to at least meet self-replication targets for each salmon river. • the aim is to see more sea trout returning to rivers in the Region.
• Status of key habitats and sites protected under the EC Habitat Regulations	S	? • it is too early to identify a trend.	• the aim will be to ensure that any adversely affected site will be remediated as soon as possible.



ISSUES AND INDICATORS	INDICATOR TYPE	CURRENT AND LIKELY TREND	FUTURE DIRECTION AND AIM
<b>MANAGING WATER RESOURCES</b>			
• Quantity of rainfall		~ • there are both spatial and temporal variations in rainfall. Climate change is expected to increase annual rainfall slightly, but with increased seasonal variation.	• rainfall cannot be controlled, but we need to plan for natural variability as well as possible future changes.
• River flows and groundwater levels		~ • there is a natural cyclical variation in river flows and groundwater levels and variations from year to year in response to rainfall. Drought years can have a significant effect. Climate change and changes in abstraction will/could have an effect in the future.	• the aim is for sustainable management of water resources to ensure a healthy environment.
• Water demand and availability		▲ • water resources are under particular pressure in the South East. Water demand is increasing due to increasing numbers of households, growing demand for non-essential uses and economic development. Water companies are producing plans to overcome forecast supply-demand deficits.	• the aim is for a positive balance between supply and demand across the Region, while ensuring environmental sustainability.
<b>MANAGING WASTE</b>			
• Commercial and industrial waste arisings, recycling and recovery		? • the publication of the SWMA provides a baseline for the first time based on high quality information. The trend in commercial and industrial waste production and management will be monitored and reported in future updates of this State of the Environment Report.	• the aim is to see a reduction in the amount of waste generated. European legislation will require significant changes to how waste is managed.
• Household waste arisings, recycling and recovery		▲ • the trend in the South East reflects the national increase in household waste arisings. This is linked to a number of factors, including the number and size of households and changes in the pattern of consumer spending. Improved recycling rates represent an increase in public awareness and participation, however there is still a need for a much greater increase if government targets are to be met.	• reducing household waste arisings is the primary aim, although this is unlikely until social changes stabilise. An increase in reuse and recycling, provided it is demonstrated to be the BPEO, would help to reduce the environmental impact of waste.
<b>RISK OF FLOODING</b>			
• Number of flood warnings		? • as the new flood warning system was introduced in September 2000, it is not possible to identify significant trends and this will only be possible in future years once a longer database is available.	• the aim is to provide more efficient and effective flood warning. In the future we also hope to provide better indicators than flood warning to monitor flooding and flood risk.

### KEY



- State



- Pressure



- Response

▼ - decreasing trend

▲ - increasing trend

? - unknown trend

■ - stable trend

~ - variable trend



# IMPROVING AIR QUALITY

## Background

The quality of air that we breathe is crucial to us all. Air quality in the UK is generally very good, but there are sometimes unacceptably high levels of pollution that can harm human health and the environment. The Government's *Air Quality Strategy* describes plans to improve and protect ambient air quality in the UK. The Strategy sets objectives for eight main air pollutants to protect health. The pollutants covered are:

- benzene;
- 1,3-butadiene;
- carbon monoxide;
- lead;
- nitrogen dioxide;
- ozone;
- particulates (PM<sub>10</sub>); and
- sulphur dioxide.

The Strategy also explains the roles of local authorities, industry and the Agency in managing air quality. Local authorities have a leading role in delivering air quality. The Agency plays its part mainly through the regulation and control of emissions from the largest, most technically complex and potentially most polluting industrial processes.

The Government is currently consulting on proposals to revise the objectives for benzene, carbon monoxide and particles. It is also looking to introduce an objective for polycyclic aromatic hydrocarbons.

## Roles and responsibilities

Local authorities control emissions from certain industrial processes through the Local Air Pollution Control (LAPC) regime. LAPC tackles local pollution hotspots, which are often caused by road transport, under Local Air Quality Management (LAQM). Local authorities also control pollution from domestic sources through the Clean Air Act and the smoke control regime. They can also use a range of other powers in pursuit of air quality objectives, including Local Air Quality Strategies and local traffic management powers. The Agency provides assistance and information to local authorities, especially within Air Quality Management Areas (AQMA) identified by the local authority.

The Agency is responsible for controlling emissions from industrial processes regulated under Integrated Pollution Control (IPC) and Pollution Prevention and Control (PPC). Best Available Techniques Not Entailing Excessive Cost (BATNEEC, or BAT under PPC) must be used by operators of these processes to prevent or minimise and render harmless releases to the environment. The Agency is obliged to take

account of the *Air Quality Strategy* in addition to EU limit values. Therefore, in setting the authorisation limits for an industrial process, the Agency must take account of national and international standards and objectives and the local air quality.

Under the Pollution Prevention and Control (PPC) regime, the Agency takes a wider range of environmental effects into account when determining permit conditions. These include energy efficiency, noise and site restoration as well as the processes' local effect.

## Air Quality in the South East Region

The South East region has relatively few major industrial processes relative to its population and economic activity. However, there are local pollution hotspots caused by emissions from industrial activity and energy generation. Air quality is significantly affected by emissions from other sources, such as road transport. A large proportion of the emissions of nitrogen oxides and carbon monoxide, for example, are from road transport. The high levels of car ownership in the South East represent a challenge for future air quality management.

To illustrate current air quality in the South East, we have included maps showing the concentration of four of the pollutants from the *Air Quality Strategy*: particulates; ozone; sulphur dioxide; and oxides of nitrogen (see Figures 2, 3, 4 and 5).

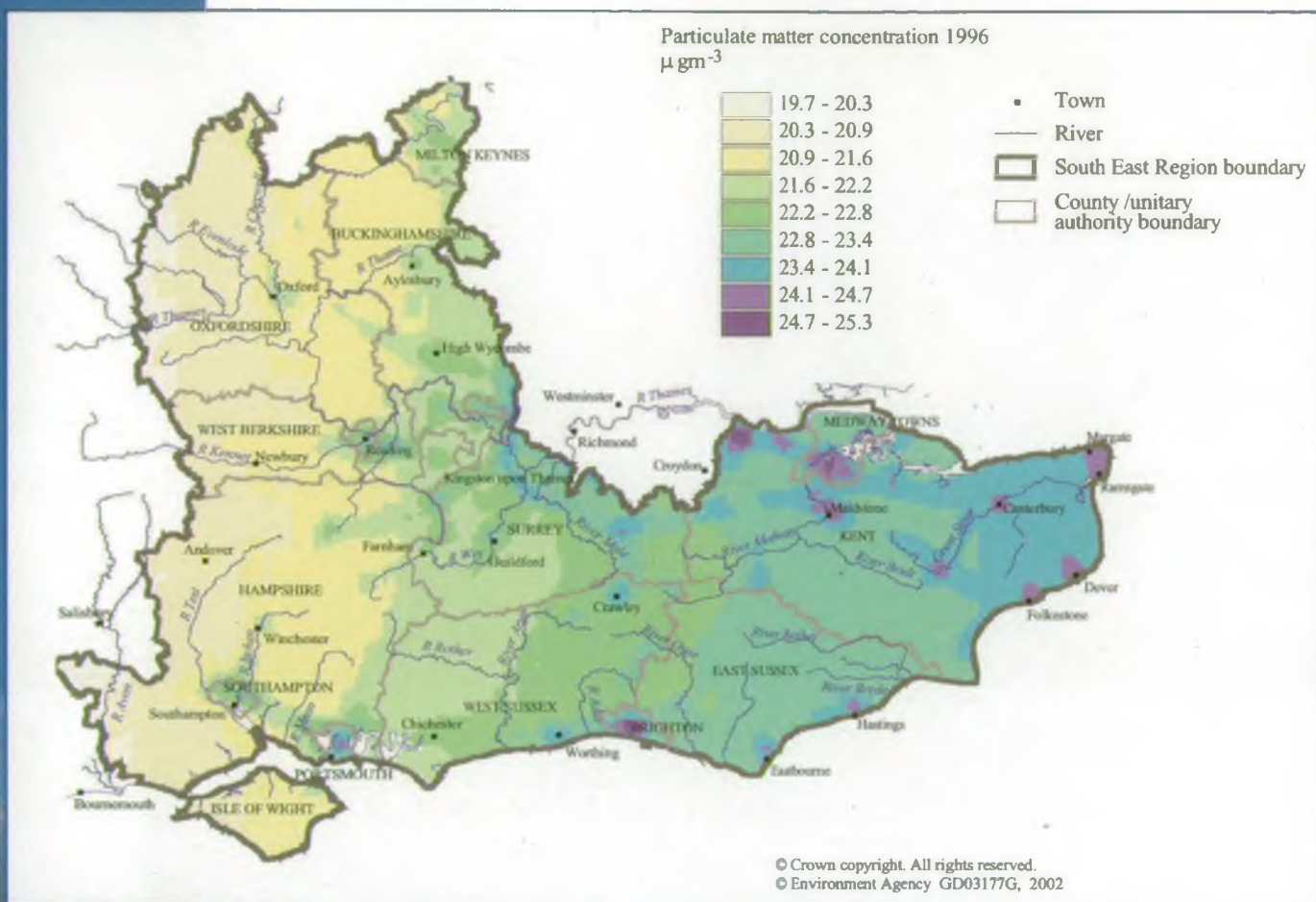
Particulates in the atmosphere are composed of a wide range of materials arising from a variety of sources. Particles including primary particles, arising from combustion sources (mainly road traffic); secondary particles, mainly sulphate and nitrate formed by chemical reactions in the atmosphere; and coarse particles, suspended soils and dusts, seasalt, biological particles and particles from construction work. In the South East Region, emissions from mainland Europe make a significant contribution to secondary particles, which explains the high concentrations shown in Kent and Sussex (see Figure 2).

Ozone is not emitted directly from any man-made source in any significant quantities. It arises from chemical reactions in the atmosphere caused by sunlight. Oxides of nitrogen and Volatile Organic Compounds (VOCs) (produced by combustion, other industrial processes and other activities such as solvent use and petrol distribution and handling) react to form ozone. These chemical reactions do not take place instantaneously and once ozone has been

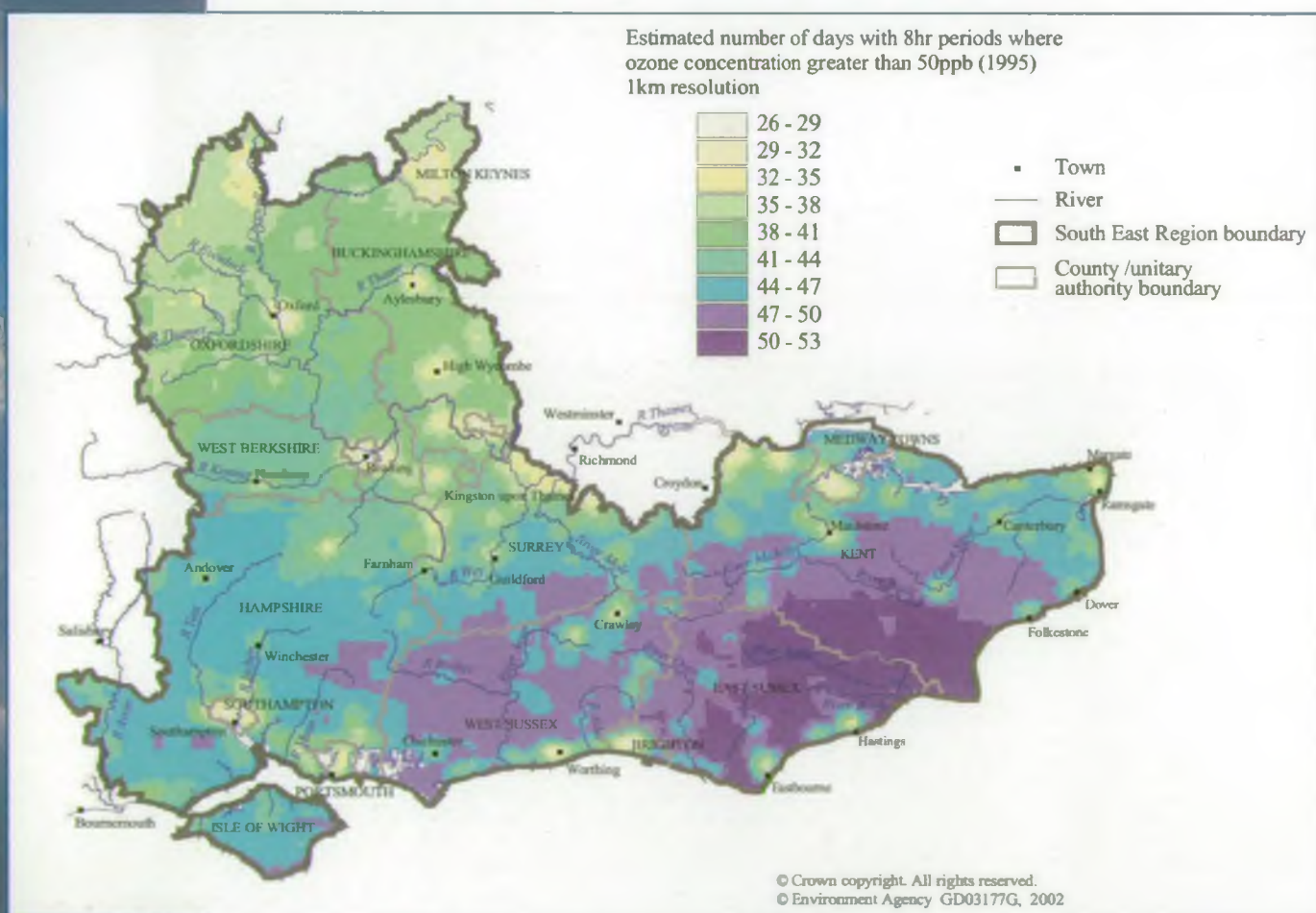
• emissions of all pollutants measured since 1990 have fallen in the South East, however Nitrogen Oxide levels may present a particular problem in the future with predicted increases in traffic. The relatively high concentrations of Particulates and Ozone in the South East are partially a result of the proximity of mainland Europe.

• a higher proportion of households in the Region own three or more cars than any other Region - approximately one in twelve in the South East. After London, the Region has the second highest daily traffic flow - in the South East each person on average travels 6,900 miles by car per year, further than any other Region.



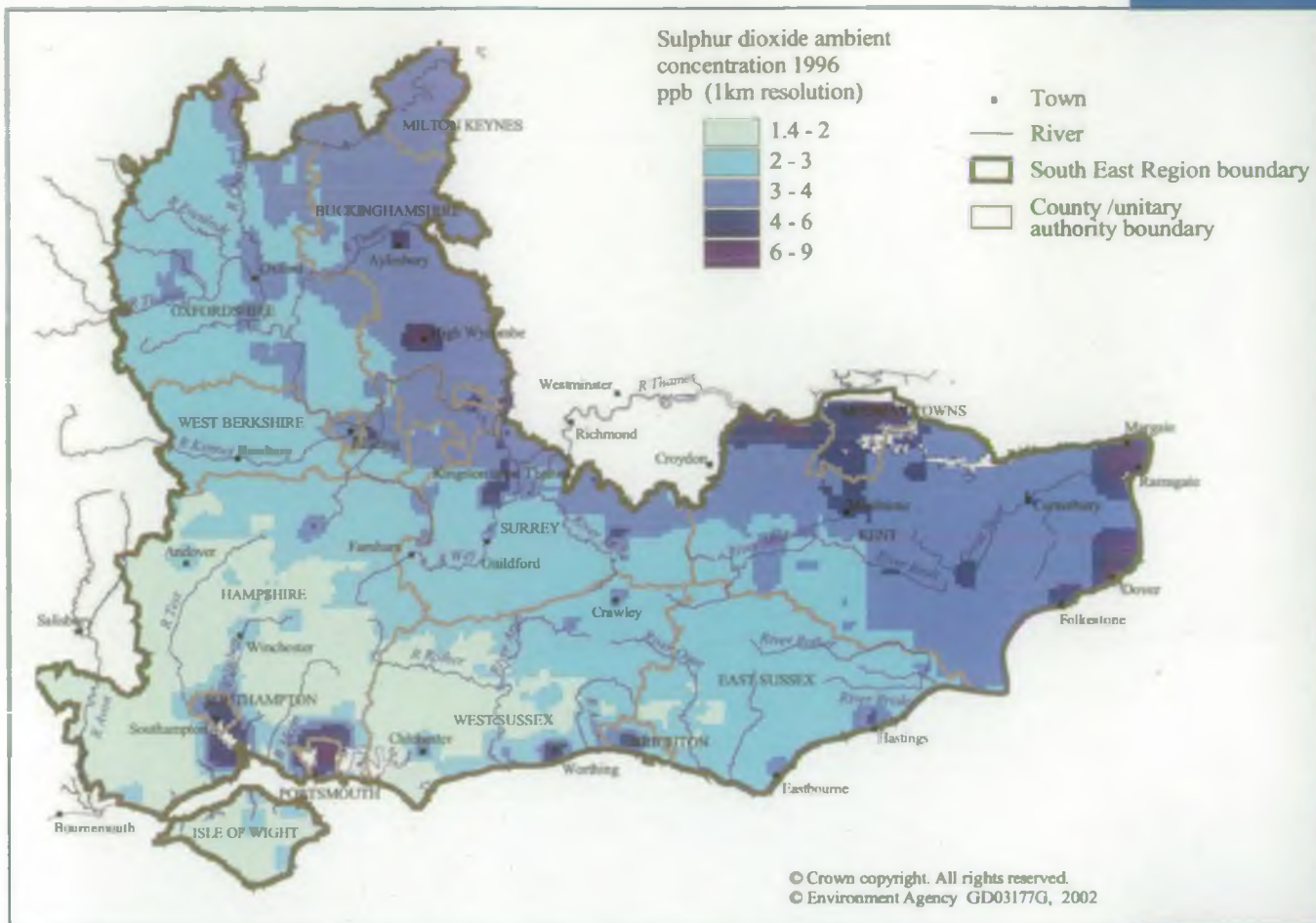


**Figure 2: Particulate annual average concentration in the South East**



**Figure 3: Ozone concentration in the South East**





**Figure 4: Sulphur Dioxide annual average concentration in the South East**

produced it may persist for several days. Therefore, maximum concentrations generally occur downwind of the source areas of the precursor pollutant emissions, this partly explains the higher concentration of ozone in rural rather than urban areas. Lower concentrations are also generally found in urban areas as ozone reacts with nitric oxide from exhaust fumes to form nitrogen dioxide. The concentration of ozone in the South East is also affected by the proximity of mainland Europe (see Figure 3).

The predominant source of sulphur dioxide is the combustion of sulphur-containing fossil fuels, principally coal and heavy oils. Sulphur dioxide dissolves in water to give an acidic solution which is readily oxidised to sulphuric acid. Cleaner fuels have largely replaced coal in the domestic, commercial and industrial sectors and power generation is now concentrated in larger, more efficient stations, generally in rural areas. The map shows higher levels surrounding industrial conglomerations near Southampton and the north Kent coast. The Agency has required the electricity supply industry to implement plans to ensure achievement of sulphur dioxide Air Quality objectives by 2005. The apparent high concentration at ports is a reflection that the sulphur dioxide from cross channel ferries is nationally assigned to their home port. (See figure 4).

All combustion processes in air produce oxides of nitrogen. Road transport is thought to account for 50 per cent of the total UK emissions of nitrogen oxides, the electricity supply industry for 20 per cent and the industrial and commercial sectors about 17 per cent. In major urban areas, road transport will account for a higher percentage. This is reflected by the declaration of a number of Air Quality Management Areas in the region due to nitrogen dioxide emission from traffic around busy roads. The map illustrates the influence of the major urban areas and the road corridors (see Figure 5).

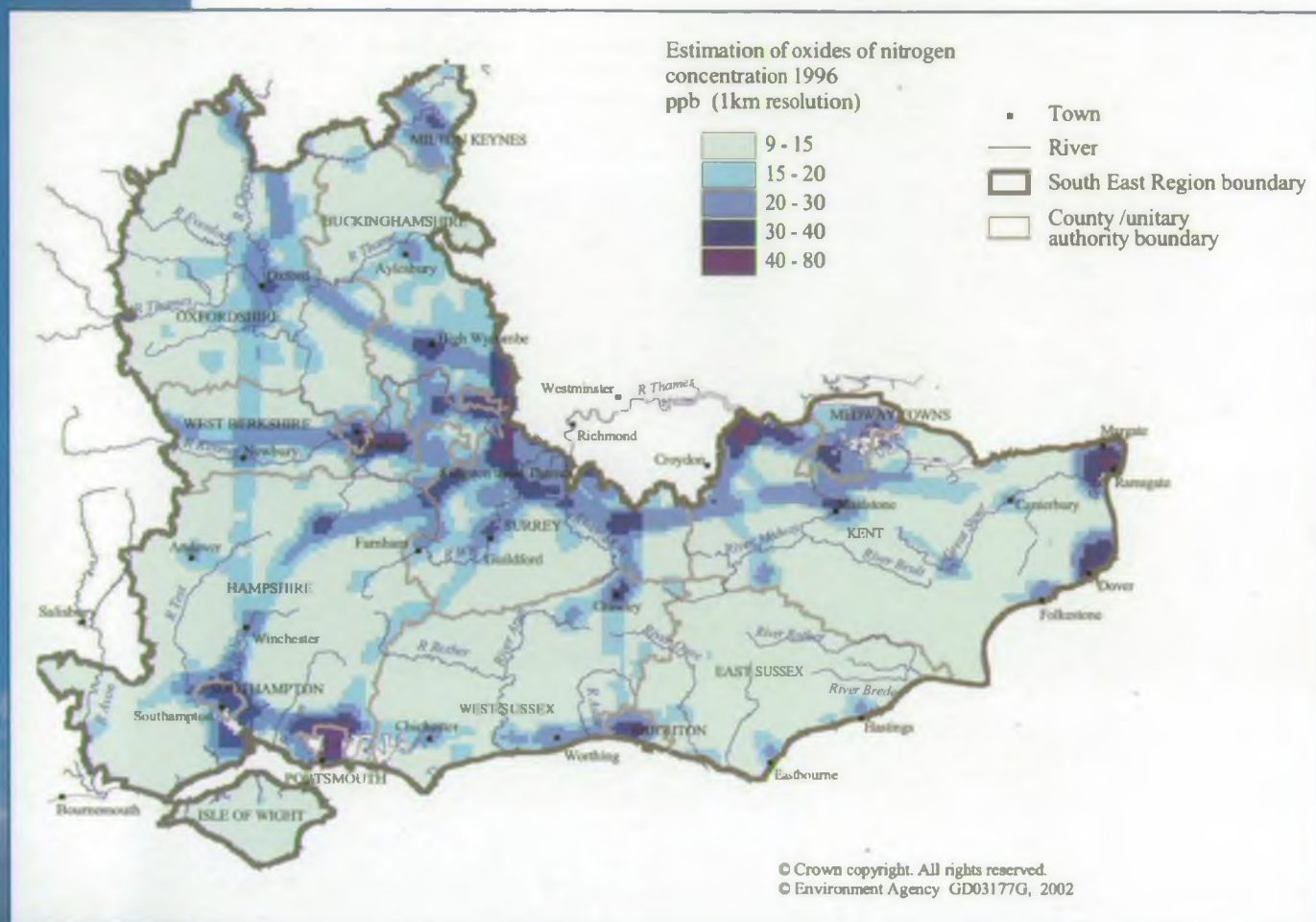
## Indicators

We have selected two indicators to measure air quality:

- *air pollution from major industrial processes; and*
- *days when air pollution is moderate or higher.*

These indicators have been selected to cover both general background air quality and the contribution of key pollutants from processes regulated by the Agency. 'Days when air pollution is moderate or higher' is a headline indicator included by the UK government in *Quality of Life Counts*.





**Figure 5: Oxides of Nitrogen annual average concentration in the South East**

## INDICATOR: AIR POLLUTION FROM MAJOR INDUSTRIAL PROCESSES

### Background to the indicator

The Agency regulates the larger industrial processes which, if not carefully managed, could potentially be the most polluting. Industry produces a significant proportion of the UK emissions of greenhouse gases, acidifying gases and to a lesser degree, fine particles, although each of these have been reduced substantially in the past decade.

The Government's *Air Quality Strategy* sets objectives for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, fine particulates ( $PM_{10}$ ) and sulphur dioxide. Site specific limits and monitoring conditions are set for these pollutants by the Agency, where appropriate, for the processes we regulate. Operators are required to report emission levels to the Agency on a regular basis. This data has been collated for the South East Region and has been compared with national emission levels for these pollutants from all sources (see Figure 6).

The levels of emissions from industrial sources provide an indication of the pollutants for which

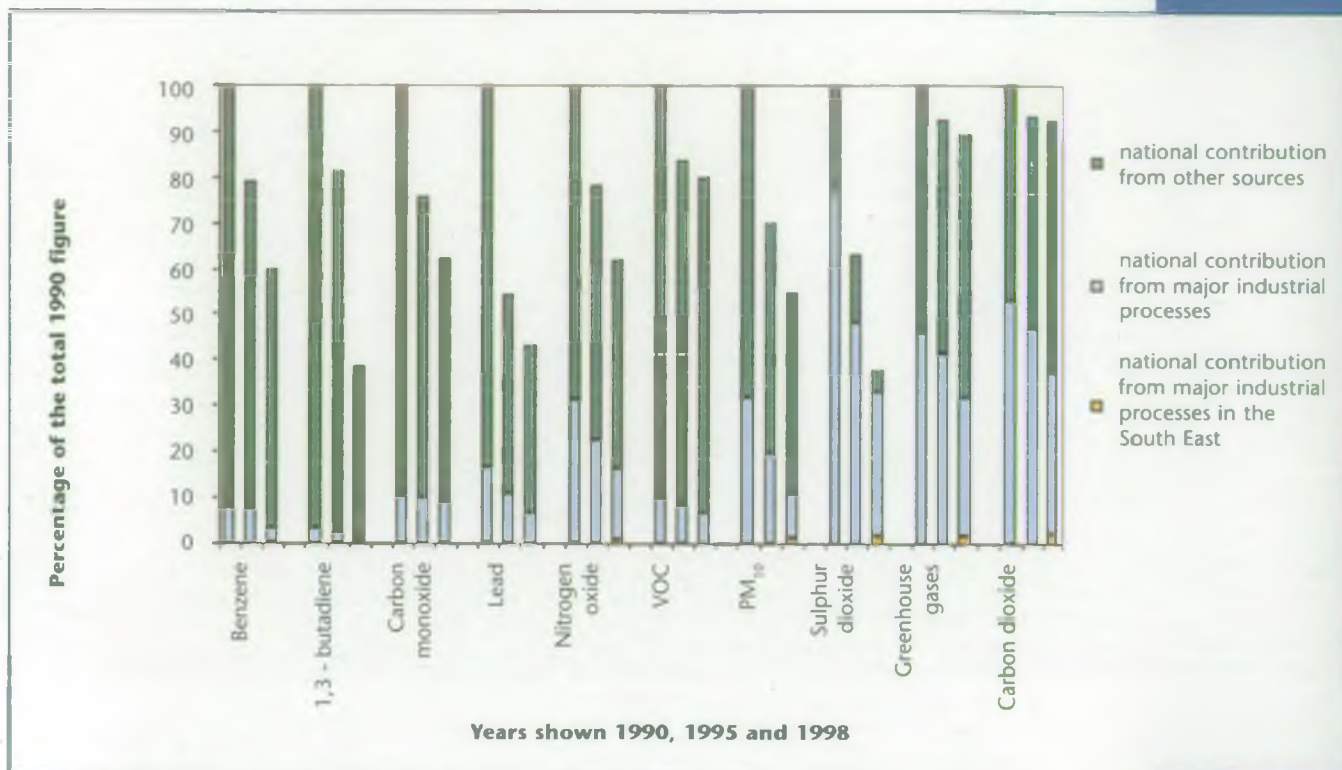
industry's contribution is significant, as opposed to other sources such as road transport. Unfortunately, a breakdown of historic data is not available for the Agency regulated industries in the South East pre-1998.

### Trends

There are a number of trends that can be identified in emissions nationally:

- *the increased use of natural gas as an energy source and the decline in the use of coal has resulted in improved general air quality since the 1970s;*
- *there have been reductions in releases from regulated processes of carbon dioxide (30 per cent), sulphur dioxide (57 per cent), nitrogen oxides (48 per cent) and  $PM_{10}$  (66 per cent) since the introduction of IPC legislation in 1991. Levels of  $PM_{10}$  from industry are now very small, the major source being traffic, as is the case with nitrogen oxides;*





**Figure 6: Air pollution from major industrial processes compared with overall air pollution nationally and in the South East (1990-1998)**

- sulphur dioxide emissions have decreased substantially over recent years from all sectors. As emissions from non-industrial sectors have decreased rapidly following the increase in use of low sulphur fuels however, the proportion attributable to industry has risen. The electricity supply industry power stations have recently had their authorisations varied by the Environment Agency requiring them to address the issue of their sulphur dioxide releases and subsequent effect on air quality;
- industrial benzene emissions are relatively small in most urban areas, the major source being attributed to traffic;
- industry releases of 1,3-butadiene are dominated by transport in all urban areas;
- the industrial contribution to carbon monoxide emissions is relatively small everywhere.

In the South East, trends in emissions include:

- emissions of all pollutants measured have fallen since 1990;
- industry in the South East region generally makes a relatively small contribution towards air pollution compared with other sources.

The data indicates that the Agency's efforts in terms of the processes it regulates should be targeted towards the control of sulphur dioxide, nitrogen oxides and PM<sub>10</sub> along with the maximisation of energy efficient techniques to reduce emissions of carbon dioxide. As more detailed emission information becomes available for the South East in the future, priorities may need to be reassessed.

## Pressures and Influences

The introduction of the Integrated Pollution Prevention and Control (IPPC) regime increases the number of processes regulated by the Agency. Therefore, in the future the proportion of total emissions from Agency regulated processes is likely to increase. However, in real terms emissions from industry are decreasing. The continuing use of BATNEEC for the processes regulated by the Agency delivers progressive reductions in releases to air and thereby contributes to improved air quality. IPPC also specifically addresses energy consumption and energy efficiency. Negotiated agreements should also bring further reductions in carbon dioxide as part of the climate change levy mechanism.

Economic development and the increasing number of households in the region will potentially have an impact on total emissions. The amount and type of industry in the region clearly has an effect on the levels of pollutants. Overall levels are also influenced by trends in emissions from traffic (a number of factors affect emissions from vehicles including: volume of traffic, congestion, fuel type, and engine technology). Several large municipal incinerators will be in operation over the next ten years.

Nitrogen oxide levels may present a particular problem in the future with the predicted increase in traffic. However, emission levels for newer vehicles are becoming more stringent and as the national fleet is gradually replaced with vehicles fitted with catalytic converters, emissions should decline. A concern remains over the high proportion of short journeys that do not allow



efficient emission control mechanisms to operate.

Through Local Air Quality Management, local authorities must identify their air quality hotspots, then plan to tackle them. In drawing up their strategies or action plans, authorities will have to consider the relative contributions of industry and other sources to local air quality pollution and need to ensure that any actions they propose are cost-effective and proportionate. The Agency is a statutory consultee for these action plans and we are working closely with local authorities to address the emissions of these pollutants.

## Targets

The Government's *Air Quality Strategy* sets individual objectives for the key pollutants. These objectives are to be achieved by between 2003 and 2008. National targets for emissions of greenhouse gases have been set under the Kyoto Protocol. These include carbon dioxide, methane, nitrous oxide and halocarbons. These have been converted to global warming potential (GWP) as some have a greater effect than others.

The Agency improves the quality of emissions from major industrial processes through its regulation of these processes and the improvement programmes it requires, as necessary, from operators. These improvement plans set release limits for particular substances for individual sites, in consultation with the operator.

## Actions and Responses

Key actions to reduce the pollution from major industrial processes in the South East include:

- *Agency is implementing the IPPC regime which draws in further industries to be regulated, including intensive farming of pigs and poultry and the food and drink industry. In addition, the wider scope of IPPC includes a requirement to maximise energy efficiency;*
- *Agency to produce guidance for operators and inspectors which details the achievable releases from new plant;*
- *Agency to identify further improvements in emissions from the processes it regulates in the South East. This could be achieved by targeting particular sectors and individual sites as a result of analyses of their contributions to emissions and comparing these with the variability of emissions between operators of similar processes.*

In addition to these actions, those identified below to reduce the number of days when air pollution is moderate or higher will also be relevant to this indicator.

## Monitoring and Review

The data on emissions from Agency regulated processes is regularly collated and this can be updated on a regular basis.



### INDICATOR: DAYS WHEN AIR POLLUTION IS MODERATE OR HIGHER

## Background

The Government's *Air Quality Strategy* sets air quality standards for the protection of human health. The standards are based on the best available scientific and medical advice. The standards should not be regarded as sharp dividing lines between levels of pollution that pose no threat to health and levels that pose a significant threat to health.

This indicator measures the number of days per monitoring site on which pollution levels were above the *Air Quality Strategy* standards.

## Trends

The graph shows the number of days when air pollution was moderate or higher in the South East Region (see Figure 7). The regional data reflects the downward trend nationally in urban areas, however in rural areas it continues to fluctuate.

At urban sites the main cause of pollution was attributed to ozone and particulates, sulphur dioxide has generally fallen to low levels. In rural areas the main cause was ozone along with raised particulate levels, mainland Europe being the main source (as illustrated in Figures 2 and 3).

## Pressures and Influences

This indicator shares pressures and influences with the previous indicator on reducing the pollution from major industrial processes. This includes economic development, the increasing number of households and increasing traffic (see above).

The influence of emissions from mainland Europe on ozone and particulate levels in the South East, particularly in rural areas, makes this an international issue. The outcome of the EC





**Figure 7: Days when air pollution is moderate or higher (1987-1999)**

negotiations on a new EC Ozone Directive, together with the commitments in the UNECE Protocol, will determine what can be achieved in terms of ambient levels of ozone in the UK. The Government considers particles to be one of the most important air quality challenges for the period covered by the *Air Quality Strategy*, this includes reducing concentrations and understanding the health effects. It will be critical to secure Europe-wide action to reduce further emission of pollutants that lead to the formation of secondary particles. This should start to be achieved following the implementation of the Air Quality Daughter Directives in 2001, which establishes limit values for particles, amongst other pollutants.

## Targets

This indicator will have similar targets to the indicator above on reducing the pollution from major industrial processes. These include achieving the objectives in the national *Air Quality Strategy*. The EC UNECE Protocol, Ozone Directive and Air Quality Daughter Directives, for example, will also set targets to be achieved. For those Air Quality Management Areas' designated, action plans are also likely to set targets for improving local air quality.

## Actions and Responses

Key actions to improve air quality in the South East include:

- *local authorities to take account of the national Air Quality Strategy and the location of potentially polluting developments and sensitive developments when preparing development plans in the South East;*

- *local authorities to designate Air Quality Management Areas in the South East where these are identified through the requirements placed on local authorities by the local air quality management system and produce action plans to identify measures to remediate problems in that locality;*
- *to reduce emissions from traffic, local authorities to review existing and forecast levels of traffic and to prepare a report with targets for reducing either existing levels, or their growth rate;*
- *local authorities to develop local transport plans to establish coherent strategies to tackle transport problems, including congestion, air pollution and other negative effects of road transport;*
- *local authorities to have regard to the implications of land use planning on transport and travel patterns in the South East;*
- *businesses to consider the introduction of Green Transport Plans.*

In addition to these actions, those identified to reduce the pollution from major industrial processes above will also be relevant to this indicator.

## Monitoring and Review

The data on days when air quality is moderate or higher is regularly collated and therefore this indicator can be updated on a regular basis.



# PROTECTING AND ENHANCING WATER QUALITY

the quality of the Region's rivers and Bathing Waters is improving - approximately 90 per cent of rivers in the Region are of good or fair water quality. There is also an increasing compliance with EC Bathing Water standards. Approximately 90 per cent of the EC Bathing Waters complied with the standards for the last three years compared with 40 per cent twelve years ago.

## Background

Rivers, wetlands, floodplains, estuaries and coastal waters are an important part of the Region's environment. They can support amphibians, fish and many plant species as well as a variety of invertebrates, which are fundamental in food chains. Large numbers of bird species and rare mammals, such as Water Voles and Otters, are reliant on these habitats. Rivers can also form important links between otherwise fragmented habitats and so act as wildlife corridors.

The Region also supports 30 estuaries which total more than 460km in length. Of particular note are the industrialised Solent Water, which supports valuable commercial shell fisheries, the Medway estuary, with the former naval dockyard at Chatham and extensive saltmarsh habitats in its middle and lower reaches. Equally important as an economic resource, the Region has 82 of the national total of 472 EC designated bathing waters.

In addition to their environmental benefit, rivers and estuaries are a source of water for drinking, domestic, agricultural and industrial use. Along with coastal waters they are also a valuable recreational resource.

Our rivers are subject to numerous stresses, which include pollution, habitat degradation, low flows (caused by drought, abstraction and climate change) and recreational activities. It is important that we are aware of the pressures on them and that we have a reliable picture of their overall 'health' in order to effectively manage water quality.

## Roles and Responsibilities

The Environment Agency is responsible for controlling discharges to the water environment under one of two regulatory systems, the Water Resources Act 1991 and the Environmental Protection Act 1990. The more complex industrial processes that have the greater potential to pollute are authorised under the Environmental Protection Act.

Other discharges, including those from sewage treatment works, require a consent which sets conditions for effluent quality. In addition to this regulatory work and more general pollution control activities, the Agency carries out extensive monitoring to ensure that water quality is maintained or improved. The Agency is also responsible for controlling discharges to estuarine and coastal waters, and for monitoring marine water quality for three miles offshore.

Others with roles relevant to water quality and its management include the companies responsible for the sewerage network and treatment works, other dischargers and the Office of Water Services (OFWAT) which is the financial regulator of the water and sewerage companies. In addition, local authority environmental health departments are responsible for issues of public health.

## Indicators

We have selected two indicators at present to monitor the changes affecting water quality:

- *River and estuarine water quality; and*
- *Compliance with the Bathing Waters Directive.*

Both of these indicators are included, or closely linked to, indicators used by DEFRA, 'rivers of good and fair quality' being a DEFRA headline indicator.

The indicator on river water quality is also further sub-divided into three component parts:

- *Chemical General Water Quality Assessment (GQA);*
- *Biological General Water Quality Assessment (GQA);*
- *Estuarine Classification System.*



## INDICATOR: RIVER AND ESTUARINE WATER QUALITY

### Background to the Indicator

The Agency has a national method for classifying the water quality of rivers and canals known as the General Water Quality Assessment scheme (GQA). This is designed to provide a consistent assessment of the state of water

quality and enable comparisons to be made between different time periods and locations. There are several components to the GQA, which cover a range of ways of describing water quality. These are:



- Chemical GQA** - describing water quality in terms of three chemical measurements (ammonia, dissolved oxygen and biochemical oxygen demand), which reflect the most common types of pollution including discharges of effluent from sewage treatment works, agriculture and industry. Chemical quality is allocated one of six grades (A to F) and is assessed using a three year period.
- Biological GQA** - using macroinvertebrate communities as the indicator of water quality. The species looked for are primarily aimed at gauging the levels of organic pollution (such as sewage effluent) but also, reflect the other factors impacting on the river. Biological quality is calculated on the basis of observed and predicted communities and is allocated one of six grades (a to f).
- Estuary Classification Scheme** - zones are identified and the chemical quality of water is classified in terms of dissolved oxygen levels, and the passage of migratory fish and aesthetic consideration. Classification involves assessment of samples taken in relation to depth and tidal cycles. These zones are classified into four classes (A to D).

Figures 8 and 10 are maps of chemical and biological GQA respectively for the rivers in the South East Region, presenting those that are of good or fair quality and those of poor or bad quality.

The proportion of rivers of different chemical and biological GQA are shown in Figures 9 and 11. The proportions of estuaries of different classes are shown in Figure 12.

## Trends

Water quality in the South East Region is generally good or fair (93 per cent - Grade A to D) and there is an underlying trend of improvement. This increase is partly due to the significant improvements that have been made in the quality of the majority of the discharges to rivers in the Region. However, deterioration and subsequent improvement in water quality can also be a result of the effects of low flow conditions during drought and subsequent recovery in the flow. For example this explains the dip in rivers of good and fair quality in 1995-97.

Most rivers have discharges flowing into them carrying polluting substances, such as waste water, run-off and discharges from farms, and constant effort is required to maintain and wherever possible improve water quality.

There will be insufficient Biological data to show a trend until the results of monitoring in 2000 are available. Current data shows that river quality is good (87 per cent - Grade a to c) and will serve as a reference point as more data becomes available in the future.

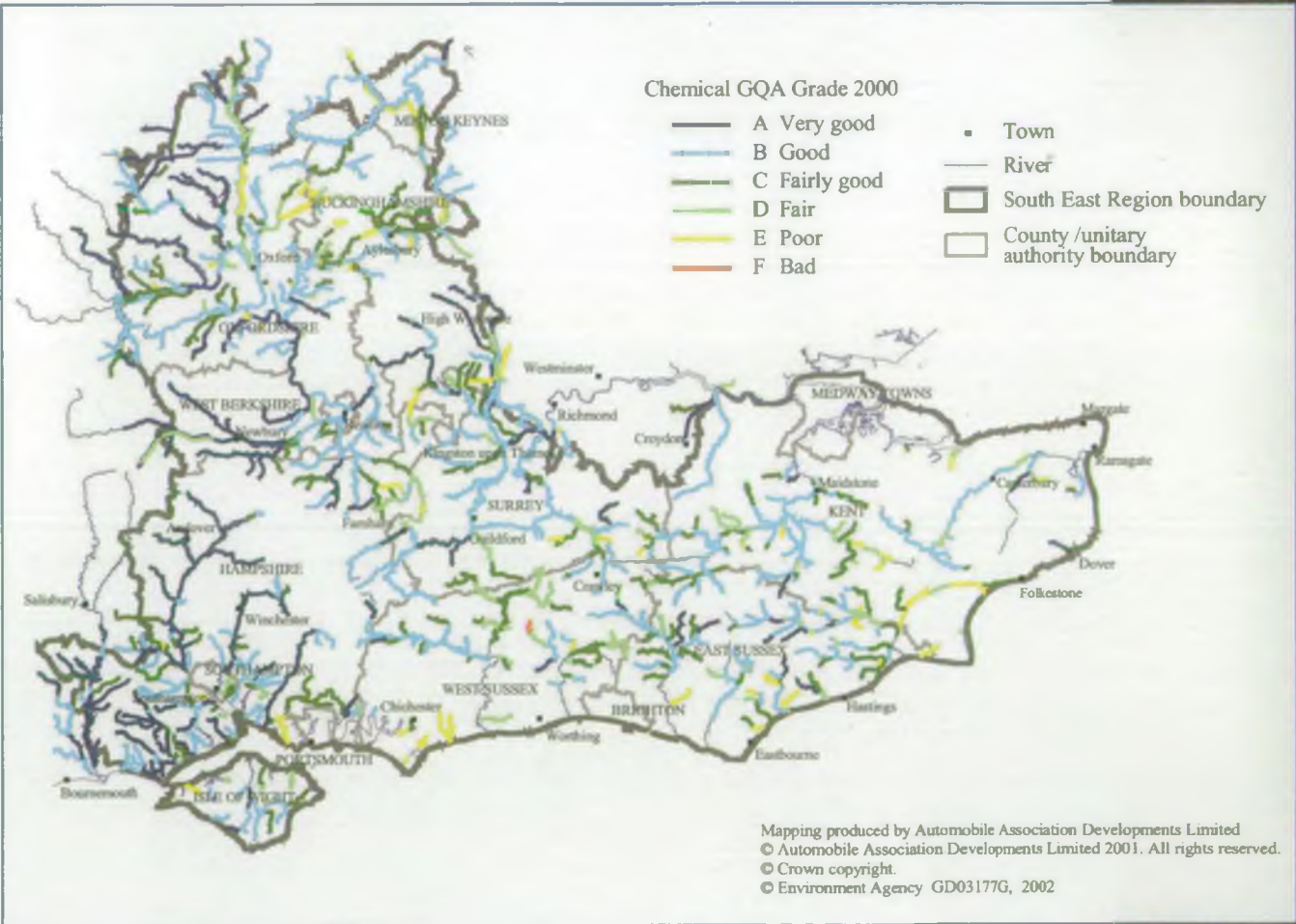


Figure 8: Chemical GQA (1998/2000)



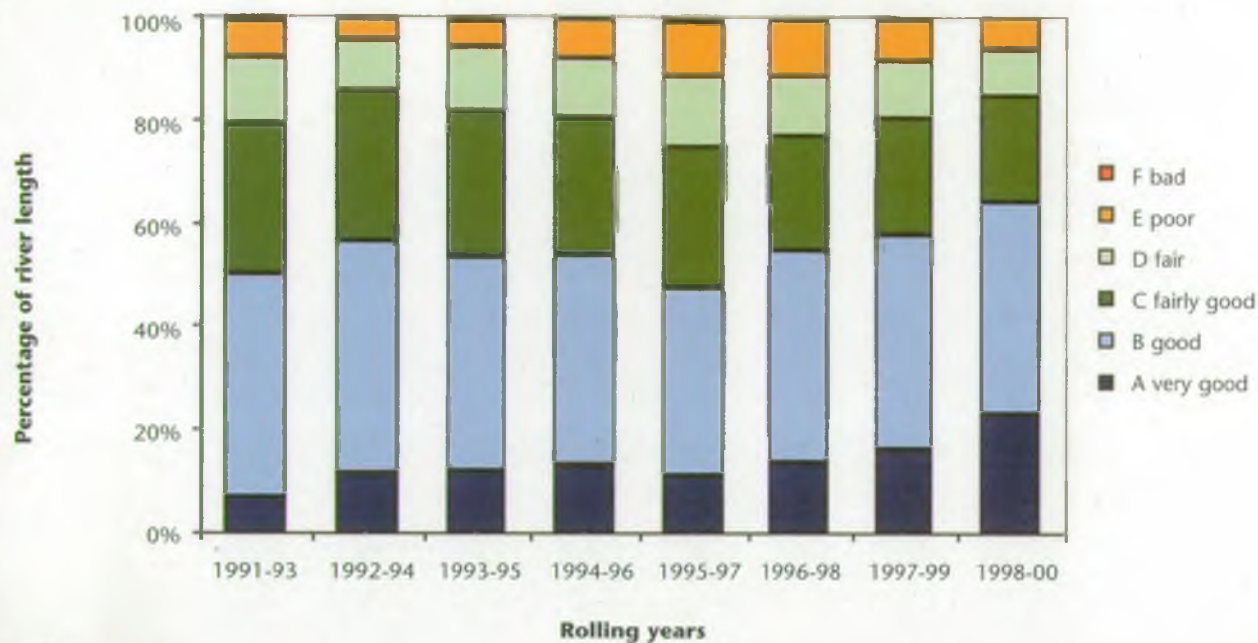


Figure 9: Chemical GQA grades in the South East (1991-93 to 1998-00)

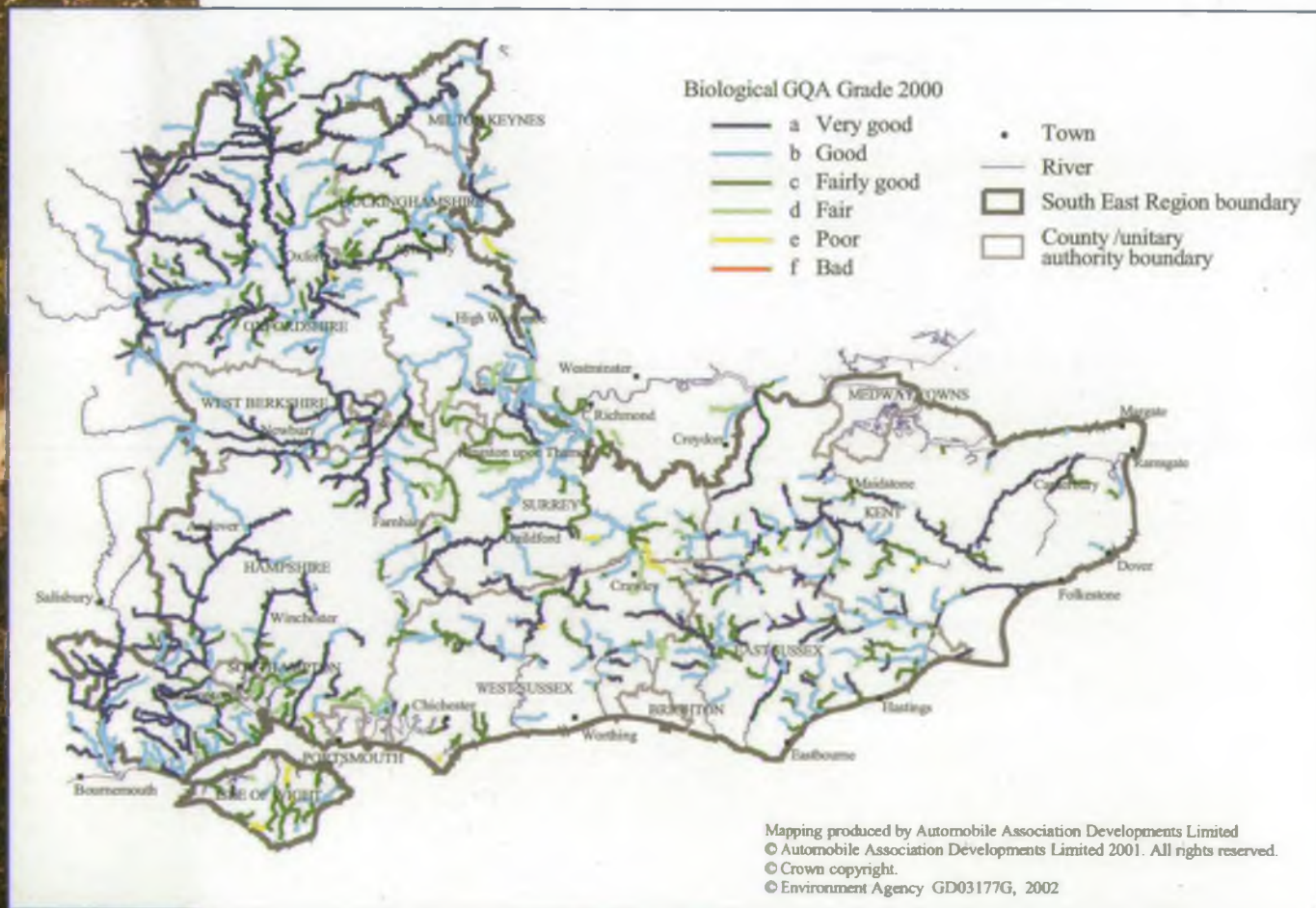
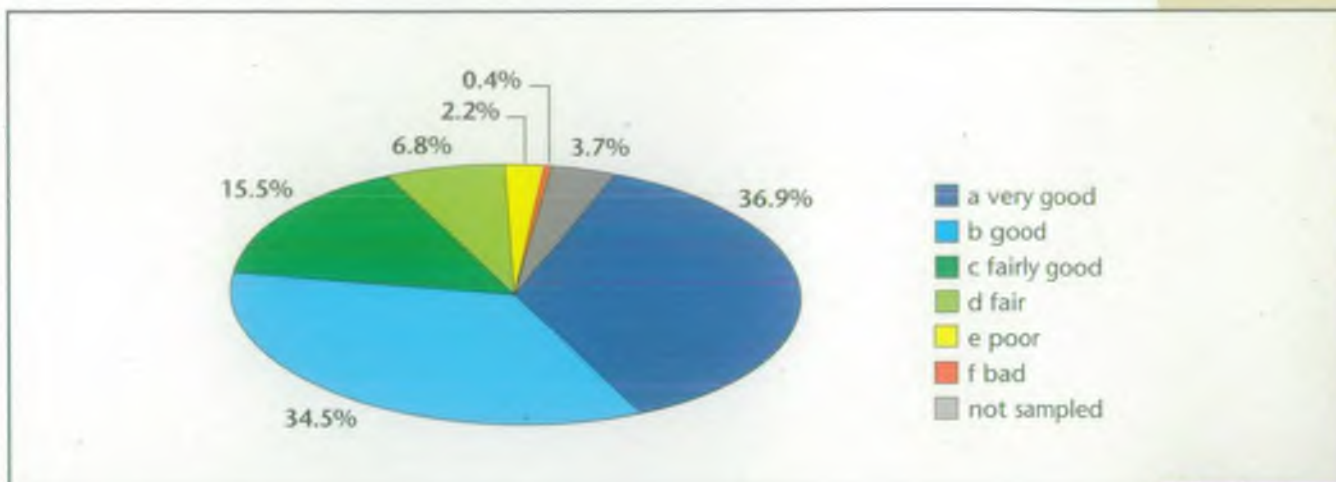


Figure 10: Biological GQA (1998/2000)

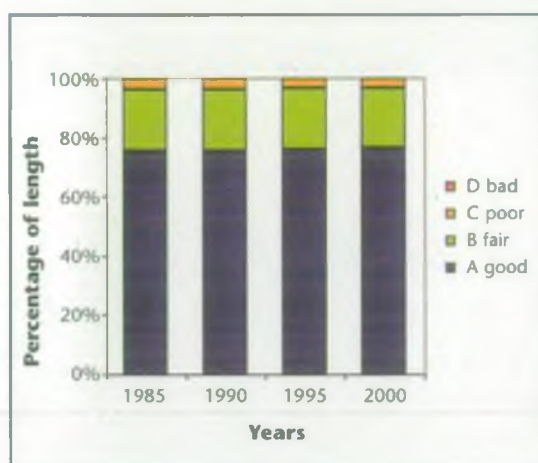
The quality of water in river estuaries shown in figure 12 is consistently good or fair (97 per cent - Grade A to B). (Generally speaking estuarine water quality has improved markedly over recent

years due to improvements in industrial discharges. However, there are still significant intermittent water quality problems particularly at times of low flow during the summer months.





**Figure 11: Biological GQA grades in the South East (1993/95)**



**Figure 12: Estuaries GQA in the South East (1985-2000)**

## Pressures and Influences

There are a number of factors that will influence the improvement of water quality. Significant reductions in the adverse impact of waste water discharges have been brought about by targeting sewage treatment works with poor performance records, inspection of farms and other initiatives to reduce or prevent pollution.

Low flows may be caused by abstractions (for drinking water, irrigation or industrial use). Drought years, such as the hot dry summers of 1995, 1996 and 1997 or times when flows are reduced, may serve to concentrate contaminants and thus worsen water quality, while the actual quantities of pollutant entering the watercourse had not varied. In years with increased rainfall, such as 1994, the reverse will tend to be true.

Although the Region has a low number of industrial discharges to freshwater rivers, its high and growing population means that sewage discharges are numerous and can cause problems both by reducing the amount of oxygen in rivers and by raising nutrient levels.

An additional problem is diffuse inputs from agricultural run-off, leading to excessive plant

and algal growths. This may indirectly affect water quality.

## Targets

The Environment Agency has set water quality targets for all rivers, these are known as River Quality Objectives (RQOs). They are used for planning the maintenance and improvement of river quality and provide a basis for setting discharge consent standards.

These objectives are based on the uses that are made of rivers. Achieving them will help to sustain the use of rivers for recreation, fisheries and wildlife and protect the interests of abstractors. The objectives in current use are based on a water quality classification scheme known as the River Ecosystem classification (RE).

The scheme comprises of five classes, which reflect the chemical quality requirements of communities of plants and animals living in our rivers. The standards defining the classes reflect differing degrees of pollution by organic matter and other common pollutants.

- RE1** Water of very good quality suitable for all fish species
- RE2** Water of good quality suitable for all fish species
- RE3** Water of fair quality suitable for high class coarse fish populations
- RE4** Water of fair quality suitable for coarse fish populations
- RE5** Water of poor quality which is likely to limit coarse fish populations

Compliance is reported annually. Where river quality does not meet the objective set, a clear improvement plan must be established. This may require improvement in discharges to the river. Many improvements have been agreed in the current round of asset management planning (AMP) with the water companies.

The aim is for all rivers to comply with their objective. Timescales depend on the scale of improvements required. Continual monitoring,





reassessment and improvement are also essential to prevent satisfactory rivers deteriorating.

## Actions and Responses

The Agency will continue to monitor and improve water quality. Actions will focus on the need to:

- *deliver compliance with standards according to agreed time-scales for improvement schemes as part of the AMP process;*
- *maintain satisfactory water quality;*
- *target additional investment to achieve guideline standards where this can be justified through an analysis of costs and benefits;*
- *continue to assess what can be done to prevent pollution from diffuse sources that results in failure to meet the standards;*
- *instigate research programs to address long-term water quality problems.*

## Monitoring and Review

As we have previously indicated the Agency will continue to monitor water quality of rivers, lakes and estuaries on a regular basis.

Rivers are routinely monitored and assessed annually using the last three years data. Biological and estuarine surveys are completed once every five years.

This monitoring will allow for management decisions to be based on accurate and relevant information and for review against the targets set under the RQO process. This will also allow for targeted action through the Asset Management Plan process of water/sewerage companies and action to improve other industrial discharges.

### S

## INDICATOR: COMPLIANCE WITH THE BATHING WATERS DIRECTIVE

### Background to the Indicator

The mandatory standards set by the EC Bathing Water Directive (76/160/EEC) are to protect the public and avoid sewage contaminated bathing water. The South East Region has 82 EC designated bathing waters. Tourism is important to local economies and the Region as a whole and the quality of bathing beaches is of major concern. Failure to comply with the Directive will have a negative impact on tourism and hence local economies.

Southern Water has had to improve sewage treatment and disposal to ensure that their discharges do not cause bathing waters to fail. The proposed costs and timings of investments in environmental improvements to the sewerage infrastructure have to be agreed by OFWAT, DEFRA and the Environment Agency. This constitutes the AMP (Asset Management Plan) process that has a quinquennial cycle. AMP1 was 1990 to 1995, AMP2 1995 to 2000 and AMP3 is 2000 to 2005. The Environment Agency is currently monitoring progress in achievement of AMP3 and is commencing negotiations to secure environmental improvements in AMP4 (2005 to 2010). The water utilities customers ultimately meet these costs.

The Environment Agency enforces the implementation of the Directive. The bathing season runs from 15 May to 30 September and sampling begins two weeks before the start of the season. A minimum of 20 samples are taken at regular intervals to monitor the quality of each of the designated bathing waters in the South East Region. All samples are taken at

predetermined points off the beach where the average density of bathers has traditionally been highest.

Each sample is analysed and compared against the standards set out by the Directive to give an indication of the cleanliness of the bathing water. In order for a bathing water to comply with the Directive, 95 per cent of samples taken must meet these standards. Compliance with the Directive is reported to the EEC.

The Tidy Britain Group Seaside Award Scheme and the European Blue Flag Scheme are both high profile awards that are locally important in attracting tourist trade. Local Authorities must apply to the Tidy Britain Group for these awards using, in part, bathing water quality data collected by the Environment Agency to support their case.

### Trends

Bathing beaches are getting cleaner. The trend is of increasing consistency of compliance, that is when a bathing water site has complied for three consecutive years (see Figures 13 and 14).

As major investment schemes are completed there have been steady improvements in the overall quality of bathing waters and this is expected to continue. The percentage of bathing waters consistently failing has reduced and is now zero (18.5 per cent in 1988-90 to 0 per cent in 1999-01).



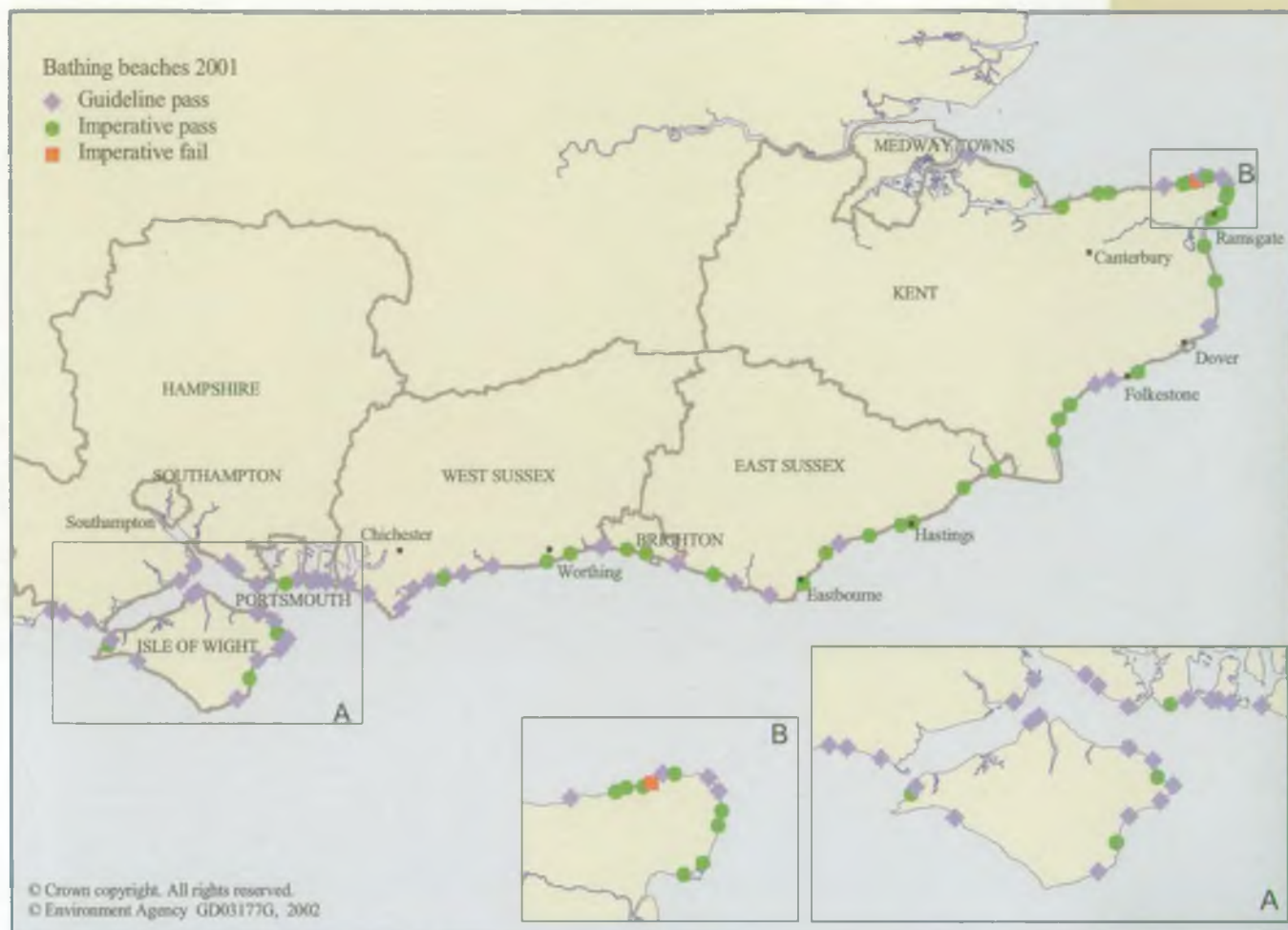


Figure 13: Bathing beaches sampled and pass/fail for 2001

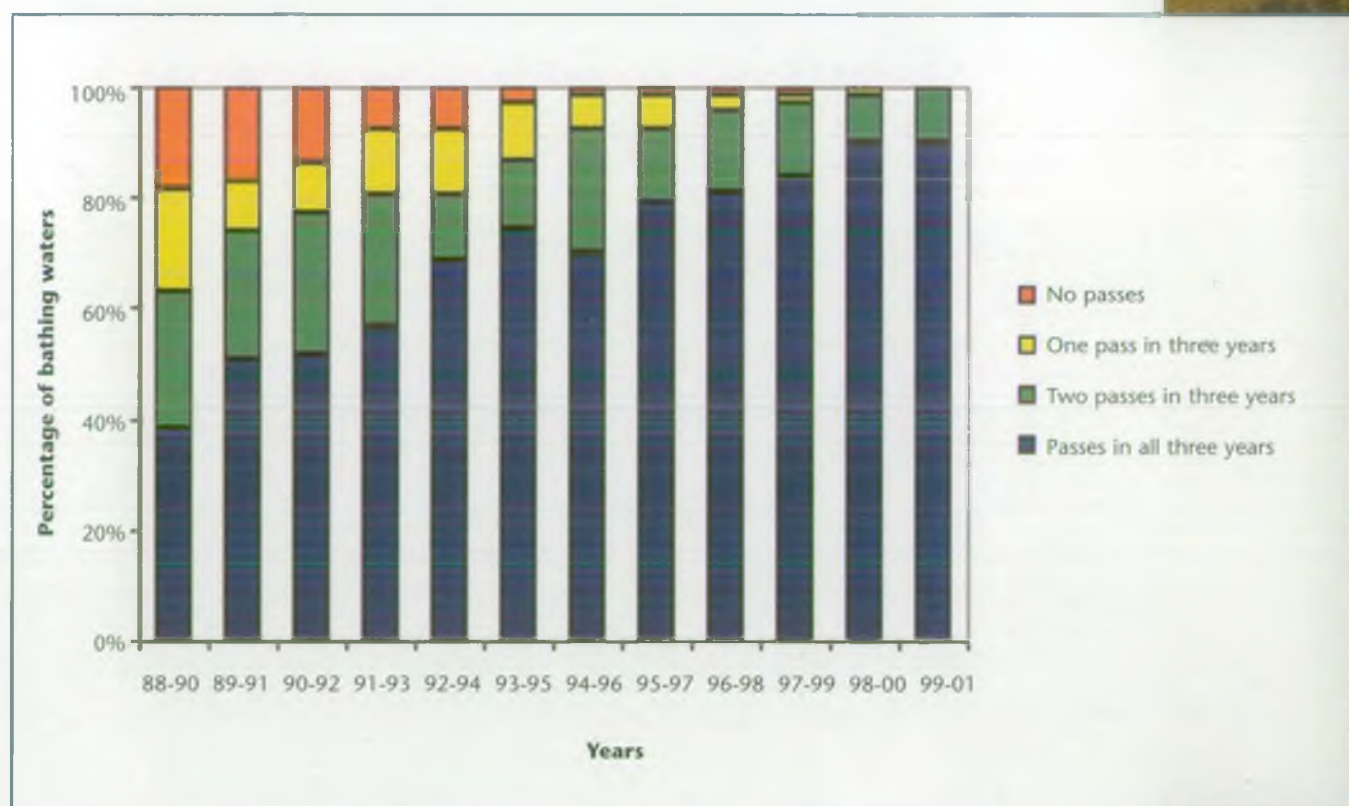


Figure 14: Compliance with the EC Bathing Waters Directive (1988-90 to 1999-01)





## Pressures and Influences

Schemes to improve waste water treatment and disposal have been and will be the major factor in improved Bathing Water Directive compliance. Other Directives such as the Urban Waste Water Treatment Directive and the Shellfish Waters Directive have also either directly or indirectly been drivers of bathing water quality improvements. Improvements will continue as Asset Management Plan 3 (AMP3) schemes are completed.

The proposed revision of the Bathing Water Directive is a move to risk-based monitoring based on a robust statistical framework. If adopted it would provide a more reliable assessment of bathing water quality.

Bathing water quality will also vary naturally with the prevailing weather conditions. Overcast summers result in poorer water quality than dry sunny summers.

In many coastal towns there are combined sewerage systems which in times of heavy rainfall can overflow carrying a mixture of rainwater and untreated sewage into surface waters. Where these finally discharge they can have an adverse effect on bathing water quality. Although generally less significant, diffuse pollution can also affect compliance.

## Targets

The Agency will continue to investigate possible sources of contamination at all non-compliant bathing waters with a view to controlling them where statutory powers allow. In the longer term we would wish to see all beaches complying in all years. Current mandatory standards are now almost completely met, but there is further investment planned to raise standards to the higher guideline compliance standard.

## Actions and Responses

It can be clearly seen that as more improvement schemes are completed the percentage of bathing waters consistently passing is increasing and the number of borderline bathing waters has decreased. The Agency will continue to investigate possible sources of contamination at all non-compliant bathing waters with a view to controlling them where statutory powers allow. Actions will focus on the need to:

- *maintain existing good quality;*
- *deliver compliance with standards according to agreed time-scales for outstanding improvement schemes;*
- *examine options for upgrading coastal sewerage systems where combined sewer overflows (CSOs) continue to cause problems;*

- *target additional investment to achieve guideline standards where this can be justified through an analysis of costs and benefits;*
- *continue to assess what can be done to prevent pollution from diffuse sources that results in failure to meet the standards;*
- *instigate research programs to address long-term water quality problems.*

Nationally, the Environment Agency is currently carrying out a joint project with DEFRA and UK Water Industry Research (UKWIR) to test two new approaches to the classification of bathing waters, based on identification of potential sources of faecal contamination and their risk to the bathing water. In the South East Region the trial has been undertaken at Gurnard on the Isle of Wight. This project will influence the revision of the Bathing Water Directive.

## Monitoring and Review

As previously highlighted monitoring will continue on a regular basis to comply with the EC Directive. This information will also allow for continued discussion over the developing AMP4 programme with the Water Companies to ensure that future investment will be targeted for maximum environmental benefit.



# MAINTAINING AND ENHANCING BIODIVERSITY

## Background

Biodiversity in its broadest sense, is the variety amongst living organisms, including within species, between species and the differences between habitats and ecosystems. Enhancing biodiversity is therefore not simply a matter of ensuring the maximum number of different species and varieties that would naturally occur in such an area are present.

The UN Convention on Biodiversity was signed by more than 150 heads of Government at the Rio Earth Summit in June 1992. The UK published four strategies in response to the Earth Summit including a *Biodiversity Action Plan* (DoE, 1994). The UK Steering Group Report (DoE, 1995) identified 1,250 species considered to be threatened. From these 'Species of Concern', a list of some 116 Priority Species has been identified which have targeted actions.

The Environment Agency has lead responsibility for 39 Priority Species and five habitats of wetland character. In the South East, the Agency's Thames and Southern Regions are contact point for 14 of these Priority Species and three of these habitats. In addition, the Agency

is involved with the preparation and implementation of local Biodiversity Action Plans and is a member of the South East England Biodiversity Forum (SEEBF), which is a liaison body that aims to provide a focus for furthering Biodiversity in the South East of England.

For the purpose of this report we have focused on just four of these species, the otter, water vole, southern damselfly and white-clawed crayfish, and one habitat: chalk rivers. The second part of this section looks closely at the habitat element of the overall subject of biodiversity.

## Indicators

We have selected three indicators at present to monitor the pressures affecting biodiversity:

- *distribution of key species - otter, water vole, southern damselfly, and white-clawed crayfish;*
- *numbers of salmon and sea trout; and*
- *status of key habitats and sites protected under the Habitats Regulations.*

the high quality of the natural environment within the Region is reflected in the large areas of land designated for amenity or intrinsic value - almost a third of the Region is designated as an Area of Outstanding Natural Beauty and over 700 Sites of Special Scientific Interest (SSSI) in the Region cover nearly six per cent of the land area.



### INDICATOR: DISTRIBUTION OF KEY SPECIES - OTTER, WATER VOLE, SOUTHERN DAMSELFLY, AND WHITE-CLAWED CRAYFISH

## Distribution of Otter

### Background to the Indicator

Otters are rare in the Region, but as a top aquatic predator are excellent indicators of good bankside and wetland habitat and river quality. To thrive, otters need good fish stocks and numerous resting sites and females need undisturbed sites for breeding. Otters have a high public profile, are listed both on the UK Biodiversity Action Plan (BAP) and in the Habitats Directive (1992) and are fully protected under the Wildlife and Countryside Act (1981).

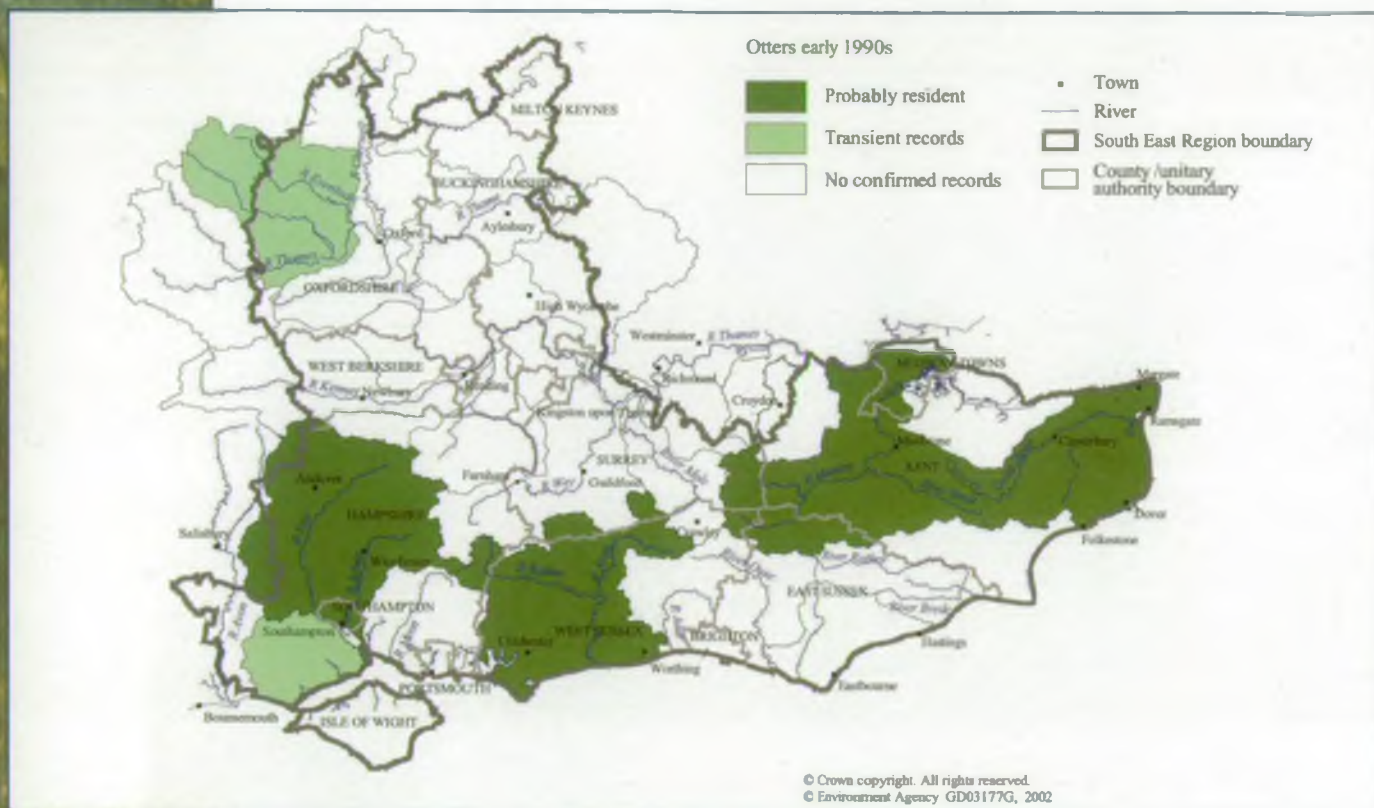
Otters suffered a population collapse across most of England in the 1960s following the introduction of persistent pesticides, although they were also declining through habitat loss as development pressures increased. Otters survived across the Region in low numbers where high quality habitat remained. The persistent chemicals involved are now banned from use and most have subsequently reduced in the environment. Consequently otters are now recolonising from their strongholds in

Wales and the South West, assisted by significant conservation action.

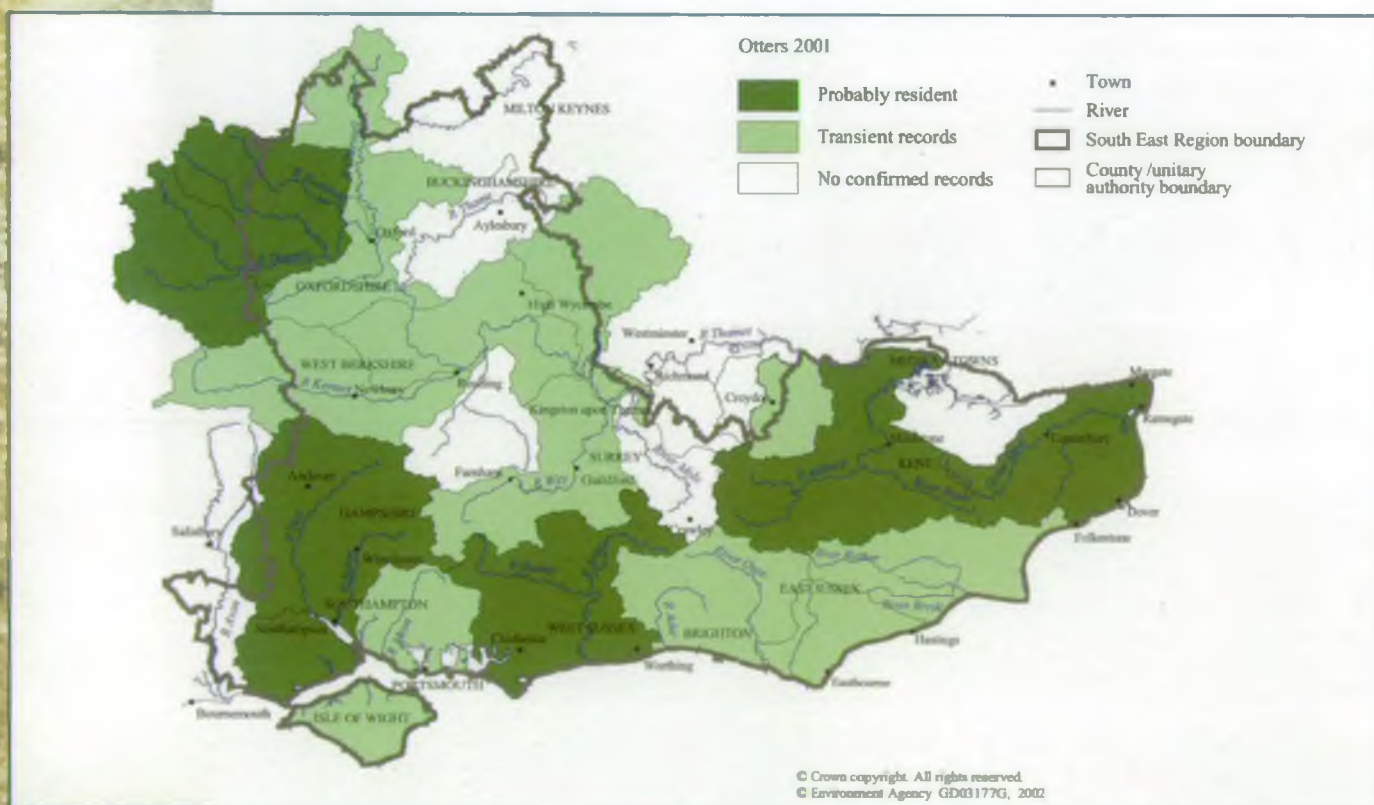
Otters have large ranges and may travel several kilometres each night. Road and rail crossings where bridges and culverts do not allow safe passage are hazardous and several otters have been reported killed in the Region in recent years. Such losses may be critical in limiting the expansion of the otter population and indicate the impacts of poorly designed and expanding development.

The maps show distribution of otters by river catchment in the early 1990s and in 2001 (see Figures 15 and 16). These maps are based on a national otter survey in the early 1990s and local surveys by other specialists in 2000/2001. It should be noted however that while whole catchments are shaded, otter distribution is usually concentrated around river corridors and the coast.





**Figure 15: Otters in the South East (early 1990s)**



**Figure 16: Otters in the South East (2001)**

## Trends

Otters are becoming more frequent and widespread across the South East Region, as habitats and environment quality are actively improved and colonising animals arrive from the South West and catchments neighbouring the Region. There have also been a number of

independent releases of captive-bred animals by The Otter Trust in the region. Evidence of otters is now regularly found in the Itchen, the New Forest (Hampshire), the Arun (Sussex), the Medway and Stour (Kent) and the Upper Thames and its Oxfordshire tributaries.



## Pressures and Influences

Otter populations are continuing to expand naturally from their strongholds. Natural recovery is likely to be slow, the South East being distant from otter strongholds. A general lack of suitable riparian habitat has been identified as a key limiting factor. In the past captive-bred animals have also been released into the wild at a few locations in the South East, augmenting the local populations.

However, re-colonisation of their whole historic range is unlikely due to development in the intervening years since their decline. The high population density and development pressure in the Region makes special provision for otters difficult and more important if the Government's UK BAP target of restoring otters to their 1960 range and population by 2010 is to be achieved.

Improvements to riparian habitat to provide resting areas, secure breeding sites, enhanced fish populations through water quality improvements and habitat management will help the otter population. Running counter to this is the loss of riparian habitat through inappropriate land drainage, intensive agriculture, fragmentation of the river corridor habitat by development and disturbance by increased access to riversides, all of which have a detrimental effect on otters.

Fish traps, particularly fyke nets that are used to catch eels, can be a drowning hazard to otters if a guard is not fitted. There are also potential problems at fish farms where economic loss by otter predation is possible. Otters also suffer disturbance caused by hunting mink with dogs, especially in Hampshire and Sussex.

## Targets

The aim is to meet the BAP target of restoring by 2010 breeding otters to all catchments and coastal areas where they have been recorded since 1960. The Agency is seeking to meet this through active habitat enhancement supporting natural recovery. However, achieving this target for the whole of the South East Region is limited by the rate of recolonisation, the loss of habitat to development since 1960 and the risk of road casualties limiting the rate of dispersal and recolonisation. Increased inappropriate development would further impact on this species.

## Actions and Responses

The Environment Agency has supported a collaborative project, the 'Otters and Rivers Project' with the Wildlife Trusts in the South East since 1991. This project has raised awareness of the otter's needs and has undertaken wide ranging habitat improvements, survey, monitoring and road crossing mitigation work across the Region to provide suitable conditions for otter colonisation.

Future actions will focus on the need to:

- *Continue to support the Otters and Rivers Project and other otter focused project work.*

- *Protect headwater streams as effective corridors between catchments and areas of high quality habitat.*
- *Influence future development proposals to include habitat provision and mitigate against the adverse impacts and threats posed to otters e.g. roads.*
- *Ensure that the use of otter guards on eel fyke nets and mink traps is being promoted and mitigation advice to fish farms is being provided.*

## Monitoring and Review

The national otter survey planned for 2001 was unable to be carried out due to the restrictions on access to the countryside resulting from the outbreak of Foot and Mouth disease. Regional monitoring is ongoing as part of the Otters and Rivers Project.

## Distribution of Water Vole

### Background to the Indicator

Water voles are much rarer in the Region than they were ten years ago and if the current rate of decline continues they may become extinct over much of their former range within the next ten years. Strongholds are noted on some kept rivers such as the Itchen (Hampshire), and the Kennet (Berkshire), in suburban areas where mink are scarce and in coastal grazing marsh sites such as the Inner Thames Marshes. To thrive, water voles need good riparian habitat and established soft banks to burrow in. Luxuriant fringing vegetation also provides food and cover in which to avoid predators, especially the American mink, which is a major threat to the water voles' survival.

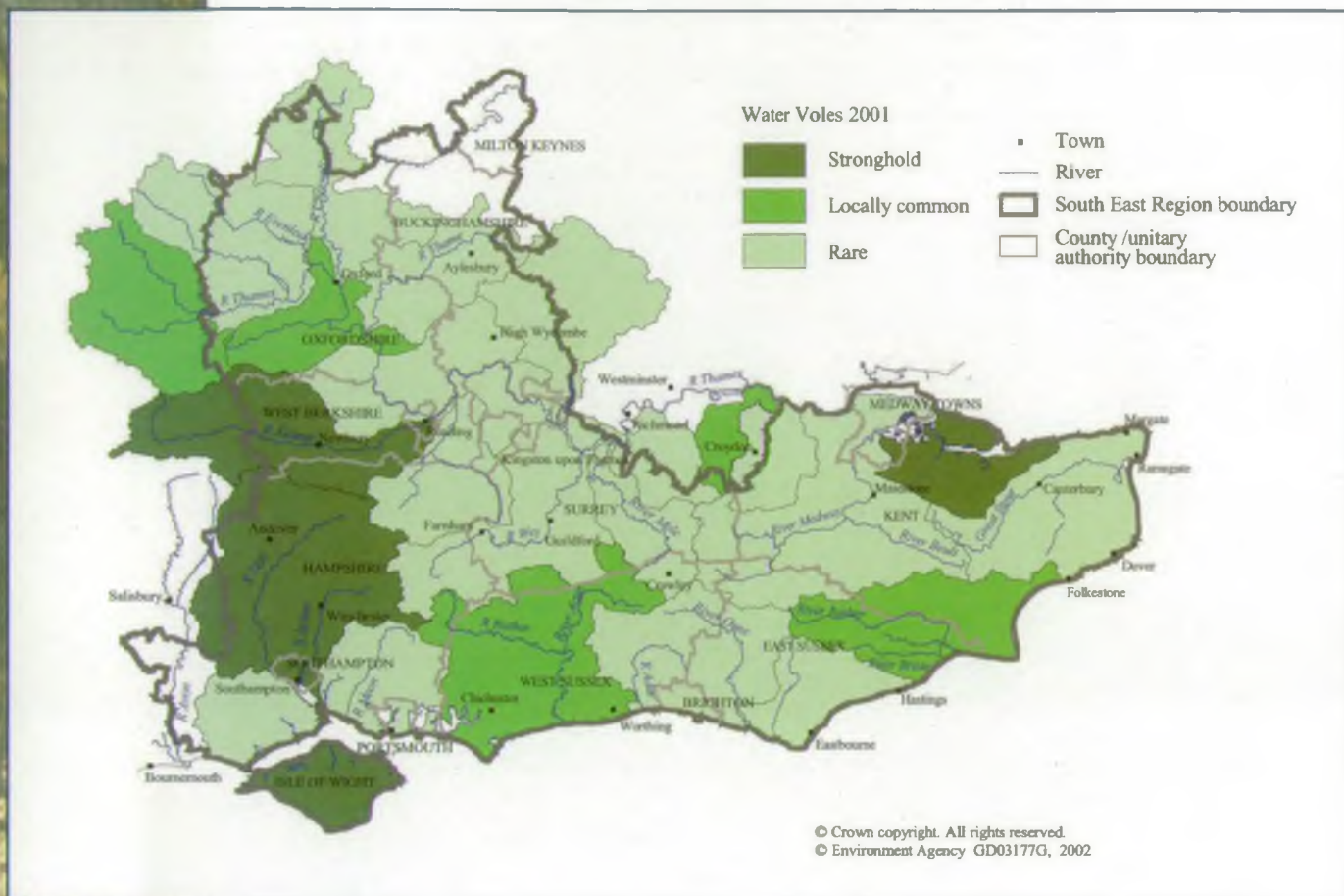
Water voles have a high public profile and are listed on the UK Biodiversity Action Plan. Their habitat is protected under the Wildlife and Countryside Act. Ratty in the childrens' classic 'Wind in the Willows' was in fact a water vole. As the water vole populations become more fragmented and isolated from one another, the rate of decline is likely to accelerate. The best populations survive where there are clusters of colonies and where mink are either controlled or absent.

The map shows the distribution of water vole by river catchment (see Figure 17). While the whole area is shaded, water vole distribution is usually restricted to river corridors and the coastal floodplain. Isolated colonies may survive in urban centres where human and dog disturbance reduces the predation pressure on the species by mink.

Healthy populations of water vole continue to be found on the kept rivers such as the Kennet (Berkshire), Test and Itchen (Hampshire), the watercourses of the Isle of Wight, in isolated pockets along the Chichester coast and the grazing marsh ditches of Sheppey, Dartford, North Kent and Romney (Kent).







**Figure 17: Water vole in the South East (2001)**

## Trends

Water voles are Britain's fastest declining mammal and the situation has now developed into a serious population crash. Two national surveys carried out by the Vincent Wildlife Trust in 1989-90 and 1996-98 show that the population has declined by 88 per cent in only seven years. According to the survey report the population decline has been most severe in the north and south-west of England. Across the South East Region the species has disappeared from three quarters of its previously known sites within the last decade.

## Pressures and Influences

Natural recovery is likely to be slow with the species being poor at dispersing long distances. A general fragmentation of suitable riparian habitat has been identified as a key limiting factor and the widespread presence of mink will continue to exacerbate the situation.

Pressure on the riparian environment from the high human population density, development and increasing recreational impacts will limit increases in the water vole population, and may accelerate decline unless mitigation measures are implemented. This makes special provision for water vole habitat more important if the BAP target of restoring water vole to their 1970s range and population by 2010 is to be achieved.

The widespread distribution and abundance of mink is a serious problem to water vole and unless this is addressed the prospects for water vole recovery are severely limited.

## Targets

The aim is to meet the UK Government's Biodiversity Action Plan (BAP) target of maintaining and restoring by 2010 water vole populations to all catchments and coastal areas where they have been recorded in the 1989 - 1990 baseline survey.

## Actions and Responses

Future action will focus on the need to:

- *continue to support collaborative projects, to raise awareness of the water vole's needs;*
- *undertake wide ranging habitat improvements and other work across the Region to provide suitable conditions for the species;*
- *protect headwater streams, ditches and ponds as effective corridors between catchments;*
- *identify areas suitable for colonisation where the species is still present and mitigate where loss has occurred.*



- *locally important 'key sites' should be identified for water voles and included in local planning policy.*
- *introduce carefully targeted catchment-wide mink control as a conservation tool to maintain important water vole populations and to enable their expansion.*

## Monitoring and Review

National monitoring of water vole has been carried out by the Vincent Wildlife Trust through a sampling survey intended to show trends in populations (2970 sites across England, Scotland

and Wales). The baseline survey was established in 1989-90, repeated 1996-98 and the next survey is due in 2005.

At the local and regional level, more detailed surveys have been carried out by the Wildlife Trusts and the Environment Agency in order to identify key populations of water voles (a priority biodiversity action). These populations should be surveyed annually/ biannually to monitor their survival. Also at the local level, habitat enhancement and water vole mitigation work should be reviewed by post project appraisal, to assess successes and failures and better inform future action.

## Distribution of Southern Damselfly

### Background to the Indicator

The southern damselfly is the smallest of the 'blue' damselflies (adult males with blue and black coloration) and is a rare species in the UK. Although it is on the north west edge of its worldwide range, it is believed that up to 25 per cent of the global population occurs within the UK. Populations in seven European countries are nearly, or have become extinct, increasing the global importance of the UK populations. Southern damselflies are restricted to shallow calcareous streams and runnels. Their current distribution is shown in Figure 18. More than

ten sites identified to date in England and Wales have been proposed as Special Areas of Conservation (SAC) under the EU Habitats Directive, one of the qualifying criteria being the presence of the southern damselfly.


### Trends

The range of this species has contracted over the last thirty years, with strongholds remaining in the New Forest (Hampshire) and Preseli



Figure 18: Southern damselfly sites in the South East





(Pembrokeshire). Southern damselfly has a restricted distribution within the South East, being found only in the New Forest, the Test and Itchen valleys and one small site in Oxfordshire.

## Pressures and Influences

The main factor thought to be influencing the decline of the species is the loss of the open nature of sites favoured by the species, which are being depleted as a result of the lack of or inappropriate management (e.g. through low intensity grazing of livestock). The species is believed to be sensitive to pollution and changes in water chemistry, such as enrichment by fertilisers from agricultural land. Loss of habitat by drainage for agriculture, forestry, drought or water abstraction will also have an adverse impact on populations. Natural recovery and spread is limited since adults are weak fliers and rarely move far from their breeding sites.

The Region plays a vital role in the conservation of the species, hosting one of two national stronghold populations. It is essential that known sites are not lost to development and to ensure that appropriate site management continues. Where possible, suitable habitat should be created close to existing colonies to encourage a wider distribution.

## Targets

The main objective of the UK BAP is to enhance the current status of the species through appropriate habitat management to increase its population and range in the UK and to prevent further loss of breeding populations in England and Wales. A second, lower priority, objective is to reintroduce the species to five former sites by 2005.

## Actions and Responses

An Action Plan has been developed by the Hampshire Biodiversity Partnership to raise awareness and direct local action to protect and enhance populations of the species.

The Agency has initiated innovative and groundbreaking new research for the southern damselfly in the South East and more is planned for 2002/03 to develop understanding of the damselfly's ecology and to improve habitat management for the species. The Agency will continue to play a leading role in implementing the BAP in the South East.

The Agency will continue to work particularly hard in Hampshire and Oxfordshire, in partnership with others, to restore and create suitable habitats adjacent to extant populations to encourage the species.

The majority of southern damselfly sites in the South East are protected by SSSI and SAC status, under the Habitats Directive. This places an obligation on the Agency to review existing permissions that might significantly affect the southern damselfly populations and their

habitats. The Agency will also carefully consider any new applications to avoid any adverse impact upon this species.

Likewise the Agency will fully contribute to the planning and development control process to ensure that development helps to deliver the UK BAP objectives for the species.

## Monitoring and Review

The Agency led a consortium of partners in funding a survey of southern damselfly sites in Hampshire in 1998. This identified a number of new sites and prompted a second comprehensive survey in 1999 of potential sites in the Itchen Valley which discovered even more new sites. This resulted in English Nature extending the boundaries of the Itchen SAC to incorporate the new populations. In 2000 the Agency collaborated with English Nature again to survey the single known Oxfordshire site and a number of potential sites in the South East. The survey established that the original site was unlikely to support a breeding population but a second site was identified nearby where breeding was taking place. The Agency plans to revisit and resurvey all extant sites in 2002.

The UK Southern Damselfly BAP Steering Group is working with the Countryside Council for Wales, English Nature, British Dragonfly Society (BDS) and others to devise a national monitoring protocol and implement a monitoring programme. The Hampshire Biodiversity Partnership will review the Hampshire Southern Damselfly BAP in 2003.

## Distribution of White-clawed Crayfish

## Background to the Indicator

The white-clawed crayfish is the only native crayfish species in the UK. Formerly widespread in clean, hard water areas, its distribution has been reduced by historic pollution and intensive river works and more recently by disease and competition from introduced species. One of the larger alien species, the signal crayfish, introduced for its potential market value, has now spread to many catchments in the Region and they carry a disease harmful to the native species.

Several crayfish plague outbreaks have been confirmed across the Region and the loss of many other populations are likely to have been due to this and other crayfish diseases. Crayfish are now restricted to only certain reaches of a few watercourses and some lakes within the Region (see Figures 19 and 20).

## Trends

White-clawed crayfish were formerly widespread



and abundant, but now are rare and declining across the Region. In many catchments they are restricted to vulnerable colonies in the upper reaches of watercourses.

## Pressures and Influences

The major cause of decline and threat to residual populations is the introduction and spread of alien crayfish species, particularly signal crayfish from North America. Signal crayfish out-compete the native species for food and shelter. The continuing spread of alien crayfish is being augmented by the illegal release or escape of crayfish bought live for culinary or ornamental purposes. This species also carries a fungal disease, crayfish plague, to which it is largely immune, but to which the white-clawed crayfish (and other European species) are highly susceptible. This disease can result in native crayfish populations being wiped out from entire river systems.

Most remaining crayfish populations are small and isolated in the middle and upper parts of watercourses and some lakes and ponds. In many cases signal crayfish are present on the lower parts of the catchment and are a threat to the white-clawed populations through plague or displacement if they spread upstream. Residual white-clawed crayfish populations are also at risk from the spores of the plague fungus being transferred from infected waters by a number of potential routes including fish transfers or wet fishing and trapping equipment.

Whilst the presence of alien species is a major

threat, losses can also arise through intensive river works such as inappropriate river dredging and its associated loss of habitat and hard engineering, pollution incidents, particularly from the newly introduced synthetic pyrethroid sheep dip, drought and over abstraction. It should be noted that there are other diseases besides crayfish plague that affect native crayfish, such as porcelain disease.

## Targets

The UK Government's Biodiversity Action Plan seeks to maintain the current distribution and increase individual colony size and if possible to increase the range.

## Actions and Responses

The Agency has published identification leaflets and has undertaken a number of habitat enhancements and other conservation projects to protect and encourage limited populations. It has undertaken research projects to better understand crayfish biology and investigate techniques for eradicating or controlling the alien species. A study into the use of pheromones for attracting and repelling signal crayfish has been initiated. In addition, the Agency, in partnership with English Nature, is funding the production of protocols for the monitoring of native crayfish and habitat enhancements and has produced guidance notes on works affecting watercourses where native crayfish occur. Increasingly, native crayfish conservation is being taken into account when determining fish transfer consents.

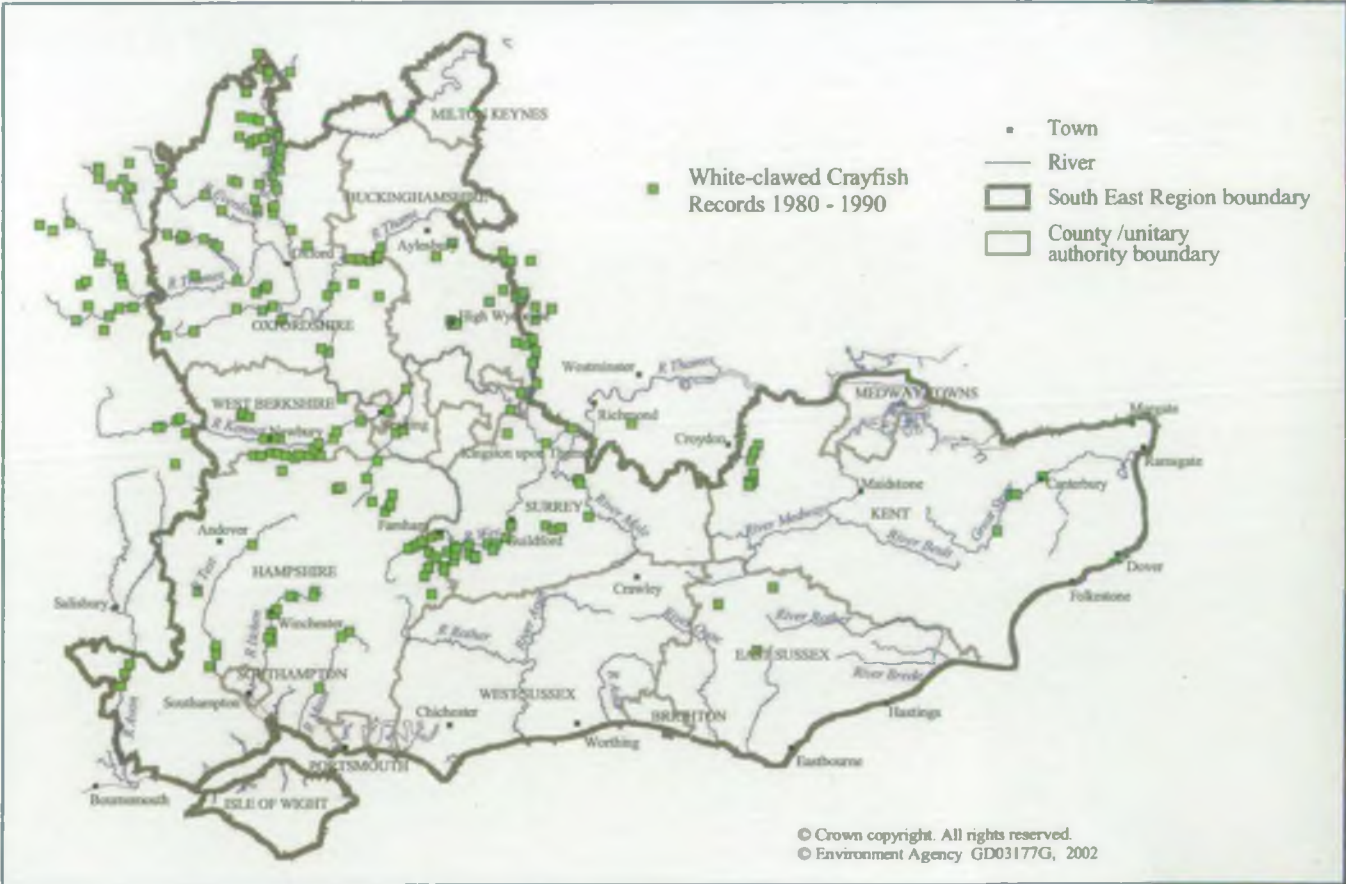


Figure 19: White-clawed Crayfish in the South East (1980-1990)

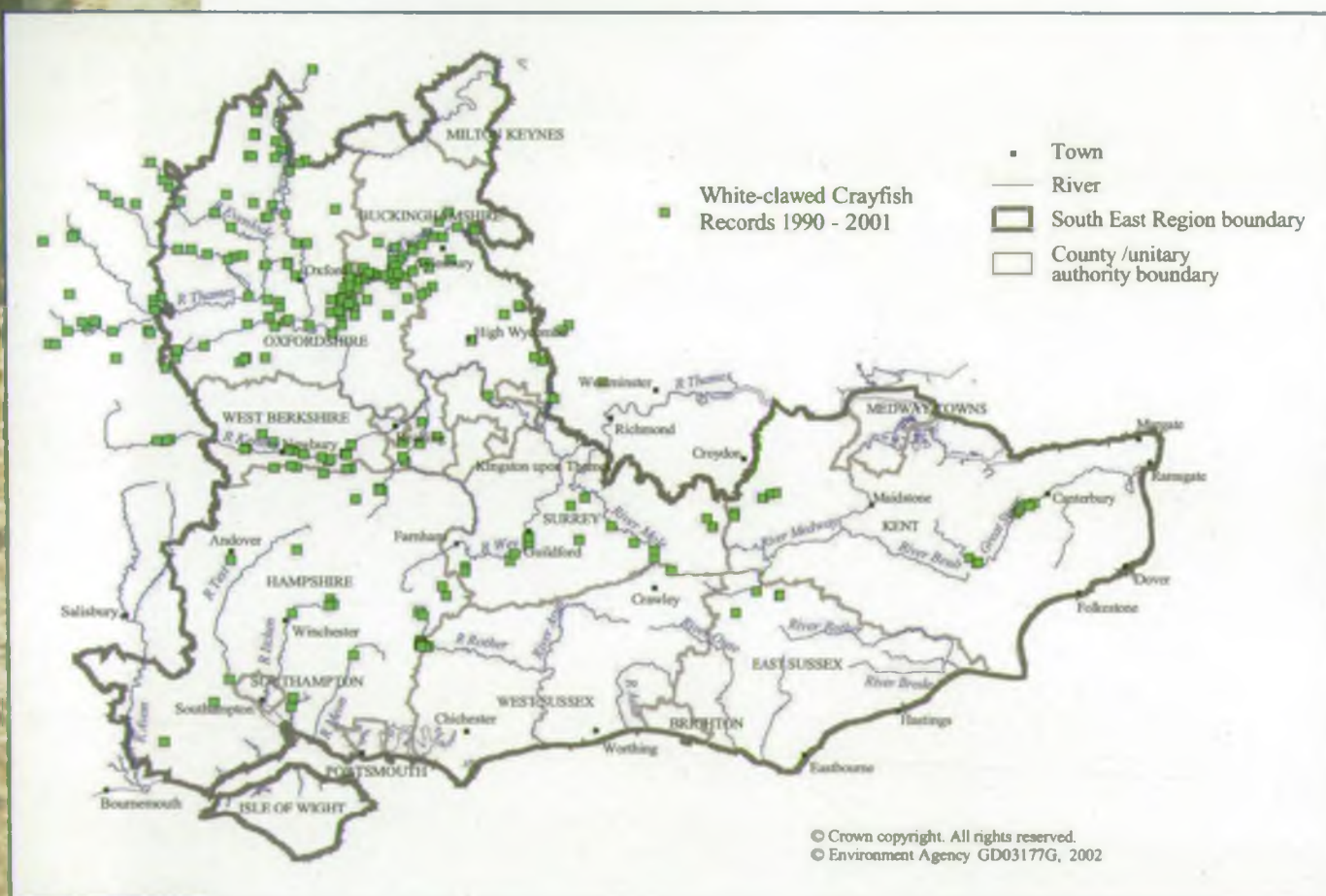


The Agency leads the UK BAP for the native crayfish and seeks in its planning responses and consenting activities to meet the UK BAP target by protecting their limited locations from development and pollution, while seeking enhancements wherever possible. The Agency is also reviewing the need to consent alien crayfish trapping.

The native crayfish is also an interest feature of the River Itchen candidate Special Area of Conservation (cSAC) and hence the Agency will carefully consider applications for new permissions in compliance with the Habitats Directive. The Agency is also reviewing its extant permissions and operations to ensure they do not adversely affect the crayfish population.

## Monitoring and Review

Specific crayfish surveys have been carried out on a number of catchments and locations across the Region in recent years to establish our current understanding of distribution and population status of both native and alien crayfish. Monitoring of known crayfish populations and surveys to locate new colonies will be undertaken as resources permit, as will monitoring the spread of alien species towards vulnerable native populations. Live crayfish sightings or mortality reports from the public will be followed up. All records of crayfish are collated for reporting purposes.



**Figure 20: White-clawed Crayfish in the South East (1990-2001)**



### INDICATOR: NUMBERS OF SALMON AND SEA TROUT

## Background to the Indicator

These migratory fish are indicators of good environmental quality both in terms of water quality and quantity, and the physical condition of the rivers and estuaries in the Region.

The salmon and sea trout stocks of the Region are under significant ecological stress from the combined effects of climate change, escalating development pressures, adverse changes in the land use management of the South East and

changes in the marine and estuarine environment through which the fish migrate. Salmon and sea trout stocks are also subject to further stress from illegal exploitation within the Region.

However, the continued degradation of river and estuarine habitats pose a real threat of collapse of the already endangered Atlantic salmon and sea trout stocks in the rivers of the South East.



The Environment Agency has a duty to maintain, improve and develop the fisheries resources of the South East, including the salmon and sea trout stocks. The abundance of salmon and sea trout within the Region are assessed by a combination of measures including fish counters, traps, rod and net catches and juvenile surveys. The historic data set for salmon catches provides the best record of the stocks and dates back to the early 1900's. The data on sea trout catches is less extensive.

Other stock assessment measures have been extensively developed for the salmon stocks of the Rivers Test and Itchen over recent years. This development has enabled high accuracy

estimates to be made of the numbers of juveniles that migrate to the sea from these rivers and the number of adult salmon that subsequently return from the sea. The adult salmon of the River Thames have also been monitored since 1984 using a fish trap at Molesey. The knowledge gained through such assessment has been essential to identify necessary management actions to promote a potential recovery of these stocks.

These assessment techniques are now being applied to the sea trout stocks within the Region. In particular, the states of individual sea trout populations are being intensively monitored where significant developments are occurring.

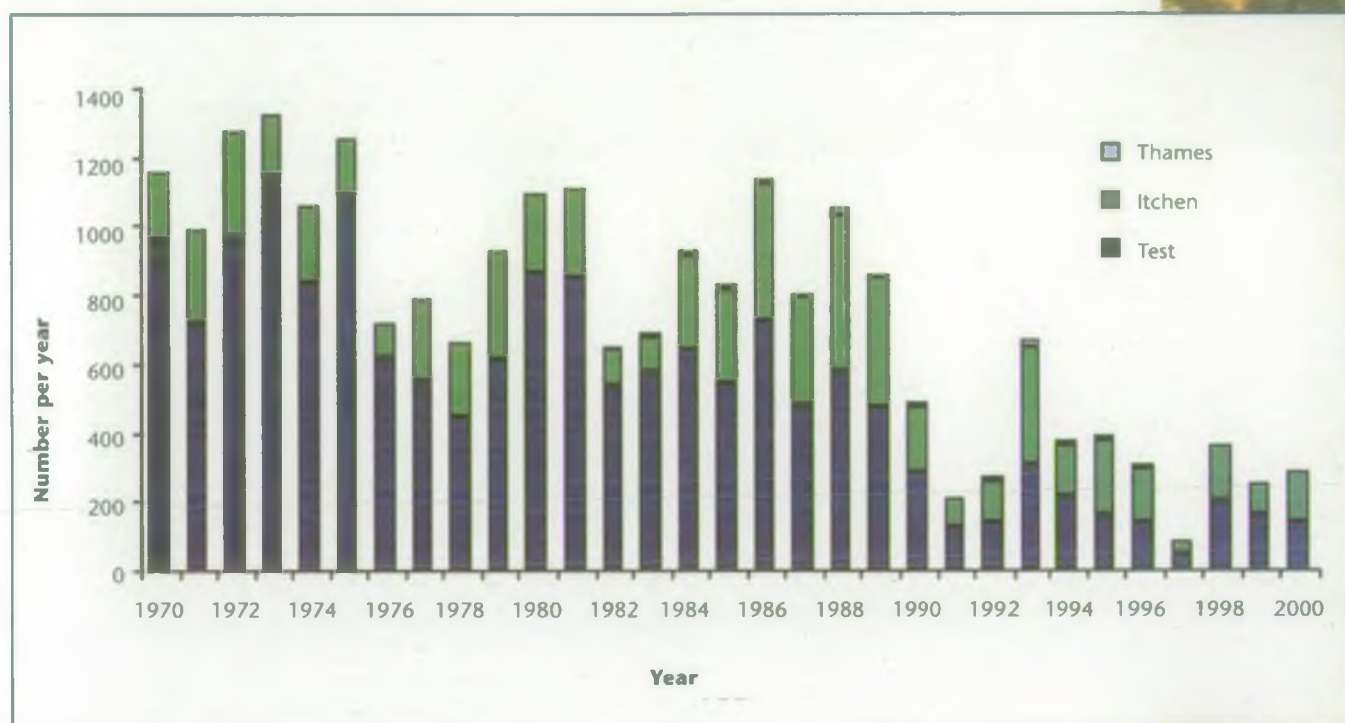


Figure 21: Salmon rod catches (1970-2000)

## Trends

The main salmon fisheries within the Region are on the rivers Test, Itchen and Thames (see Figures 21 and 22). The Thames salmon population has been subject to a rehabilitation scheme run by the Environment Agency in partnership with the Thames Salmon Trust, since 1979. Prior to 1974 salmon had been extinct in the river since 1833.

The Hampshire chalkstream rivers, the Test and Itchen, historically supported salmon in their thousands and remain the prime salmonid fisheries in the South East Region. Salmon stocks have declined dramatically since peaking in the 1950s to populations currently unable to self replicate adequately to support major fishing activity. The catches of salmon in the Region have declined substantially from the 1970s levels and reflect a real decline in stock numbers. However, the Agency's collaborative programme to sustain these stocks has contributed to the

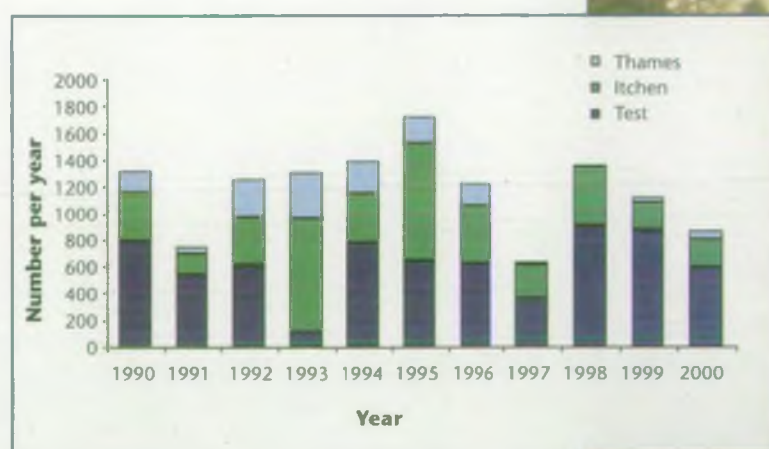



Figure 22: Returning salmon stock estimates for Test, Itchen and Thames (1990-2000)

maintenance of the stocks while the environmental causes are being addressed.





Less is known about the relative abundance of sea trout in the Region, although the species is present in the majority of the rivers. Limited evidence and angler observations have suggested that populations of sea trout have fluctuated significantly over recent years and exist on a knife-edge between stock maintenance and decline.

The declines in both salmon and sea trout could be linked to conditions at sea, however most significant changes in estuarine and freshwaters have undoubtedly occurred and are impacting adversely on these stocks. Trends in salmon catches indicate the combined impact of many factors. One such impact is the reduction of egg survival, which has fallen from 25 per cent to four per cent on the River Itchen. This is due to agricultural run off. This represents a six-fold reduction in survival. Large changes in open sea survival typically reduce the return rates by up to two-fold.

Despite the national decline there have been some UK rivers that have shown significant increases in salmon since the 1990s, often associated with the removal of heavy industry and urban impacts such as the Tyne in the North East.

Locally the numbers of sea trout have fluctuated significantly in many rivers over recent years. This is again due to similar impacting factors especially the impact of poor agricultural practices. However, additionally the environmental quality of estuaries and coastal waters are of greater importance to sea trout, as they inhabit these more local waters during the marine phase of their life cycle. By comparison salmon migrate to the North Atlantic areas off Greenland and the Faeroes.

## Pressures and Influences

The salmon and sea trout of the Region are under significant ecological stress from the combined effects of climate change, escalating development pressures impacting on water use and effluent, habitat loss and changes in land use management of the South East.

Reduced winter rainfalls and greater storm intensities have left many rivers in the Region silted with eroded riverbanks and changed flora and fauna. The fisheries of the rivers Test, Itchen, Western Rother, Darent, Meon, Hamble and their tributaries have notably been impacted by these changes.

Escalating development not only affects river ecosystems, but also increases demand for water and resultant waste discharges. These have combined with the changed rainfall pattern to reduce the seasonal flows through much of the river habitat and have increased the polluting load from discharges. Despite improved treatment of discharges, reduced river flows and increased volumes of discharge have overall increased the quantity of fine particulates in the rivers. These particulates are especially damaging to fisheries as they reduce the survival of fish eggs spawned into the gravel, however this impact is thought to be small in comparison to agricultural sources.

The stocks of Atlantic salmon and sea trout fisheries are each particularly sensitive to such impacts.

Land use and its management, especially agriculture, has significantly increased the silt ingress to the rivers by changes from low intensity practices to widespread industrial farming practices applied to maximise production and profitability. It has been shown that through better farming practices and planning the environment can benefit and profitability raised through a lower requirement for expensive fertiliser and pesticides. The intensity of crop farming has increased through advances in fertilisers and new crop variants, enabling multiple crops to be grown in a single year. Modern ploughs are highly efficient at reducing soil into a finer till. Ploughing also tends to be undertaken up and down the landscape gradient, rather than across it. Additionally, crop fields tend to be ploughed just before winter.

The result of these practices is increased soil erosion. The break up of the soil structure by ploughing releases greater quantities of soil to be mobilised by winter rains falling onto barren ploughed fields. The soil-laden water drains down the landscape through the ploughed furrows until it eventually discharges into a watercourse. Such soil inputs contribute extensive quantities of fine particulates to the river systems and the habitats within them. They blanket the very spawning areas that are the keystone to the entire economic activity of salmon and trout fisheries and the important employment they bring to rural communities.

The continuing development in the South East must include adequate protection of the aquatic environment to preserve the river ecosystems essential to the economically productive fisheries of the Region.

## Targets

We have conservation limits for the Hampshire salmon populations, if the stocks fall below these levels then the stock is at substantial risk of collapse. For the River Test the target is to return the stock to a run of around 2000 adults by 2020. For the Itchen the target is a run of around 1000 adults by 2020. To achieve this we have a target of increasing the average survival of deposited salmon eggs to greater than 10 per cent in each river. This, combined with the complex array of other management measures being used to reduce losses during the salmon's lifecycle, should promote the recovery of the stocks to target levels.

## Actions and Responses

The Agency wishes to see more salmon and sea trout returning to the rivers of the South East. This would indicate, amongst other things, good environmental quality and favourable productive habitats in these rivers.

The Agency also wishes to see a recovery of the



existing salmon stocks from non-sustainability to at least meet self-replication targets for each salmon river. This would indicate that challenges from chemical, silt and thermal pollution, water abstraction and habitat destruction had been addressed. Future actions would focus upon:

- *the review of water abstraction and authorised discharges established within the principles of sustainability for biodiversity in the Region;*
- *attempt to secure the long-term economic value to the Region of highly productive salmon and sea trout fisheries;*
- *influence land management to conserve soil and to reduce the serious impact of diffuse pollution on salmon, sea trout and many other economically important and biodiversity important species; and*
- *reduce impacts of development through regulation and consultation.*

## Monitoring and Review

Salmon rod catches and the numbers of returning adult salmon in Hampshire are

routinely assessed on an annual basis and will continue to be so assessed whilst funding is available. The salmon smolt run is annually assessed on the River Test, although pressures upon funding may result in the cessation of this monitoring. Sea trout are monitored on the River Rother, Adur and Ouse in Sussex to assess the numbers of returning stock to these areas.

Significant R&D work is also being undertaken in Hampshire to investigate a number of specific factors that have been observed to impact on the salmon's lifecycle. This research provides additional short term monitoring data for use in the management of the salmon.

As part of the rehabilitation scheme run by the Environment Agency in partnership with the Thames Salmon Trust on the Thames, returning salmon are regularly monitored. The minimum number of returning salmon is calculated from fish taken in traps, by rod, mortalities and electric fishing operations. This is estimated to represent 60-70 per cent of the run. The adult salmon of the River Thames have also been monitored since 1984 using a fish trap at Molesey.



### INDICATOR: STATUS OF KEY HABITATS AND SITES PROTECTED UNDER THE HABITAT REGULATIONS

## The effects of Agency authorisations on sites of European wildlife importance

### Background to the Indicator

Wildlife habitats and the plants and animals that depend upon them are under pressure from increasing demands we make on our environment. The purpose of the European Habitats Directive (1992) and the subsequent UK Conservation (Natural Habitats &c.) Regulations (1994), the 'Habitats Regulations', is to statutorily protect the most important wildlife sites in Europe. This will help ensure the long term conservation of biodiversity through a network of protected areas across the European Union to be known as 'Natura 2000'. The Natura 2000 network includes Special Areas of Conservation (SACs), selected for plants, habitats and non-avian animals, and Special Protection Areas (SPAs), selected for wild birds under the European Birds Directive (1979). SPAs and candidate SACs have equal legal status under the Regulations, whilst UK Government policy is to treat Ramsar<sup>1</sup> sites in a similar manner.

There are currently 98 SPAs, 301 candidate SACs in England and Wales, covering large areas and a wide range of habitats and species on land and at sea. The Habitats Regulations require the Agency, as a competent authority, to ensure that all the operations that it authorises or undertakes do not adversely affect the integrity of these European

wildlife sites. This statutory obligation also requires the Agency to review all existing authorisations.

The South East Region is particularly notable for the number and extent of sites of European wildlife importance including SPAs, candidate SACs as well as Ramsar sites. One or more of these designations covers well over 1000 km<sup>2</sup> of the South East Region. At a more local level, the Hampshire and Isle of Wight area for example has 437km of coastline of which around 80 per cent is SPA, candidate SAC, or both, and approximately 13 per cent of its land area designated as SSSI, of which over 90 per cent is also SPA, candidate SAC or both.

### The Indicator

The South East Region has 30 SPAs and 47 candidate SACs (see Figure 23). The Agency and English Nature have provisionally assessed a number of these SPAs and candidate SACs as likely to be currently adversely affected by existing Environment Agency authorisations. A

<sup>1</sup> Ramsar sites are designated as Wetlands of International Importance under the International Convention signed in Ramsar, Iran in 1971.





much larger number have been deemed as requiring further investigation to clarify whether adverse effects are present.

## Trends

It is too early to show a trend. Those sites provisionally assessed by the Agency and English Nature as likely to be currently adversely affected by existing Agency authorisations are being addressed as a matter of priority.

## Pressures and Influences

The South East's European wildlife sites can be affected by authorised activities located many miles away from them. Coastal or riverine SPAs or candidate SACs can potentially be affected by operations originating upstream, while all SPAs and candidate SACs can be affected by airborne pollution.

Stages 1 and 2 of the Agency's review of consents exercise identifies those Agency authorisations having, or likely to be having, an adverse effect upon SPA or candidate SAC qualifying features. Stage 3 of the review is currently underway and involves further investigation to establish those consents that are actually having an effect on the ecological integrity of the sites and inform the necessary action required in Stage 4 to remediate the situation in each case.

The joint Agency/English Nature approach to dealing with new authorisations and activities

has lead to earlier identification and avoidance of potential adverse effects in the consenting and planning process, so ensuring the protection of the sites.

Sea level rise is likely to lead to some loss of coastal SPA or candidate SAC habitat and may require alternative provisions to ensure that the ecological integrity of the Natura 2000 network is maintained. Non-sustainable use of natural resources and inappropriate development may threaten to compromise the integrity of SPAs and candidate SACs ability to support their species and habitats. The Regulations may preclude certain development in locations of relevance to SPAs and candidate SACs.

The Region's candidate SACs support a number of priority habitats, as listed under the Habitats Directive, that are in danger of disappearance in EU countries. These include several types of woodland in the New Forest, chalk grassland with orchids at a number of sites in Sussex and Kent, saline lagoons around the Solent and Isle of Wight and important populations of wintering waterfowl in the Region's estuaries. The Region's SPAs also support a wide variety of bird species that are often rare or vulnerable to habitat change including several tern species found breeding on many coastal SPAs, bewick's swan in the Arun Valley, Dartford warbler in the Ashdown Forest and bittern at Stodmarsh in Kent.

With the woodland, heathland and downland sites the concerns are mostly associated with the possible effects of air pollution.



Figure 23: Sites of International wildlife importance in the South East



## Targets

The Agency wishes to see those sites which are, or will be, identified as being adversely affected to be remediated as soon as reasonably practicable. English Nature's evaluation of a site's condition - favourable or unfavourable - and their conservation objectives to maintain or improve that condition will act as an indicator for the Region's SPAs and candidate SACs.

## Actions and Responses

The Agency will consult holders of Agency authorisations thought to be having a likely adverse effect on a Natura 2000 site. The Agency is keen to work openly with consent holders to discuss the potential implications and

information requirements at all stages of the Review process. The consent holder can expect informed decisions based on the best available information. Applicants for new authorisations are urged to discuss their proposals as early as possible with the Agency so that any implications of the Habitats Regulations to their proposal can be assessed at an early stage.

## Monitoring and Review

English Nature will be undertaking a monitoring programme for all SPAs and candidate SACs to ascertain the condition of each of the qualifying features and identify trends in improvement or deterioration.

## Conservation and enhancement of Chalk Rivers

### Background to the Indicator

Five of the Region's chalk rivers are designated as SSSI (Hampshire Avon, Test, Itchen, Lambourn and Kennet), with the Avon, Itchen and Lambourn being candidate Special Areas of Conservation under the Habitats Directive, although they are also protected by their SSSI status.

Many of the chalk rivers have been damaged by a combination of influences, particularly historic fisheries management, over-abstraction and diffuse pollution. The major chalk aquifers extend widely across the Region providing high quality drinking water at relatively low treatment costs. However, the chalk stream rivers they support are dependant on adequate groundwater being preserved to support the mostly UK and European designated wildlife for which they are renowned. Several of these catchments may already be over abstracted and breach these designations.

Chalk rivers are those whose flow is predominantly derived from chalk groundwater and which flow for a significant distance over chalk. Typically the water is of high clarity, has a gravel bed and supports abundant and characteristic plant growth within the channel and along the margins.

### The Indicator

The Region holds about 50 per cent of the UK chalk river resource. About 70 per cent of public water supply in the Region is from chalk sources, mainly from groundwater abstraction with some direct abstraction from chalk rivers.

The heavy development pressure in the South East puts the Region's chalk rivers at further risk by adding to pressure on water resources, the need to discharge additional treated waste-water, increasing storm discharge, decreasing rainwater infiltration to the chalk aquifer and increasing the risk of accidental pollution.

Figure 24 shows the location of these rivers in the Region. The length of chalk rivers in the South East Region is 1,498km (the total length of main river in the Region is 6,059km).

### Trends

Chalk rivers are a highly valued environment identified for special protection within the UK Biodiversity Action Plan. They are a fixed resource since they are entirely dependant on the underlying geology. New rivers cannot be created, although existing rivers can be reduced in quality through a variety of causes, including excessive abstraction, poor river management, pollution, overwidening and sedimentation. Many chalk rivers have headwaters known as winterbournes, which are naturally dry for varying periods each year.

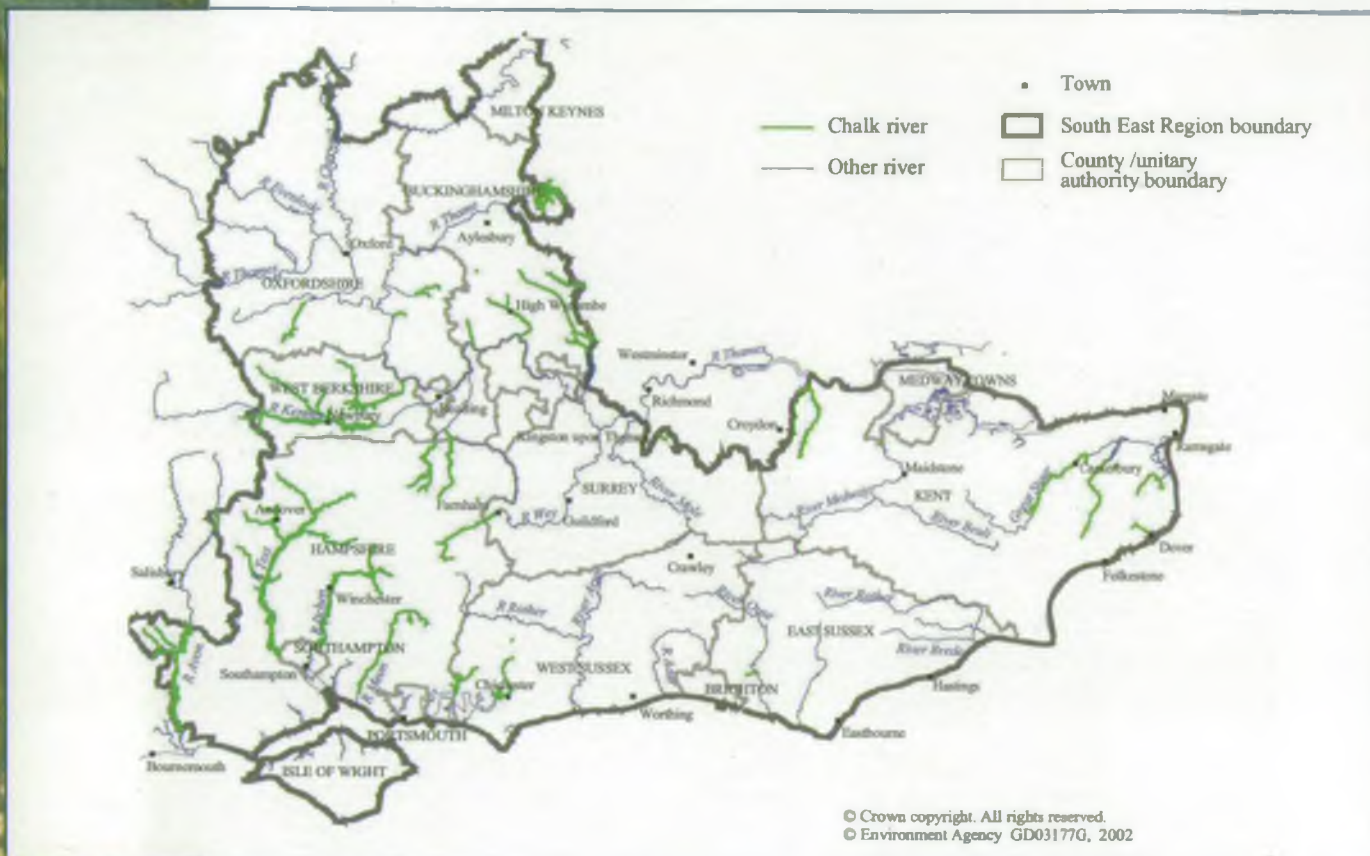
### Pressures and Influences

Chalk rivers are dependant on springs arising from chalk, so are strongly influenced by groundwater recharge and abstraction. Global warming will have an as yet uncertain impact on chalk rivers by changing the rainfall pattern. Abstraction of groundwater, especially near the headwaters of chalk rivers, whether for public supply or agriculture can directly reduce river flow and delay the annual onset of higher winter flows resulting from winter recharge of the chalk aquifer. Abstraction directly from the river diminishes flow to the detriment of the characteristic ecology for which they are identified.

Chalk rivers are also at risk from accidental storm groundwater and surface water pollution and the impacts from point discharges.







**Figure 24: Chalk rivers in the South East**

Agricultural intensification over the last 50 years has had a significant adverse impact on the key chalk stream attributes particularly increasing diffuse inputs of nutrients, some pesticides and, notably, silt which clogs gravel used by spawning trout and salmon. Banks of chalk rivers with their associated fauna and flora are also easily damaged by trampling by livestock or excessive recreational use.

Development in chalk river catchments increases flows that can adversely impact the ecology of chalk rivers which are adapted to relatively constant flow.

Many chalk rivers are managed for fishery purposes. Inappropriate or insensitive methods can damage the habitat mosaic of both the river and its banks.

## Targets

The UK Government's Habitat Action Plan has set the objective to maintain the typical fauna and flora of chalk rivers, including winterbourne stretches, restoring water quality, flows and habitat diversity where these have deteriorated on SSSI designated rivers and on other chalk rivers where this is cost effective.

## Actions and Responses

Several rivers in the region are the subject of continuing Alleviation of Low Flow (ALF) programmes. These involve a variety of projects, including negotiations with water companies to relocate abstraction points.

The programme of river enhancements on the Rivers Test and Itchen in Hampshire to enhance salmon and wild brown trout stocks, water crowfoot and the wider chalk river ecology has restored over 60,000m<sup>2</sup> through river narrowing, the addition of gravel and gravel cleaning since 1996.

The Agency has established a partnership project with Thames Water to restore degraded reaches of the River Kennet. Habitat enhancement works have been carried out on four stretches of the river. The Agency continues to support the long term studies of the Kennet and Lambourn which have been undertaken since the 1970s. These involve mapping macrophyte and invertebrate communities and are designed to identify long-term changes in river ecology that may be linked to changes in the catchment or climate.

The River Itchen Sustainability Study is a major partnership with water companies, the Agency and local authorities to model the groundwater and surface water hydrology of the Itchen catchment and establish the state of key ecological features and their environmental needs.

## Monitoring and Review

Chalk rivers are subject to routine hydrological, chemical, biological and fisheries monitoring programmes and special investigations to answer specific questions are undertaken. Methodologies and a programme to evaluate the conservation status of chalk rivers are being developed.



# MANAGING WATER RESOURCES

## Background

Water is vital to life whether that be in the natural environment or supporting man's use of it. An adequate supply of clean and wholesome water is fundamental to public health and the maintenance of public water supplies. Water also plays an essential role in many industrial processes, including food production, power generation and chemical manufacture. However, water is a finite resource and a sustainable balance needs to be struck between our demands upon it and the needs of the environment that are dependent upon it. Where this balance is tipped, constraints on licensed abstraction will affect the reliability of supplies potentially leading to supply restrictions or appeals for restraint in use. In exceptional circumstances, such as droughts, permissions may be sought to allow further abstraction or a relaxation of constraints, which in some circumstances could lead to impacts on river and wetland habitats.

When fresh water is abstracted, there is a reduction in the usable resource available in rivers and aquifers - unless the water abstracted is used, treated and returned upstream of the original point of abstraction. Excessive abstraction will cause environmental damage and for this reason, all licensed abstractions are routinely monitored to ensure the licensed conditions are maintained and enforced. There are clearly limits to the amount of resource available for use from rivers and groundwater. These will be related broadly to the effective rainfall which determines the hydrological and hydrogeological conditions within the catchment; the need for in-river flows to dilute permitted discharges of industrial effluent and treated sewage; and, the needs of aquatic wildlife and other species that depend on the water environment. Abstraction licences are granted based on a precautionary view of all the available information. Nevertheless, some licences granted in the past have since been shown to be unsustainable and for that reason the Agency has put in place its Restoration of Sustainable Abstraction Programme.

Although England and Wales are relatively well supplied with water resources on average, their distribution, both temporally and spatially, is not necessarily well matched with patterns of demand. The average effective rainfall is low in the south and east of England and becomes critical during periods of drought. By contrast, we already use a greater proportion of effective rainfall than any other region in the country. The South East is set to experience some of the most challenging pressures on water resources; through continued increases in demand from the existing population, new demands from

housing and economic development, as well as the potential uncertainties of global warming and further climate change on both demand and available resources.

## Roles and Responsibilities

Even though fresh waters have long been used for human activities, abstractions have only been regulated since the Water Resources Act, 1963 which followed a severe drought in 1959. The Act led to the setting up of 29 river authorities to provide regional catchment based integrated management of water resources and to the introduction of abstraction licensing.

Today, the Environment Agency is responsible under the Water Resources Act 1991 for achieving sustainable management of water resources, and balancing the needs of the environment and abstractors. The Agency sets the overall framework for water resources planning and development through national and regional water resources strategies. Effective management of water resources is principally secured by a system of abstraction licensing and enforcement. There are a number of other key stakeholders involved in the management of water resources in particular the Office of Water Services (OFWAT), the economic regulator of the water companies, and the water companies themselves who supply treated water to households, commercial and industrial premises through the supply network.

## Indicators

To identify the current state and pressures that are being placed upon our water resources we have selected three indicators:

- *quantity of rainfall;*
- *rivers flows and groundwater level;*
- *water demand and availability.*

'Water demand and availability' is an indicator included by the UK government in *Quality of Life Counts*. Water leakage and abstraction by purpose are also included.

• the Region consumes more water per person than any other Region, but receives one of the lowest amounts of rainfall in some parts of the Region the average consumption per person is as high as 197 litres per day.





## Background to the Indicator

Rainfall is the natural source of all fresh water that replenishes rivers and aquifers. Water resources planning needs to take account of not only the average amount of rainfall, but also its temporal and spatial variability, and how these might change in the future. Effective rainfall, that is rainfall minus evaporation and transpiration by plants, is an essential consideration in determining the amount of water available to rivers and aquifers.

The average annual rainfall across the South East Region is 738mm. On average 37 per cent of this total is effective rainfall. This is the maximum potential water resource. However, this must also provide the water required to maintain river flows at levels acceptable for conservation, recreation and fisheries, and groundwater at levels acceptable for conservation and to prevent saline intrusion into coastal aquifers.

The map shows the distribution of rainfall across the South East Region (see Figure 25). It is based on the 1941-1970 long term annual average rainfall for over 100 gauges. The graphs (see Figure 26) show the deviation in annual average rainfall going back to 1853 with the recent annual and monthly variations emphasised.

## Trends

Rainfall is generally lowest in the south and east of the country, resulting in the South East Region having some of the lowest annual rainfall totals in the UK. It also has the highest evapotranspiration rates.

There is great variability, both spatially and temporally, around the average rainfall values. The isohyetal map shows that average rainfall can vary from less than 600mm along the north Kent coast to over 1000mm along the South Downs. The proportion of annual rainfall that is effective rainfall also varies across the Region, ranging from 25 per cent to 50 per cent, being generally higher in the south-west of the Region.

The time series plots show that rainfall can vary greatly through time, both on the scale of years and months. Again, the proportion that is effective also varies greatly, from virtually nil in the summer to almost 100 per cent in the winter. However, a large proportion of winter rainfall drains off to sea and can cause flooding, even before the aquifers are completely recharged.

So, whilst the long-term average effective rainfall puts an overall limit on the available water within the Region, planning also needs to take into account the spatial and temporal variability of rainfall and effective rainfall.

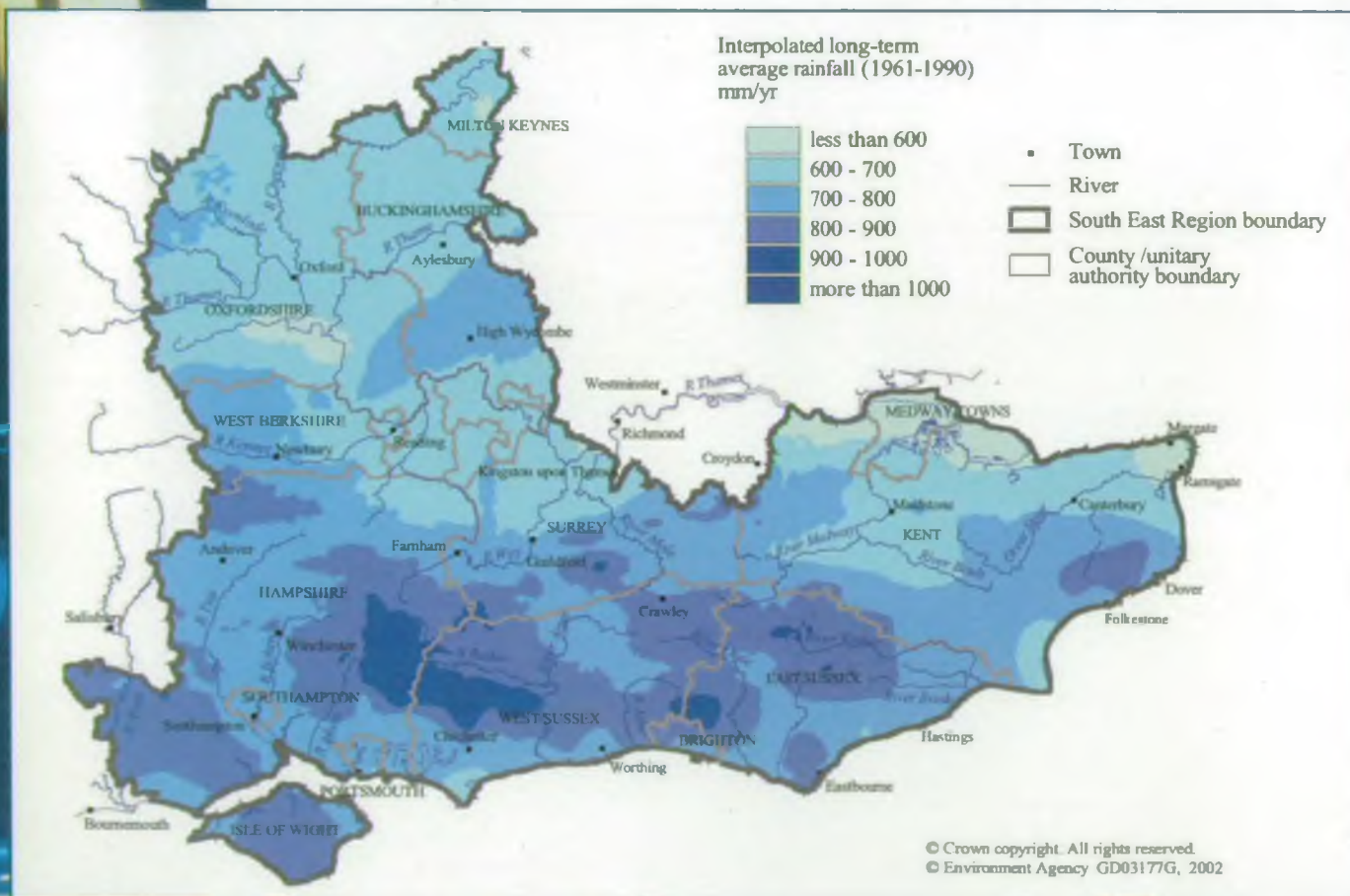
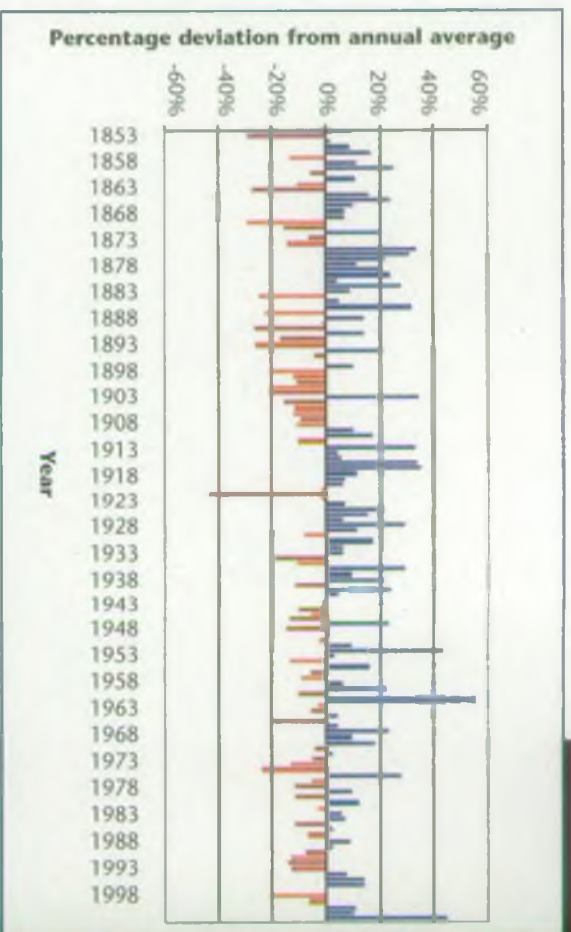


Figure 25: Average rainfall in the South East

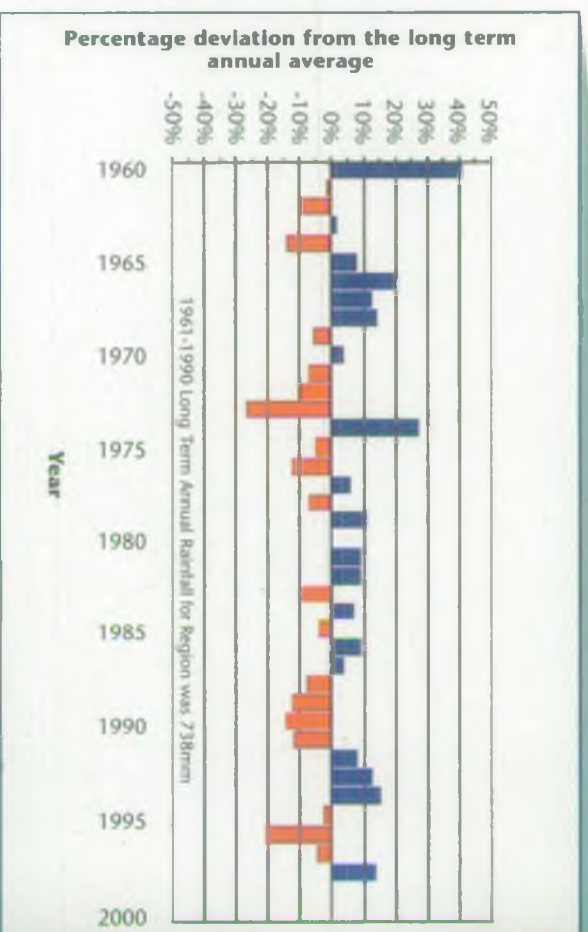


**Figure 26: Rainfall in the South East - long term annual average (1853-2000), recent average (1960-1998) and monthly average (1990-1998)**

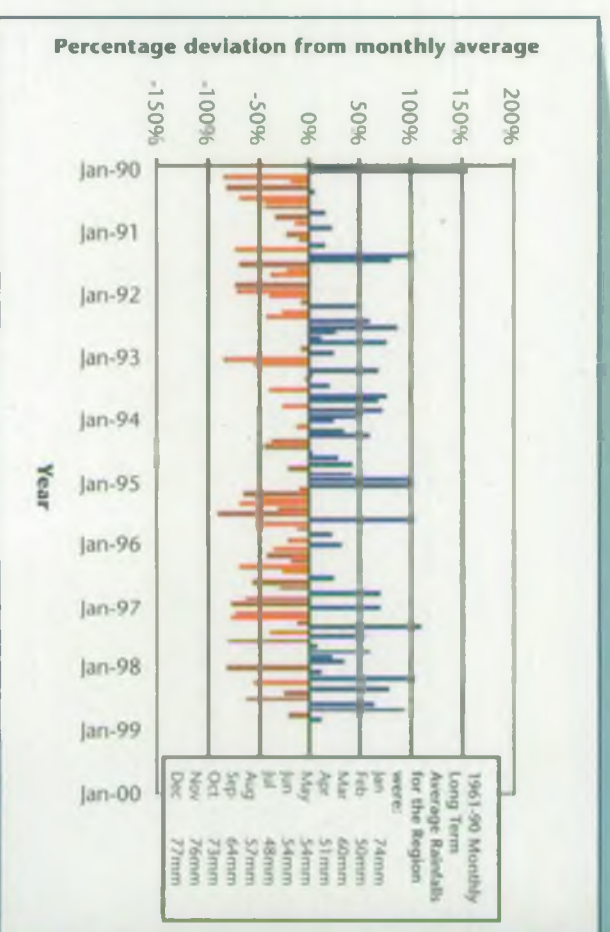
Average rainfall for the raingauges at Oxford, Otterbourne, Chilgrove and Canterbury, expressed as a percentage deviation from the 1961-1990 long term annual rainfall for these gauges



Annual rainfall totals for the South East Region, expressed as a percentage deviation from the 1961-1990 long term annual average rainfall for the Region



Monthly rainfall totals for the South East Region, expressed as a percentage deviation from the 1961-1990 long term monthly average rainfall for the Region



[Note: the 1960 onwards annual time series and the monthly time series are areal averages calculated for the South East Region, normalised using the 1961-1990 long-term annual and monthly averages for the Region, respectively. The 1853 onwards annual time series is included to give a longer term picture of rainfall. It is not an areal average, but a simple average of four gauges (Oxford, Otterbourne - south of Winchester, Chilgrove - north of Chichester, and Canterbury), again normalised to the 1961-1990 annual average].





## Pressures and Influences

Climate change, both natural and man-induced, could have an impact on rainfall totals and variability, evapotranspiration and therefore effective rainfall. The 1998 UK Climate Impacts Programme (UKCIP) report (Hulme & Jenkins, 1998) made various predictions. The UKCIP will issue updated predictions in March 2002.

Although there are significant uncertainties in the nature and extent of climate change impacts, the key impacts are thought to be: wetter winters and drier summers, and small overall increases in average rainfall. Higher temperatures are likely to result in increased evapotranspiration losses and, therefore, a decrease in effective rainfall. The impact on available resources remains uncertain. Changes in effective rainfall in late summer and early autumn could reduce available resources through decreases in river flow or delays to the long-term normal period of groundwater recharge. Groundwater-fed catchments could see a small increase in available resources as a result of wetter winters, increasing recharge. Predominantly surface water derived catchments are likely to see significant changes in available resources.

## Targets

We have no control over rainfall. However, future development proposals will need to be

planned to take account of natural variability of water resources as well as possible future changes in average rainfall and its variability. It will also need to take account of the variability of and future changes in evapotranspiration.

## Actions and Responses

With increasing uncertainty, we need to ensure that we manage the water that is available effectively. If we have wetter winters, for example, we will need to ensure that water is not dispersed so quickly to the sea by encouraging more effective storage and recharge. This will be achieved by adopting surface water management techniques that maximise the potential water resource and benefit the environment.

We will have to learn to use our water resources wisely - see the water demand and supply indicator below.

## Monitoring and Review

Our knowledge of the quantities of fresh water in the environment depends on measurements at different points of the hydrological cycle. Precipitation is measured at more than 3000 sites across England and Wales. The Agency will continue to work in conjunction with the Meteorological Office and other partners in recording data for future analysis.



### INDICATOR: RIVER FLOWS AND GROUNDWATER LEVELS

## Background to the Indicators

### River flows

In managing our use of water resources, it is essential that river flow and groundwater regimes are maintained to protect river and wetland ecosystems and to maintain their use for fisheries, recreation, navigation and existing licensed abstraction.

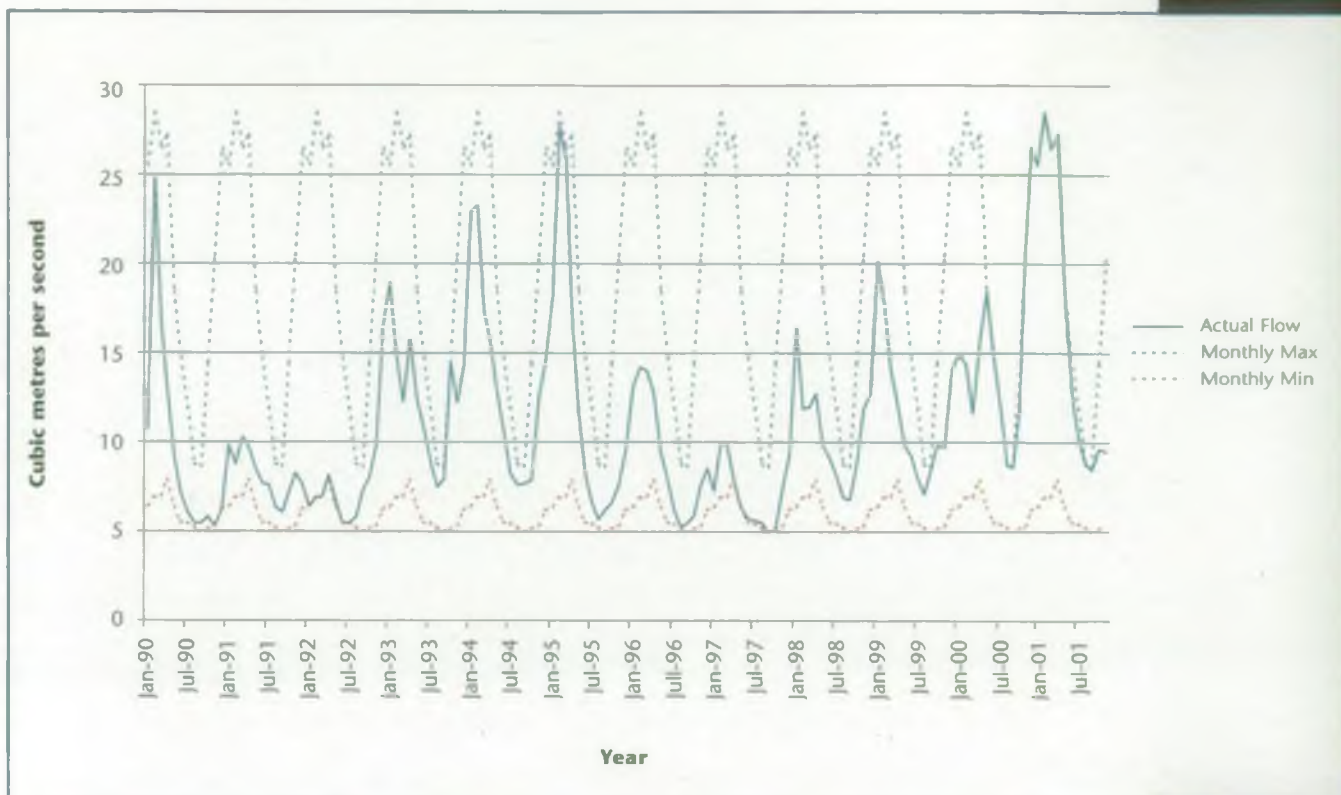
The indicator allows periods of low flows to be detected. Low flows may be due to short-term weather fluctuations, climate change, or changes in abstraction policy or practice. Over many years the indicator should respond to climate change and any changes in abstraction policy.

Three rivers typical of the Region have been chosen: the River Test at Broadlands; the River Medway at Teston; and the River Thames at Reading (see Figures 27, 28 and 29). The Test rises on the chalk of the Hampshire Downs while the Medway flows across the clay and sandstone of the Weald. The Medway will respond more quickly to rainfall than the Test because its catchment is less permeable. The Thames at Reading reflects the nature of the different

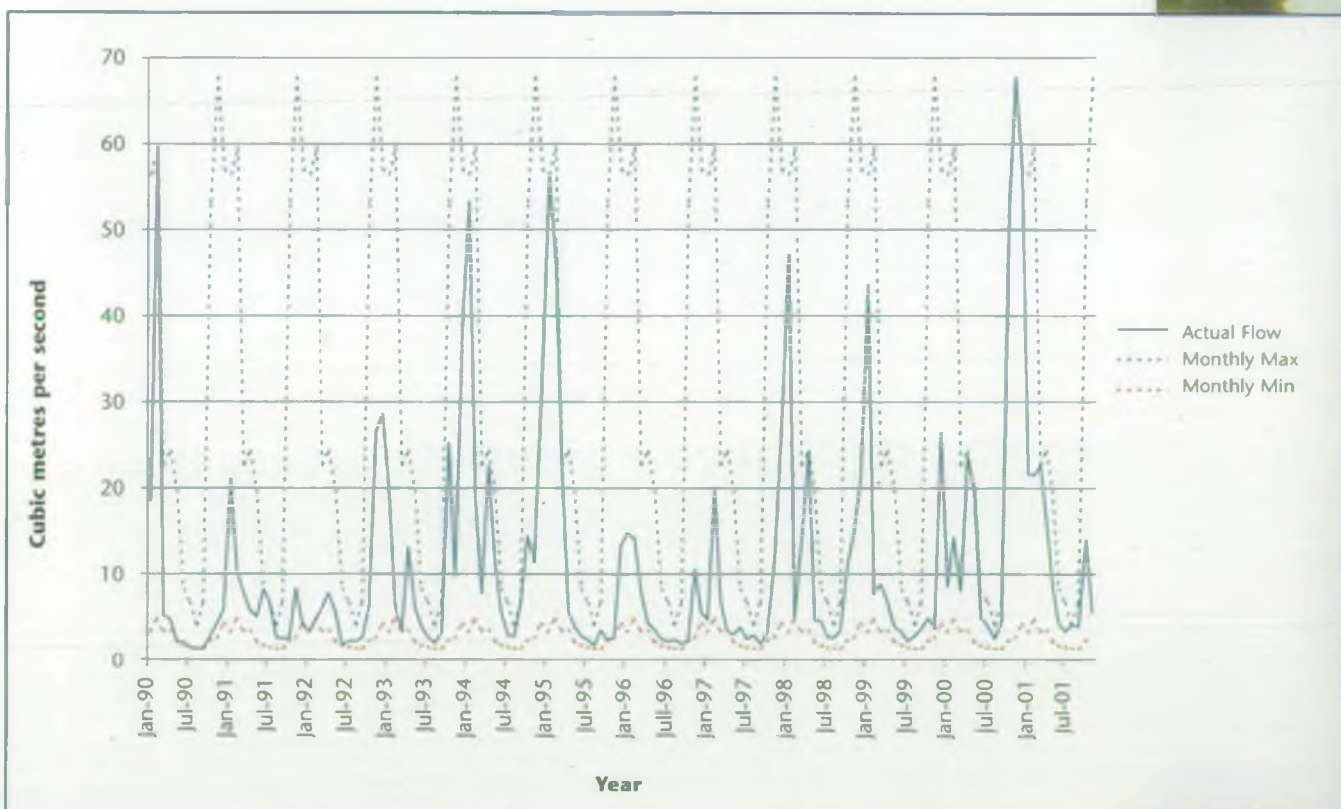
hydrological inputs upstream: from the Cotswold Jurassic Limestone, the Chalk, and the groundwater-fed and clay tributaries upstream, the effects of abstraction downstream of the Goring Gap and the effects of river regulation for navigation.

Although the Test at Broadlands and the Medway at Teston have similar catchment sizes, 1,040 and 1,256km<sup>2</sup> respectively, they have very different hydrological characteristics. The Medway is very flashy with peak mean monthly runoff between 30m<sup>3</sup>/s and 70m<sup>3</sup>/s but a baseflow of only 1-2m<sup>3</sup>/s. The Test is much less responsive. Since 1990 its mean monthly flow has not risen above 30m<sup>3</sup>/s but its baseflow is consistently above 5m<sup>3</sup>/s. The Thames at Reading has a catchment size of approximately 6,470km<sup>2</sup> and peak flows almost reach 160m<sup>3</sup>/s.



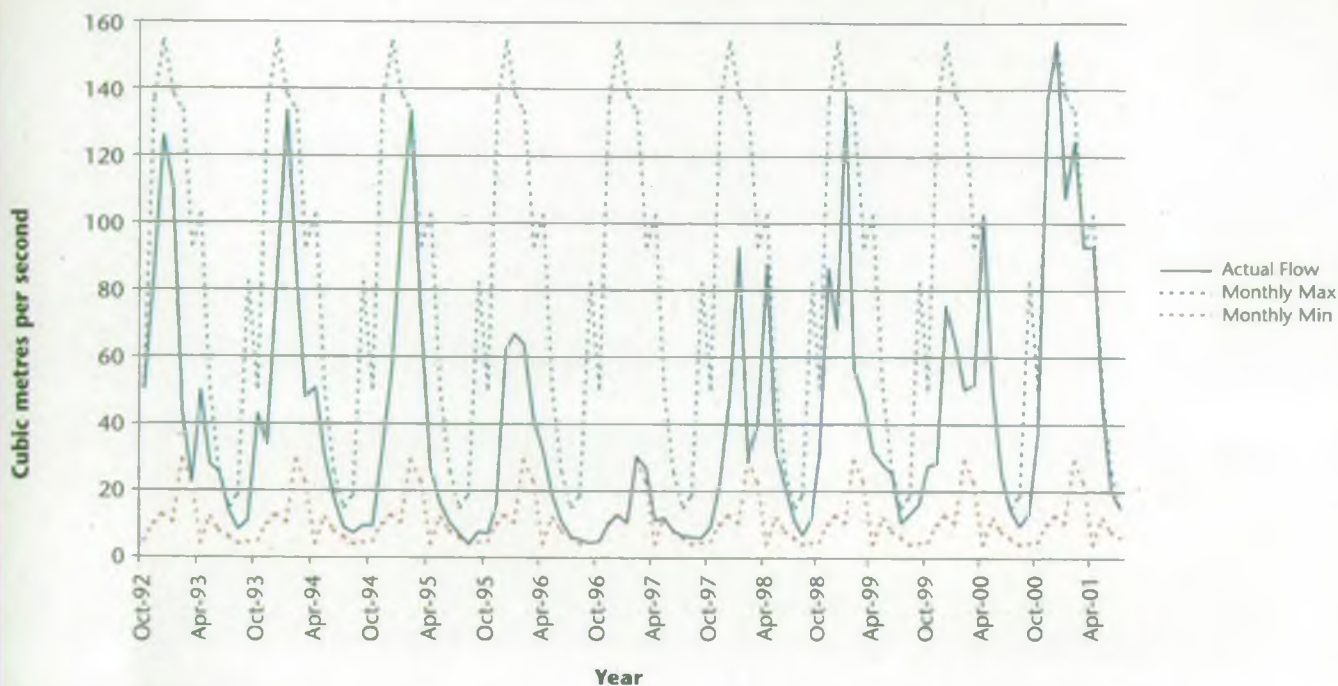


**Figure 27: Mean monthly flow for the River Test at Broadlands (1990-2001)**



**Figure 28: Mean monthly flow for the River Medway at Teston (1990-2001)**



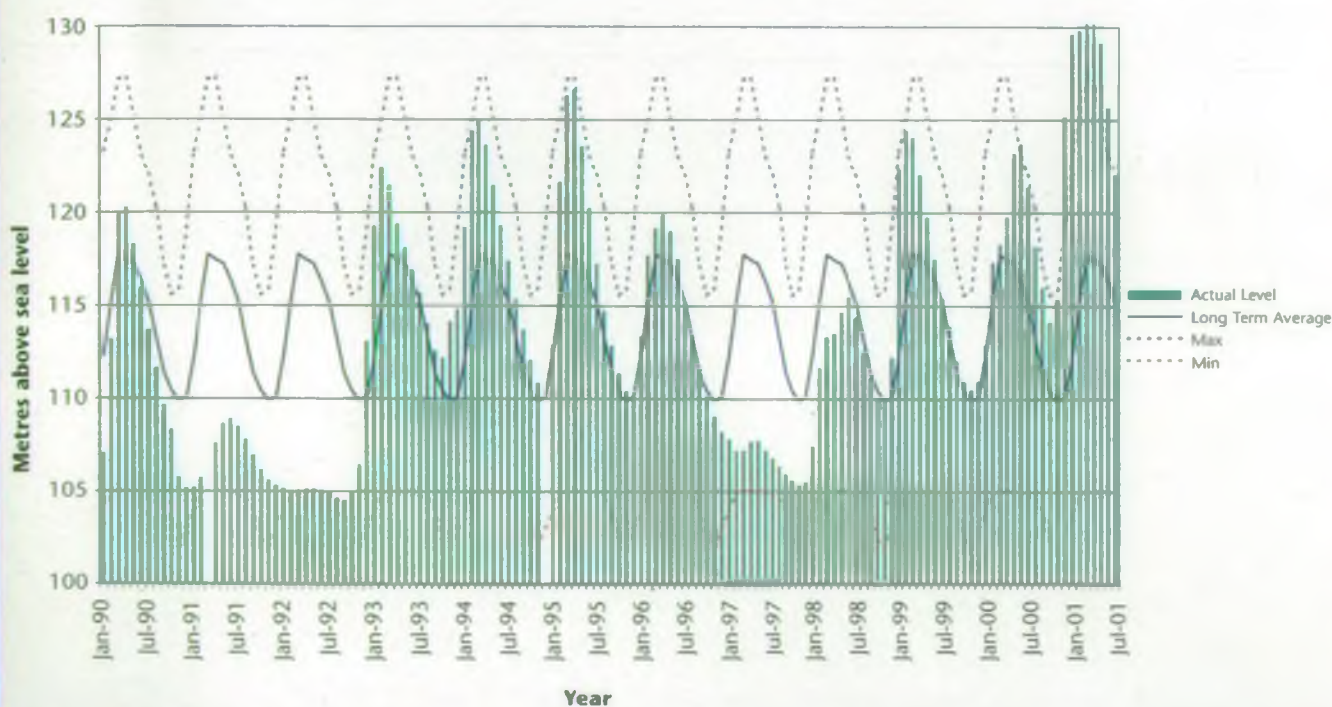


**Figure 29: Mean monthly flow for the River Thames at Reading (1992-2001)**

#### Groundwater levels

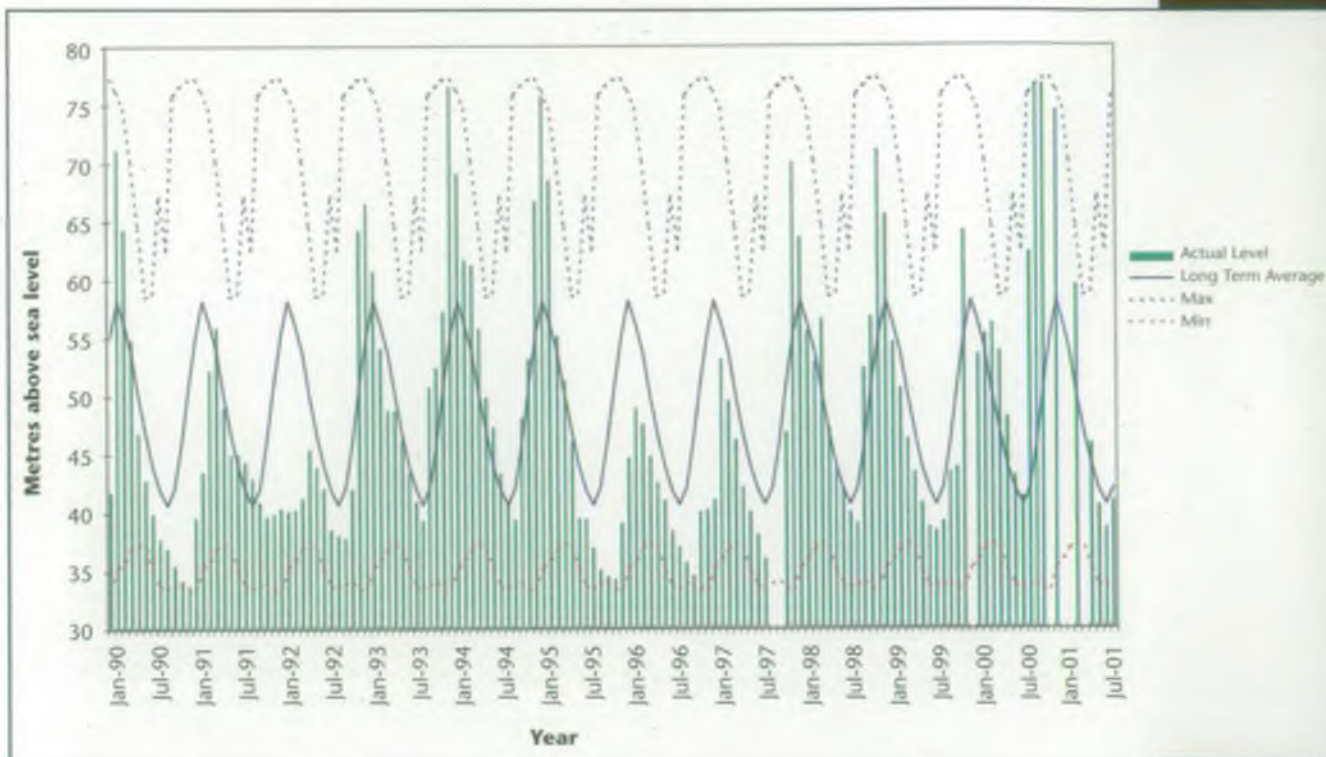
Aquifers provide natural storage of freshwater resources. Much of the water supply across the Region comes from groundwater (70 per cent within the Environment Agency's Southern Region and 40 per cent within Thames Region). Groundwater levels and abstractions also can have a direct effect on river flows. Groundwater

levels vary according to the amount of effective rainfall, abstraction and the characteristics of the aquifer. The example sites have been chosen to illustrate levels found within the main aquifers of the Region (see Figures 30 and 31).



**Figure 30: Groundwater levels at Gibbert, Berkshire Downs (1990-2001)**





**Figure 31: Groundwater levels at Chilgrove, Chichester chalk (1990-2001)**

## Trends

### River flows

The example rivers show both seasonal and annual variation. The dry years in 1992 and 1996/1997 are apparent, along with the more average flows at the end of the 1990s, and the high flows of winter 2000/2001.

### Groundwater levels

Both sites show both seasonal and annual variation in relation to recharge, with peaks and troughs reflecting effective rainfall, soil moisture deficit and hydrogeological factors. During the drought of 1995-97 recharge was much lower than normal. Over the last few years most groundwater sites have recharged to a high level, but they were below average for substantial periods in 1992, 1996 and 1997. In the future, trends might reflect abstraction and licensing policy and potentially climate change.

## Pressures and Influences

River flows and groundwater levels vary in response to rainfall, temperature, soil moisture and plant productivity (which directly affects evapotranspiration), soil type, geology, topography, land use and water use and return.

Longer term fluctuations in weather and climate change will clearly have potential implications and impacts.

In addition to natural factors, abstractions and, in the case of river flows effluent discharges, can have a marked effect. As we have highlighted in the section on biodiversity, over-abstraction can have a particularly dramatic effect on aquatic environmental quality.

Compared to the rest of the country, the South East Region has low mean annual effective rainfall, a large population and a high level of economic development. In addition to ecosystem demands, high water demands from the public must be met in a Region with limited water resources.

Twenty nine rivers have already been identified nationally by the Agency as suffering from low flows because of the high rates of abstraction, and many Sites of Special Scientific Interest are reported to be at risk from low water levels. The Agency is assessing the implications of abstraction on candidate Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in particular, as required by the Habitats Directive (see biodiversity section). The Agency is currently working with English Nature to identify critical sites, and to identify the changes needed to water company abstraction licences. It is already clear that the requirements for restoring sustainable abstraction will affect water yields and there may be a need to renegotiate licences at some cost to the Agency.


The Agency is approaching this issue by encouraging and demanding more efficient use of water, implementing schemes to restore sustainable abstraction, and ensuring that all environmental needs are fully taken into account in the next asset management plans of the water companies.

## Targets

Once again the Agency has little direct control over river flows. River flows do however provide a good indicator of the pressures being placed upon river catchments from factors such as climate







change, the impact of increased development and abstraction. It is the objective of the Agency to ensure that water resources are developed in a sustainable way taking into account environmental, economic and social factors.

## Actions and Responses

Following the Government's review of abstraction licensing legislation, the Agency is developing and will periodically review Catchment Abstraction Management Strategies (CAMS). These strategies will provide the local framework for achieving sustainable management and utilisation of water resources in a catchment. The revised licensing policy, based on CAMS, should ensure that there are sufficient flows in rivers to maintain a healthy viable ecosystem.

In 1998, the Agency published *A Price Worth Paying* that identified Habitats Directive, Sites of Special Scientific Interest (SSSIs) and Alleviation of Low Flow (ALF) sites of abstraction related environmental concern. This also put in place a programme of environmental improvements to be undertaken by the water companies over the period 2000-05. This is currently being undertaken through the Asset Management Planning (AMP) programme.

National and regional water resources strategies were published in March 2001. These provide a framework for the sustainable management of water resources over the next 25 years.

The Policy and Practice for the Protection of Groundwater was first issued in 1992. The document was updated in 1998 to include the latest changes in legislation and refocus the policy to highlight the wider role of the Environment Agency. Whilst the main content of the document remains as before a number of policy statements have been added. In particular new guidance has been produced on 'the physical disturbance of aquifers and groundwater flow'. The policy is presented as a framework within which decisions should be placed.

## Monitoring and Review

The Agency will continue to monitor river flows across the Region - flows are recorded at over 200 river gauging stations. This network is amongst the highest density of all European countries. Many gauges are linked to offices by telephones or radio to give data quickly, typically at 15 minute intervals, which is essential for flood forecasting.

Groundwater levels are monitored at approximately 1400 observation boreholes in the Region. With improvements in electronics, measurements have increased in precision in the last 10 years. Knowledge about the physical components of the water cycle far outweighs knowledge of the chemical and biological components of the system.

### P

## INDICATOR: WATER DEMAND AND AVAILABILITY

### Background to the Indicator

The demand put on water supply has increased over the last century due to population growth and the increase in the uses of water. People now expect a secure, high quality, water supply. It is important to safeguard our water supplies and to ensure that they are affordable in the future. This must be achieved without causing detriment to our environment.

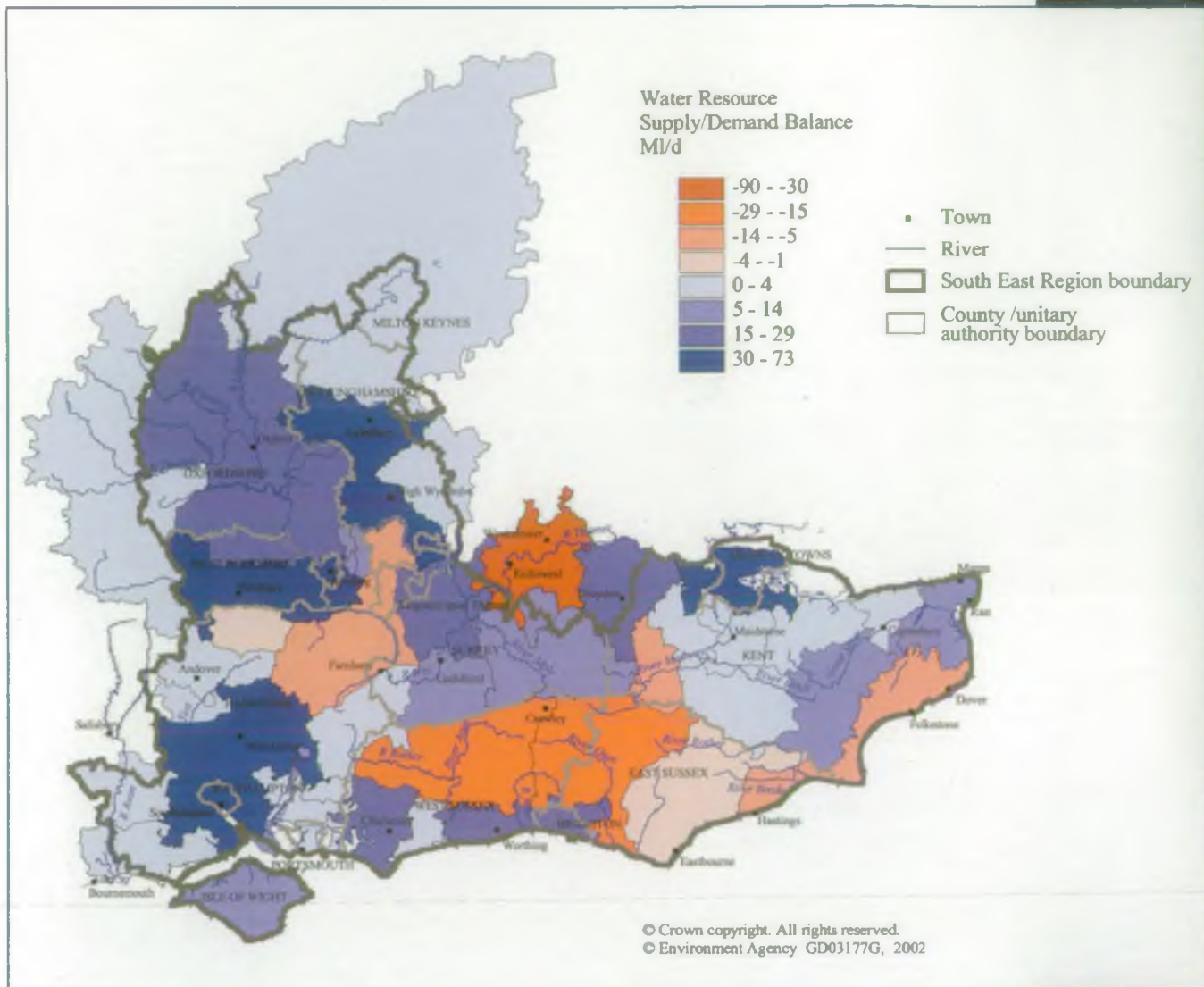
Water companies have a major impact on the water cycle due to the large volumes of water that they take from rivers and aquifers and the effluent they return to the system. Some uses of water, such as public water supply and some industrial uses are consumptive, that is they remove more water from the environment than they return, or water is not returned close to the point of abstraction. These abstractions can cause environmental stress and low flows in some rivers. Public water supply accounts for over 80 per cent of total consumptive water abstraction. The majority of the remainder is for industry.

Industrial and agricultural users also abstract water directly from rivers and aquifers. Some of the water abstracted for industrial use, such as that used for cooling, is returned at or near the point of abstraction.

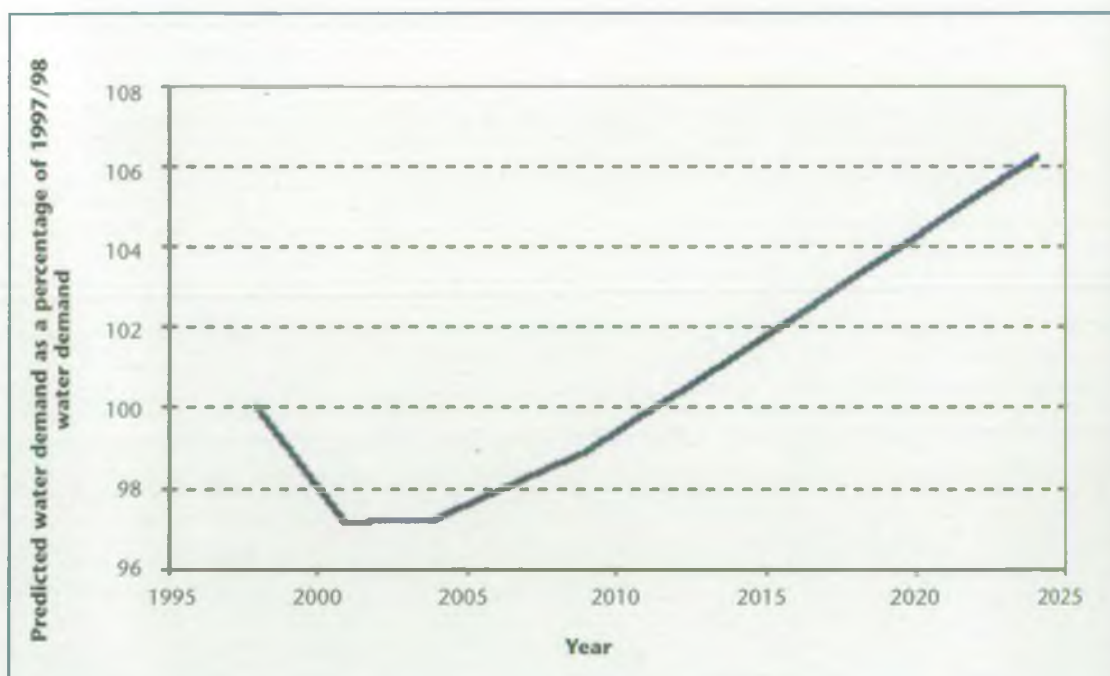
The difference between the water available for use (licenced reliable water supply) and the demand in a dry year is shown in Figure 32. This is expressed as the surplus/deficit water resources (+ or -) for water resource zones, each including a margin to allow for uncertainties in the forecast surplus/deficit. It shows the situation if 2000/01 were a dry year and no demand management or resource development were implemented beyond the 1997/98 baseline level.

The predicted water demand (that is water supplied by water companies including that lost to leakage) over the next 25 years as a percentage of the water demand in 1997/98 is shown in Figure 33.



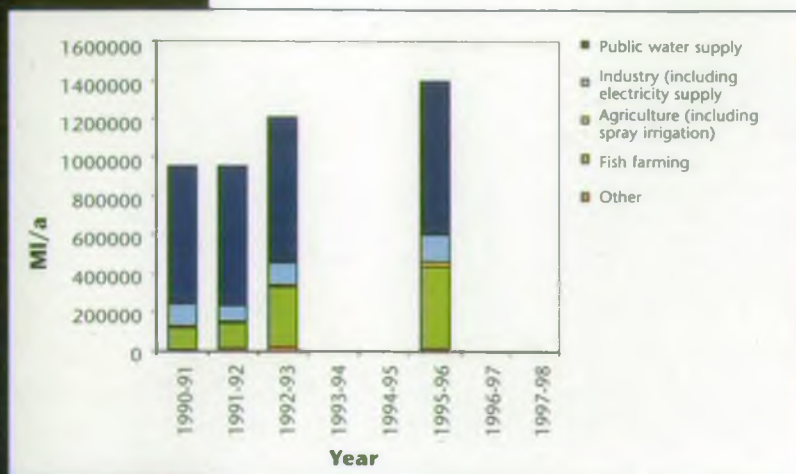


**Figure 32: Water resource supply/demand balance in the South East**



**Figure 33: Predicted water demand as a percentage of the 1997/98 water demand for the South East (1995-2025)**

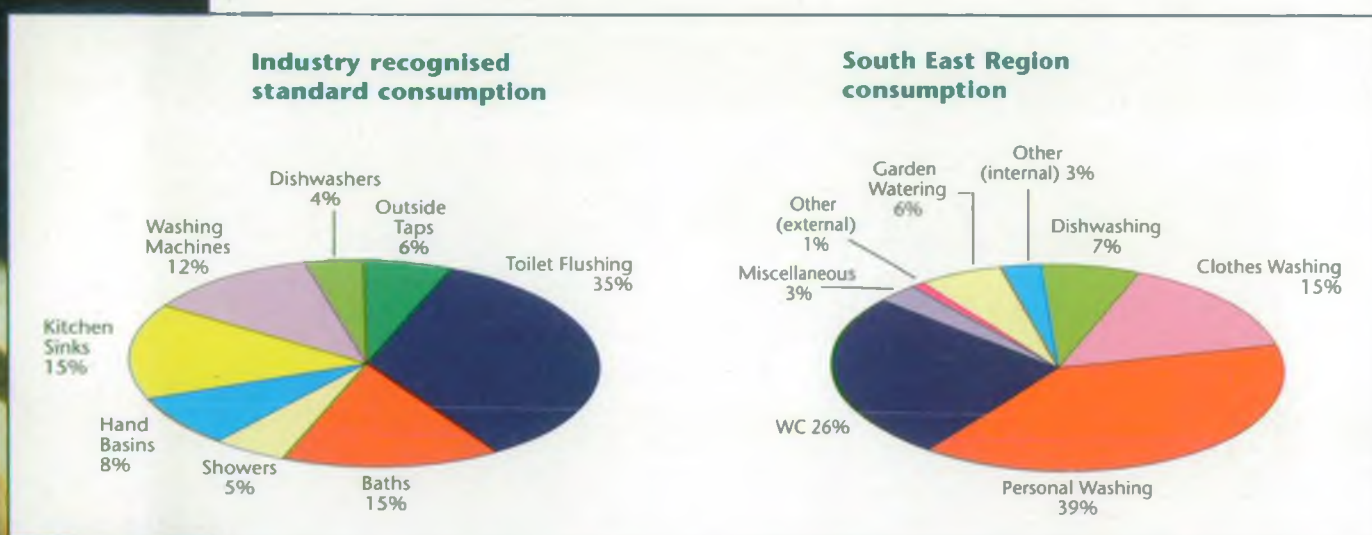




**Figure 34: Annual abstraction by use in the South East (1990/91-1995/96)**

Figure 34 and 35 show the amount of water abstracted annually for different purposes and typical household consumption by use, respectively.

Future pressures on water supply include increasing demand, restoring sustainable abstraction and changes in water resource availability due to global warming. Demand is likely to increase due to increasing numbers of households (beyond 1997/98 forecasts), growing demands for non-essential uses of water such as power showers and private swimming pools, increased garden watering and new industrial and commercial ventures. Accelerated socio-economic development would place greater pressures on the supply-demand balances.



**Figure 35: Typical household water consumption - Industry recognised standard and South East Region figures**

**Table 2: Actual leakage in 1997/98 and 2000/01 and forecast leakage for 2000/01 for the South East Region**

	Actual 1997/98	Actual 2000/01	Forecast 2000/01
Distribution losses (Ml/d)	331.12	286.8	273.88
USPL (Ml/d)	143.44	123.3	126.62
Total leakage (Ml/d)	474.56	410.0	400.50

[USPL - underground supply pipe losses]

**Table 3: Comparisons of dry year measured and unmeasured household per capita consumption (l/h/d) for resource zones in the South East Region for 1997/98 and 2024/25**

	1997/98			2024/25		
	Min	Max	Mean	Min	Max	Mean
Measured average	119.5	187.1	158.3	132.0	210.0	178.0
Unmeasured average	158.5	193.1	167.9	176.6	228.2	195.3
Measured peak period	158.7	277.3	213.8	195.1	284.9	228.7
Unmeasured peak period	199.4	369.9	252.3	239.4	550.5	268.0

**Table 4: Actual measured and unmeasured household per capita consumption (l/h/d) in the South East Region for 2000/01**

	Min	Max	Mean
Measured	124.9	197.2	147.0
Unmeasured	143.1	187.4	159.4



Distribution input includes two substantial components of water that are lost from the supply network through leakage. These occur before the water reaches its point of delivery (distribution losses) and between the point of delivery and the point of consumption (underground supply pipe losses or USPL). Leakage has been reduced substantially over the last few years (see Table 2). However, it still comprises one fifth of the distribution input.

Whilst leakage in the Thames Water supplied area has been reduced significantly by recent efforts, it still makes up nearly a third of the total leakage in the South East Region in 1997/98. This reflects the larger area and population served by the company in addition to high residual levels of leakage in comparison to other companies in the South East.

## Trends

The forecast supply-demand balance map for 2000/01 shows great variation across the Region. In some water resource zones the situation is negative (i.e. demand is predicted to outstrip the supply).

Water companies have produced plans to overcome these deficits. The plans contain the preferred options but in order for some to be implemented planning permissions and licences may be required.

The water companies forecast that water demand will fall until 2004/05, mainly due to reductions in leakage, but will increase again beyond this date due to the underlying trends in consumption. Some water companies did not achieve their forecast leakage for 2000/01 (Table 2).

Annual abstraction for public water supply, agriculture and industry has increased from 1990/91 to 1995/96. The increase in abstraction shown for fish farming is due to a change in the law and in reporting.

## Pressures and Influences

The water resources balance for three water companies in the South East Region was defined as 'tight' by the Office of the Director General of Water Services (OFWAT) in 2000, and agreed by the Agency. Further economic development and increases in demand and population will serve to exacerbate the situation across the Region.

Beyond 2004/05 the water companies do not expect further leakage reduction to be economically viable. However, the economic level of leakage reduction may vary with supply and demand and changes in technology and approach.

It is likely that there is a relationship between water use and affluence. Some areas of the Region are amongst the most affluent in the country and exhibit some of the highest levels of per capita consumption (PCC).

Water companies predict that metered water consumption will be lower than unmeasured water consumption, but that both measured and unmeasured PCC will rise between 1997/98 and 2024/25 (see Table 3, showing forecasts for dry years). In 2000/2001, actual average annual water consumption varied from 125 to 197 litres per person per day (Table 4). However, the Environment Agency needs to plan for drought or dry years as there is a significant increase in the amount of water used in these years. For example, in the 1995/96 drought more water was abstracted for public water supply, agricultural and industrial uses than in a typical year. There is a background of generally increasing abstraction to meet demand.

In many parts of the Region special attention has to be paid to peak demand levels as the majority of water supply is derived from groundwater sources. Abstraction from groundwater causes the water table to be drawn down in the vicinity of the borehole and therefore cannot be increased beyond a maximum rate to meet rising peak demand.

Parts of the Region are protected by environmental designations such as Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). Some of these sites have abstraction-related environmental concerns. Parts of the region are over-licensed, that is, if abstractors took their full quota then conflicts would arise between man's needs and the environment's needs and between the needs of different abstractors. More urgently, some areas are over-abstracted as the actual water abstraction is thought to cause environmental damage.

UK climate impact programme scenarios indicate that temperature increases will be higher in southern England than anywhere else in the UK. The volume of winter rainfall is likely to be greater while summer rainfall may be reduced. This may require more effective management of winter precipitation, including storage. Effective rainfall may be less due to greater evapotranspiration.

## Targets


The aim is for there to be a positive balance between supply and demand across the South East Region while ensuring environmental sustainability. This should be achieved by a twin track approach of measures intended to manage (existing, and future increases in) demand and, where appropriate, develop further water resources. Plans include measures for the restoration of sustainable abstraction.

## Actions and Responses

Over recent years water companies in the Region have turned their attention to reducing leakage. The scope for further reductions in leakage should continue to be vigorously pursued by the companies. A tripartite group







(DEFRA, OFWAT and Environment Agency) has been set up to investigate best practice on leakage and target setting. The outcome from this study is expected in 2002. Thames Water are working alongside the Environment Agency and OFWAT to develop a robust assessment of their economic level of leakage and to produce and implement an acceptable resource plan from 2003/2004.

Water conservation and demand management measures, including metering, will play an important role in managing the envisaged increase in per capita consumption. Nevertheless, close attention will need to be paid to trends in supply and demand to ensure that where new water resource schemes may be required, that they are identified and planned prior to any major new development.

Further demand management and the introduction of metering should help to reduce per capita consumption. However, peak water demand will continue to be a critical water supply problem.

The National Environment Programme identifies sites of abstraction related concern that water companies will be required to remedy by 2005. The Agency will seek to recover abstraction licences over the next 20-25 years in areas where abstraction is no longer deemed acceptable. This will limit the water available for supply and may require abstraction from other sites to compensate for the shortfall.

In conjunction with the water resource plans produced by the water companies the Agency's water resources strategies will form the direction of future water resource management.

## Monitoring and Review

The Agency's Water Resources Strategies, published in March 2001 set out the long-term framework for sustainable water resources management in the Region. The strategies contain 30 national actions that will be undertaken by a national project team. The regional strategies also contain more local actions. Progress against the strategies will be reported annually. The strategies will be reviewed completely in a few years time.

The water companies' water resources plans, submitted in 1999, are monitored and reviewed annually, with reporting to the Agency in September each year. The annual review reports include actual figures on components of the supply/demand balance for the preceding financial year including distribution input, leakage and metered and non-metered consumption. The companies will be asked to revise and resubmit their plans in detail in advance of the next periodic review of prices by OFWAT in 2004.

These processes will provide the framework for monitoring and review of public supply-related issues. Alongside this work, the Agency's CAMS process will provide a more detailed catchment-based review of water resources. The first CAMS will be published in 2003. CAMS will be reviewed on a rolling six-year cycle.

In all of these, it should be recognised that the boundaries of CAMS, resource zones, water companies and strategic planning authorities are not contiguous. Therefore, drawing any direct, local conclusion needs to be done with care and detailed discussion with the various interests involved.



## Background

Waste is controlled because people discard it, allow it to escape or dispose of it without proper care. The Waste Framework Directive<sup>1</sup> requires Member States to develop a system of permitting sites where waste is taken for disposal. When waste can be beneficially re-used without causing harm to health or pollution of the environment a system of exemption from permit requirements exists. In 1998/99 the South East of England produced four million tonnes of municipal (household) waste and 9 million tonnes of industrial and commercial wastes. Waste production is growing at about three per cent per year nationally. We are running short of landfill sites in the South East and the UK needs to comply with the Landfill Directive<sup>2</sup>, requiring substantial diversion of municipal waste away from landfill. We all need to play our part as individuals in managing our use of resources more sustainably, minimising waste and gaining value from it. This chapter sets out some of the key information, issues and indicators that will help us meet this challenge.

In the UK, most waste has been controlled by legislation since 1976. The legislation was introduced when it became clear that uncontrolled waste disposal posed a serious threat to quality of life and to the environment. Since 1976 there has been a very large growth in waste related legislation controlling the storage, movement, treatment and disposal of 'controlled waste'. Controlled waste is household, industrial and commercial waste, but not mines and quarries waste, explosives or waste from agriculture<sup>3</sup>. A recent example of new legislation is the Landfill Directive. This will reduce the environmental damage associated with the landfill of waste by imposing stricter standards and requiring diversion of waste away from landfill towards more sustainable options.

In 2000, the Environment Agency published its Strategic Waste Management Assessments (SWMA). The ten reports present information to a consistent standard on waste production and management for each of the nine planning regions in England with a separate report for Wales. Key issues from the South East of England SWMA include:

- *four million tonnes of municipal waste and nine million tonnes of industrial and commercial wastes were produced in the South East in 1998/99;*
- *landfill remains the most popular waste management option with 85 per cent of municipal waste and 51 per cent of industrial and commercial wastes disposed of through this route;*
- *about 12 per cent of municipal waste is recycled, whilst industry and commerce recycle 28 per cent of their wastes;*
- *the South East produced over 13 million tonnes of construction and demolition wastes in 1999, with half of this being re-used or recycled. An additional 25 per cent of this waste stream went to exempt facilities for management and recovery;*
- *landfills in the South East received 13.5 million tonnes of waste in 1998/99 accounting for 17 per cent of the waste landfilled in England and Wales. This compares to only 122,000 tonnes of waste going for incineration in the South East.*
- *there is about seven years of landfill space left in the South East at current rates of filling for household and industrial/commercial wastes; and*
- *the South East will need to divert from landfill 3.7 million tonnes of municipal biodegradable waste by 2020 to comply with the Landfill Directive, if current trends in waste production continue.*

The Government has recently published the *Waste Strategy for England and Wales (Waste Strategy 2000)* setting a range of demanding targets to increase the re-use, energy recovery and recycling of waste. The Strategy discusses roles and responsibilities and the various levers for change.

## Roles and Responsibilities

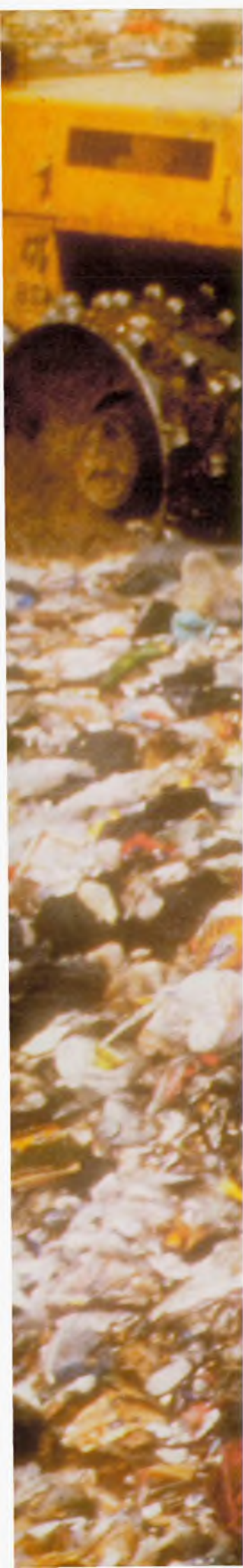
Achieving sustainable waste management will require action by different sectors: Government; local government; industry; commerce; and the waste management industry. It will also require us all to take action as individuals, consumers and householders. Decisions on waste management, including decisions on suitable sites and installations for treatment and disposal, should be based on a local assessment of the Best Practicable Environmental Option (BPEO)<sup>4</sup>.

The Government sets out its view of the role of the Environment Agency in *Waste Strategy 2000*; to ensure that waste management activities do not cause pollution of the environment or harm

- 1 Council Directive 75/442/EEC as amended by Council Directive 91/156/EEC; Council Directive 91/689/EEC; European Parliament and Council Directive 94/62/EC.
- 2 Council Directive 99/31/EC on the landfill of waste.
- 3 Government is likely to add agricultural waste to the list of controlled wastes in 2002.
- 4 A systematic approach to decision making that balances the full environmental impact of each option.

Each year the amount of waste generated in the UK increases by approximately three per cent. In 1998/99 13 million tonnes of waste was produced in SE of England. 85 per cent was landfilled. Landfill space is running short and the Landfill Directive requires massive diversion of waste away from landfill towards more sustainable technologies. Action is needed now to reduce waste production and to make some use of the waste that is produced.





to human health. The Government also states that the Agency has a very important wider advisory and information gathering role. This role is developing rapidly following the production of the Agency's Strategic Waste Management Assessments (SWMA). The Agency is developing approaches and tools that will assist greatly in the planning and decision making that will be essential in the delivery of the national waste strategy.

#### Environment Agency as Regulator

The Agency is developing its regulatory work in respect to waste by increasingly adopting a risk-based approach to regulation, moving towards environmental outcomes as a means of measuring success. An example of this is the inspection of licensed waste management facilities. The Agency now uses the Operator and Pollution Risk Appraisal (OPRA) approach. Each licensed site is given a score based on a combination of the environmental risk that it poses together with the operator risk. The environmental risk is based on factors such as the type of waste accepted, proximity to sensitive receptors such as surface waters. The operator risk is based on the record of licence compliance, the risk of pollution or harm together with the existence of quality management systems. The higher the score, the higher the risk. Higher risk sites are inspected more frequently and have more officer time allocated to them. Success in terms of producing high quality licences and inspecting and enforcing them effectively can potentially be measured by the trend in overall OPRA scores.

Producer responsibility legislation has a clear environmental outcome. The Packaging Waste Regulations<sup>1</sup> place a requirement on industries that handle significant amounts of packaging to recover a prescribed proportion of packaging waste. This is achieved by tradable certificates of recovery enabling businesses to buy packaging recovery notes should they be unable to recover the required amount of waste packaging themselves. The Agency regulates these industries and can monitor the amount of packaging recovered.

The Agency works with local authorities and land owners to prevent contaminated land causing pollution or harm. New regulations<sup>2</sup> place on landowners, industry, local authorities and the Agency duties designed to ensure contaminated land is remediated. The quantity of contaminated land is a potential measure of environmental outcome.

Agency as Information Gatherer and Adviser  
*Strategic Waste Management Assessment 2000: South East* includes a chapter on waste forecasting and modelling. The chapter indicates how the quantity of waste requiring management is likely to grow over the next 20 years and then compares three possible options in managing the waste. One option is a baseline "do nothing" option, the second is to implement a strategy based mainly on energy recovery, the third is to base a strategy mainly on recycling. The model enables the reader to

see how many facilities of various types may be needed in the period. This is an example of the value of the work the Agency can provide to enable key decision makers to make sound, well informed decisions. The Agency has also developed a Life Cycle Analysis tool that enables the various environmental effects of each known waste management option to be calculated. It includes the effects of the construction and operation of all infrastructure, transport arrangements and the re-use of recycle. Correctly applying the tool enables decision makers to properly compare the environmental effects of each option enabling them to take BPEO into account when producing waste strategies or determining planning applications.

The Agency is currently updating the SWMAs and is working with partners to maximise the use of this information and advice. Foremost in this liaison is the work the Agency is doing with the Regional Assembly and Technical Advisory Body developing a regional waste strategy. The Technical Advisory Body will develop strategic options in the first instance before passing them to the Assembly for consultation and adoption of the preferred strategy. Once approved the strategy will be used to prepare regional planning guidance. The outcome of this work will be more sustainable waste management.

## Indicators

Some potential indicators of the effectiveness of the Agency as regulator based on environmental outcomes were outlined above. These potential indicators may be added in later reports once baseline information has been established:

- *risk-based OPRA scores of all licensed waste sites within the region;*
- *tonnes of packaging waste recovered as a result of the Packaging Regulations; and*
- *square metres of contaminated land restored to a condition that is fit for its intended end use.*

The indicators presented in the first version of this State of the Environment Report have been reviewed following publication of Strategic Waste Management Assessment 2000: South East. The new indicators better reflect Government targets and information within the SWMA report. They represent the role of the Agency as information gatherer and provider of information:

- *commercial and industrial waste arisings, recycling and recovery.*
- *household waste arisings, recycling and recovery.*

<sup>1</sup> Producer Responsibility Obligations (Packaging Waste) Regulations 1997.

<sup>2</sup> Environmental Protection Act Part 11(A).



## Background to the Indicator

The South East of England has approximately 300,000 business sites situated within it. Service industries employ almost 80 per cent of the workforce with a further 19 per cent employed by production and construction industries and a small fraction in agriculture, forestry and fishing. The important finance and banking sector is clustered in Berkshire, Surrey and Hampshire and has grown rapidly during the 1990s. Tourism is especially important along the South coast and in Oxford and Windsor. There is a cluster of defence industries in Hampshire and West Sussex linked with the naval dockyard at Portsmouth. Reading and the Thames Valley have seen a substantial expansion of high technology industries and services and these businesses are now a major employer and the area has become nationally important in this sector. A large number of people are also employed by the pharmaceutical industry in Hampshire, West Sussex and Kent. Bluewater near Ebbsfleet in Kent is one of the largest retail developments in the UK, whilst the Channel Tunnel Rail Link and development along the Thames Gateway east of London will have an increasing impact on the South East.

The amount of commercial and industrial waste produced within the region will vary with the economic cycle. Waste production has historically grown at its highest rate when the economy is growing. One of the systemic issues that Waste Strategy 2000 seeks to change is the link between economic growth and growth in waste production.

The Environment Agency conducted a survey of some 20,000 businesses in 1998-99 to collect the data needed to support national and regional estimates of waste production from the industrial and commercial sectors. The data does not include construction or demolition wastes.

## Trends

The publication of the SWMA provides a baseline for the first time based on high quality information. The trend in commercial and industrial waste production and management will be monitored and reported in future updates of this State of the Environment Report (see Figures 36 and 37).

## Pressures and Influences

The key pressures on waste production and management include:

- *economic growth leading to more output and hence waste production;*
- *increase in number of businesses situated within the South East;*
- *lack of facilities within the South East for treating waste (as opposed to landfill); and*
- *need for industry to increase its use of recycle.*

The key Influences on waste production and management include:

- *greater business awareness of need to minimise, re-use and recycle waste;*
- *development of a Regional Waste Strategy that will encourage reduction, re-use, recycling and recovery;*
- *establishment of Government targets for waste reduction, re-use, recycling and recovery;*
- *establishment of new business initiatives supported by Government incentives;*

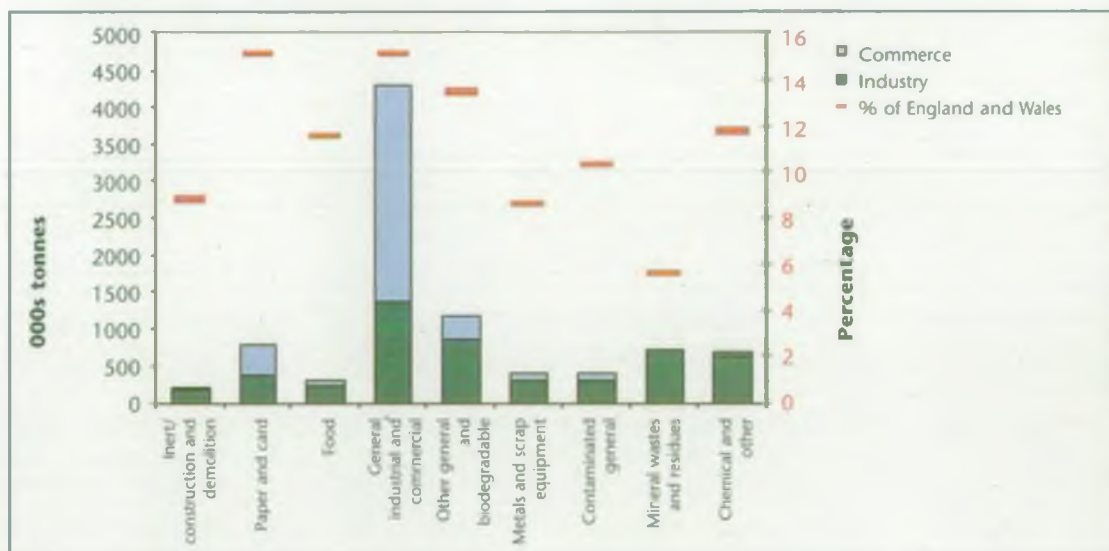
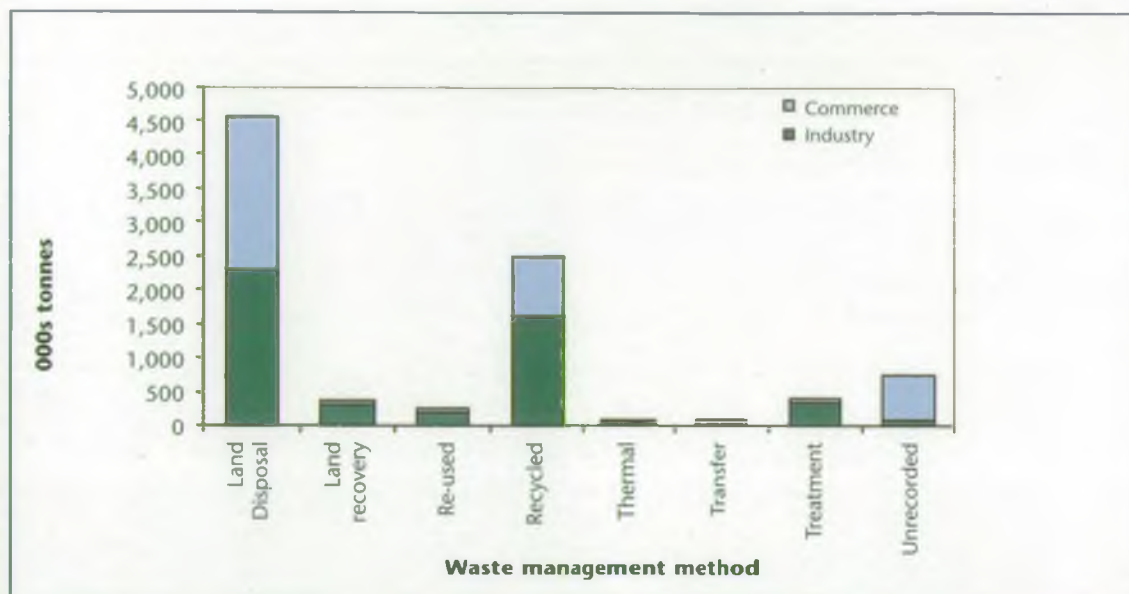


Figure 36: Amount and composition of industrial and commercial waste produced in the South East (000s tonnes)





**Figure 37: Waste management methods used for Industrial and commercial waste produced in the South East (000s tonnes)**

- development of the Waste and Resources Action Programme (WRAP) set up by the Government to improve markets for recycled goods;
- greater business awareness of need to design products that can be more easily re-used or recycled; and
- "Producer Responsibility" legislation designed to ensure business recovers value from prescribed waste products.
- attitudes to waste - raising awareness amongst the public and business of the issues surrounding waste production and management;
- product design - look at ways of creating packaging which can be cheaply re-used and recycled;
- infrastructure - developing new facilities for the collecting and recovery of waste; and
- markets for secondary materials - a major barrier to recycling at present is the limited availability of end markets for secondary materials. WRAP has been set up to overcome barriers and increase recycling.

## Targets

The Government's target set in *Waste Strategy 2000* is by 2005 to reduce the amount of industrial and commercial waste sent to landfill to 85 per cent of that landfilled in 1998. This will be the target adopted within the State of the Environment Report.

## Actions and Responses

*Waste Strategy 2000* focuses on four key areas that will need action, namely:

## Monitoring and Review

The Agency will update the national waste survey and the new data will show how business is responding to the challenges and targets. The results will be published in updates to the State of the Environment Report.



### INDICATOR: HOUSEHOLD WASTE ARISING, RECYCLING AND RECOVERY

## Background to the Indicator

Municipal waste is mainly comprised of household waste, but also includes commercial waste collected by or on behalf of local authorities. It typically accounts for some 15 per cent of the controlled waste produced in an area and arrangements for its management are more important now than ever because of the Landfill Directive. The Directive requires Member States to progressively divert biodegradable municipal solid waste (MSW) away from landfill (see 'Targets' below).

Producing less household waste will directly help the UK to achieve the Landfill Directive targets whilst continuing to allow MSW to grow by three per cent annually will demand the building of more waste facilities. More information on the inter-relationship between growth in waste, waste type and waste management options can be found in *Strategic Waste Management Assessment 2000: South East* published by the Environment Agency.



Reducing the quantity of MSW produced is essential and forms one of the targets that the Government has set Local Authorities in *Waste Strategy 2000*. The Government has also set local authorities targets to recycle and recover value from household waste. Figure 38 shows the amount of MSW produced in 1998/99, the amount recycled and the amount where energy has been recovered from waste through incineration.

## Trends

The trend in the South East reflects the national increase in household waste arisings, which is currently approximately three per cent annually. This is linked to a number of factors, including the number and size of households and changes in the pattern of consumer spending. There could also be an increase in the amount of commercial waste mixed in with household waste due to increased costs of disposal. Improved recycling rates represent an increase in public awareness and participation, however there is still a need for a much greater increase if government targets are to be met.

## Pressures and Influences

The key pressures on waste production include:

- *increase in number of single or low occupancy homes generating more waste per person;*
- *increase in number of houses in the South East; and*
- *increase in disposable income in the South East leading to more consumption and more waste.*

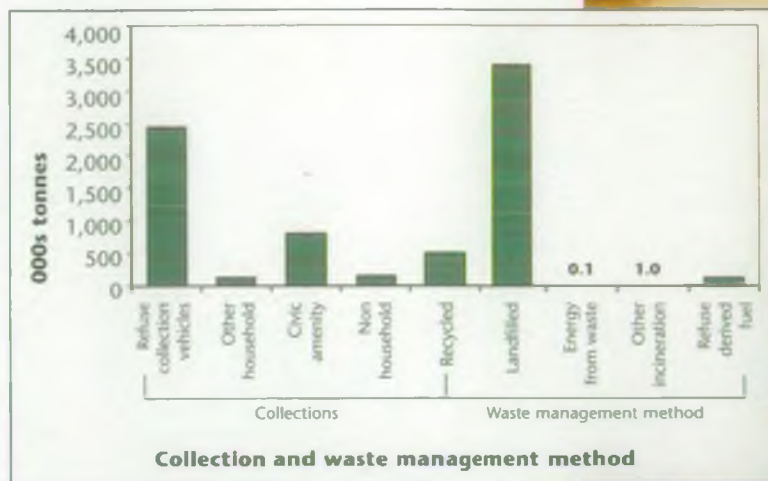
The key influences on waste production, recycling and recovery include:

- *greater public awareness of need to re-use and recycle waste;*
- *development of a Regional Waste Strategy that will encourage reduction, re-use, recycling and recovery;*
- *establishment of Government targets for waste reduction, re-use, recycling and recovery; and*
- *establishment of "Best Value" initiatives within local authorities*

## Targets

*Waste Strategy 2000* sets local authorities targets that include the following:

- *recover value from 40 per cent of municipal waste by 2005, rising to 67 per cent by 2015;*
- *recycle of compost at least 25 per cent of household waste by 2005, rising to 33 per cent by 2015; and*
- *consider setting targets to reduce significantly the growth in household waste per head and where possible to reverse that growth.*



**Figure 38: Amount and composition (by collection method) of MSW produced in the South East in 1998/99 (000s tonnes)**

It also reproduces the Landfill Directive targets:

- *by 2010 to reduce biodegradable municipal waste landfilled to 75 per cent of that produced in 1995;*
- *by 2013 to reduce biodegradable municipal waste landfilled to 50 per cent of that produced in 1995; and*
- *by 2020 to reduce biodegradable municipal waste landfilled to 35 per cent of that produced in 1995;*

## Actions and Responses

The challenge is for local authorities and other key stakeholders to respond to the targets set in *Waste Strategy 2000*. This should include plans for increased waste re-use, recycling and recovery through their Waste Strategies, Recycling Plans and Waste Local Plans. They can be assisted in their task by the co-operation of business in developing best practice, such as less packaging, and by the Regional Assembly through the publication of a Regional Waste Strategy.

## Monitoring and Review

Since 1995/96, the Government has commissioned an annual survey of local authorities in England and Wales, to gather information on the collection, treatment and disposal of household and other waste collected by local authorities. In addition, the Agency will update information within the SWMA. Progress towards the targets set in *Waste Strategy 2000* will be reported annually by the Government and will be included in updates of the State of the Environment Report. The Government has also stated that it will act in the event that monitoring shows targets are unlikely to be met within the existing legislation and policy framework.



# RISK OF FLOODING

over 230,000 properties in the Region have been identified as being at risk from flooding - during Autumn 2002 continuous heavy rainfall caused significant flooding throughout the South East with 1746 Flood Watches, 621 Flood Warnings and 78 Severe Flood Warnings being issued between September 2000 and March 2001.

the effects of climate change are uncertain, but are likely to be significant for the Region - predicted effects include that annual rainfall is expected to increase by between zero and 10 per cent by 2050 and there will be a relative sea level rise of 6mm per year.

## Background

Flooding of land adjacent to rivers and the coast is a natural process that can have far reaching effects on people and property as a result of previous decisions about settlement and land use. There are considerable costs associated with the damage it causes. These costs are not only financial and economic, such as damage to property and flood defences and disruption to business, but can also cause distress, injury and loss of life as well as extreme demands on the emergency services and loss of public confidence in the planning services. However, flooding can also have many benefits to the environment, for example it is essential to maintain certain important habitats.

### Causes of Flooding

The Government's Planning Policy Guidance on *Development and Flood Risk* (PPG 25, 2001), identifies the principal cause of river flooding as excessive rainfall or snow melt within a limited period, which overwhelms the drainage capacity of land, particularly when the ground is already saturated or when channels become blocked. Inundation by the sea is largely due to combinations of high tide, storm surge and wave activity but may also be associated with structural failure of defences. Some areas are subject to combinations of tidal and river impacts. The impacts can be aggravated by:

- *the growth of built development in catchments and other changes in land use, which increase the rate and volume of run-off;*
- *sediment movement that has changed river cross-sections and affected flood levels;*
- *inadequate maintenance of flood defence systems, watercourses, culverts (including the flood relief areas around them) and road gullies, particularly where this leads to channel blockage;*
- *canalisation, modification and diversion of rivers and watercourses, which increase the rate of flow and decrease the time taken for water to travel within a catchment; and*
- *building of structures (e.g. embankments) which reduce storage and restrict flows over historical flood plains and thereby create additional flood risks both upstream and downstream.*

Flooding damage is, therefore, a combination of human activity and natural physical conditions.

### Climate Change and Flood Risk

Whilst there are uncertainties involved, climate change is predicted to cause increased

storminess in the summer and winter and rising sea levels that are likely to increase the frequency of flood events. Following the 1990 reports of the Intergovernmental Panel on Climate Change, allowances for the relative sea level rise of 6mm per year were adopted for the Agency's Thames and Southern regions by DEFRA for coastal defence schemes. The latest climate change scenarios suggest that annual rainfall is expected to increase by between zero and 10 per cent by 2050. A shift in the seasonal pattern of rainfall is also expected, with autumns and winters becoming wetter over the whole of the UK, by as much as 20 per cent under some scenarios. Climate change has the potential to not only affect flood risk but also other aspects of the environment considered in this report including water resources, biodiversity and water quality.

### River and Coastal Flood Plain

The Environment Agency has provided Indicative Floodplain Maps to indicate the areas at risk from flooding (these maps do not take into account of the presence of defences or the effects of climate change). Figure 39 shows the indicative floodplain for the South East Region. It is based on the approximate extent of floods with a 1 per cent annual chance (1 in 100-year flood) from rivers and a 0.5 per cent annual (1 in 200-year flood) chance from the sea under present expectations or the highest known flood.

More than 230,000 properties have been identified in the South East Region as being currently at risk from flooding and in an extreme event many more properties would be affected. This includes properties in coastal areas and river floodplains, as well as elsewhere in a catchment.

The coastline of the South East is subjected to huge dynamic forces. The present day position is largely the product of ongoing management for both flood defence and coastal protection reasons. Climate change is placing further pressures on this heavily managed coastline. Significant stretches of our coastline are monitored each year by the Agency to assist with coastal management decision making, producing an annual record over the last 25 years. This information, shown in Figure 40, is increasingly invaluable for investment planning purposes.

## Roles and Responsibilities

The primary responsibility for safeguarding land and other property from flooding remains with the owner. There is no statutory duty on central or local government to protect land or property against flooding. However, operating authorities have permissive powers to carry out flood defence works in the public interest. Individual property owners are also responsible for





Figure 39: Indicative flood plain in the South East

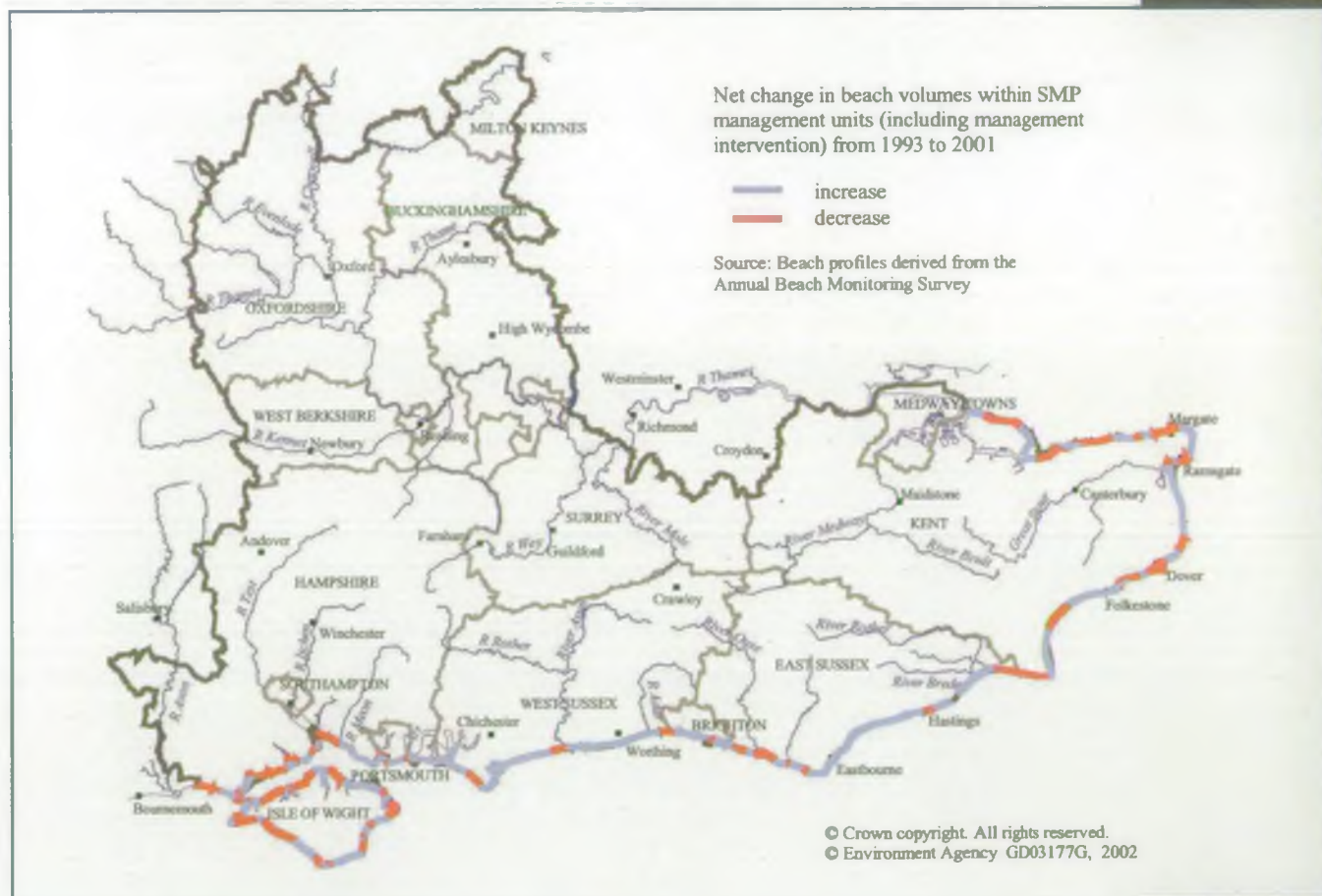


Figure 40: Net change in beach volumes within Shoreline Management Plan management units (1993-2001)



managing the drainage of their land in such a way as to prevent impacts on neighbouring land.

In addition to property owners, DEFRA, the Environment Agency and local authorities all have significant roles in managing flood risk. Government guidance on flood and coastal defence is set by DEFRA, who also contribute significantly to the funding of flood defence measures. The Environment Agency has a supervisory duty for all matters relating to flood defence and is the principal operating authority for main rivers and sea defence. The Agency also has the lead role for managing the dissemination of flood warnings. Local authorities are the operating authorities for ordinary watercourses (except where the power rests with Internal Drainage Boards). Local planning authorities are responsible for the control of development where it might be directly affected by flooding or affect flooding elsewhere.

#### Flood Defence Alleviation

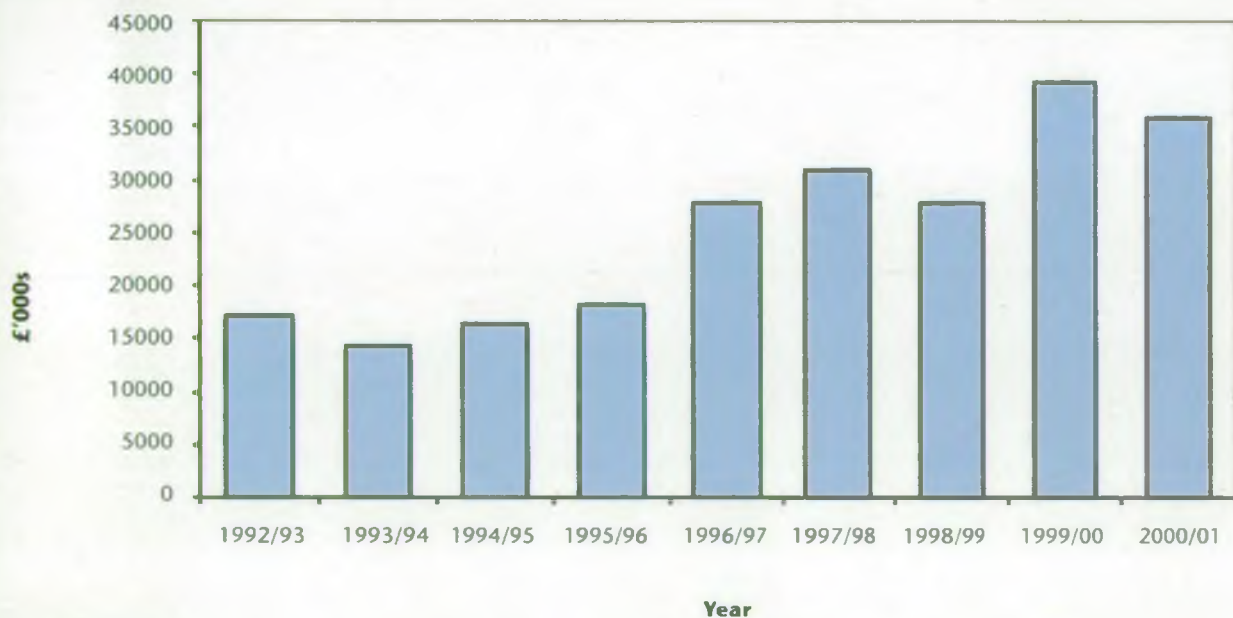
The Agency makes a significant contribution to river basin management through works related to flood defence. Improvement works aimed at reducing the risk from flooding to life and property might take the form of channel deepening or widening, storage provision, river control structures or raised defences. Such works may tackle insensitive or inappropriate works in the past, or they may be needed to address

increased risk arising from new development within the floodplain.

Our internal workforce carries out extensive essential maintenance works to watercourses and previous improvement schemes. In addition, channels are kept free from debris and blockages, and excessive growth from vegetation controlled where required. The workforce is also deployed on emergency response work, when there is a high risk of or actual flooding, that includes operating defences and control structures and ensuring that flows are maintained without blockages occurring.

Flood risk will be a particularly important issue in future years with the intense pressure for development in the South East Region, coinciding with increasing concerns related to climate change.

Figure 41 illustrates the level of capital investment by the Agency in the South East Region. Capital investment in flood defence has doubled since the early nineties. This represents between 40 and 45 per cent of total flood defence expenditure. Significant future growth in investment is needed if the existing flood defence infrastructure is to be both sustained and improved. In certain situations it may not be economically or environmentally appropriate to undertake capital works to reduce flood risk and other floodplain and / or catchment management options may be considered.



**Figure 41: Capital expenditure on flood defence (1992/93-2000/01)**

#### Flood Warning

The risk of flooding from the rivers and the sea is with us all the time. It can happen very quickly and without warning. Since September 1996 the Environment Agency has taken the lead role in issuing flood warnings. The Agency conducts

detailed flood forecasting and makes the decision whether or not to issue a flood warning. Flood warnings are considered in more detail below.



## Indicators

We have selected only one indicator at this stage to monitor flood risk:

- *number of flood warnings.*

As this indicator has limitations, we hope to be able to provide data on other flooding indicators in the future. These could include:

- *number of people living in unprotected flood risk areas;*
- *proposed development and consented planning permission in flood risk areas;*
- *numbers of people and properties flooded for defined return period/events.*



### INDICATOR: NUMBER OF FLOOD WARNINGS

## Background to the Indicator

The Environment Agency commissioned an independent review (The Bye Report) following flooding across Wales and central England over Easter 1998. This identified the need to strengthen the flood warning capability and raise the public awareness of flood risk. The Agency has responded to these recommendations by making significant investments in its flood warning service. One of the improvements was the introduction of a new system for issuing warnings to the public.

On the 12th September 2000 a new four staged warning system was introduced as follows:



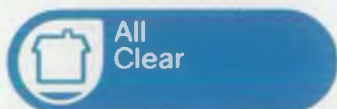
**Flood Watch:** flooding is possible in the area, be aware, be prepared, watch out!



**Flood Warning:** flooding of homes, businesses and main roads is expected in the area, act now!



**Severe Flood Warning:** severe flooding is expected in the area, there is imminent danger to life and property, act now!



**All Clear:** there are no Flood Watches or Warnings currently in force in the area

The number of warnings has to be treated with some caution as a measure of potential flooding as the areas for which warnings are issued vary in terms of their size and number of properties covered.

Significant investments are being made to improve our ability to forecast and warn of imminent flooding. Future developments will enable more rigorous assessment of performance as our knowledge improves of flood warning risk areas and properties at risk. Thus the analysis of flood warnings used in this report is offered as an interim step.

## Trends

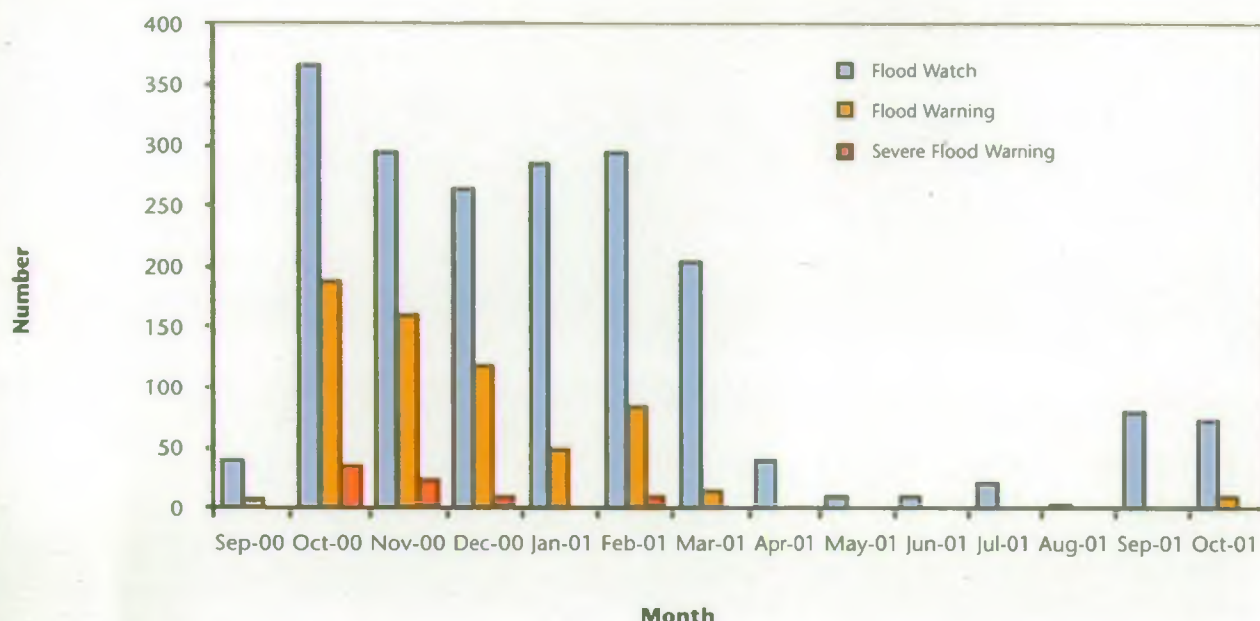
The data presented for flood warnings demonstrates the combination of different factors, including the stormy weather during the winter of 2000/01 and the growth in the Agency's flood warning capacity (see Figure 42). Note that as the new flood warning system was introduced in September 2000, it is not possible to identify significant trends and this will only be possible in future years once a longer dataset is available.

## Pressures and Influences

Several factors could affect the number of flood warnings and flooding in the future, including the adequacy of current flood defences, the amount of inappropriate development in at risk areas and changed weather conditions. Climate change scenarios predict more intense summer thunderstorms and an increase in winter rainfall, which could result in more frequent river flooding during the winter in the future. DEFRA suggest an allowance should be made for a 20 per cent increase in flow and frequency of flow. Similarly, increasing sea levels and increasing storminess are likely to result in a higher frequency of coastal flooding.

Many large rivers in the South East such as the Thames, Medway, Arun and Eastern Rother have extensive floodplains that could cause extensive flooding problems where they have been developed. Many developed upon floodplains benefit from flood alleviation schemes, but the design of these schemes was based upon analysis of historic records which may not reflect future risk.





**Figure 42: Number of flood warnings issued (September 2000 to October 2001)**

There is considerable development pressure in the South East region for new housing on both greenfield and brownfield sites that are often located in floodplains. The pressure to develop within floodplains will need to be resisted. We use our regulatory powers to deter development in the floodplain and to enforce compliance with Bye Laws. It will be vital to focus more strongly on sustainable drainage systems (SuDS), which use techniques to control surface water run off as close to its origin as possible before it enters a watercourse.

A major concern for the South East is the risk from coastal flooding. Soft defences comprising of shingle are used to protect many stretches of vulnerable coastline. High winds and tides can frequently test these defences as recently seen on the Selsey and Pevensy frontages.

## Targets

The key objectives to achieve DEFRA's policy aims for flood and coastal defence are:

- *To encourage the provision of adequate and cost effective flood warning systems.*
- *To encourage the provision of technically, environmentally and economically sound and sustainable flood and coastal defence measures.*
- *To discourage inappropriate development in areas at risk from flooding and coastal erosion.*

In November 1999 DEFRA issued a set of High Level Targets for flood and coastal defence operating authorities. Operating authorities are organisations that have flood defence

responsibilities and include the Environment Agency, Local Authorities and Internal Drainage Boards. The High Level Targets are a comprehensive set of fourteen targets, which provides the framework by which performance will be measured and monitored. Published along side these targets is the *Elaboration of the Environment Agency's Flood Defence Supervisory Duty* which addresses issues that are complementary to the High Level Targets.

The targets covered are:

- *policy statements;*
- *provision of flood warning;*
- *emergency exercises and emergency plans;*
- *National Flood and Coastal Defence Database;*
- *flood defence inspections and assessment of flood risk;*
- *coast protection inspections and assessment of coastal erosion risk;*
- *expenditure programmes;*
- *Shoreline Management Plans;*
- *biodiversity;*
- *Water Levels Management Plans;*
- *Coastal Habitat Management Plans;*
- *development in areas at risk of flooding;*
- *development in areas at risk of coastal erosion;*
- *Internal Drainage Board administration and membership.*



Other targets include the requirement for the Environment Agency to report annually to DEFRA on those local authority development plans upon which the Agency has commented, identifying plans which do, and do not, have flood risk statements or policies. The Agency will also report where final decisions on planning applications were in line with or contrary to Agency advice on proposed development in areas at risk from flooding. DEFRA is monitoring the extent to which planning authorities are heeding flood risk advice. The publication of Government's Planning Policy Guidance on *Development and Flood Risk* (PPG 25) along with the flooding in Autumn 2000 has given rather more weight to the advice of the Agency on these matters.

## Actions and Responses

The Environment Agency along with the other operating authorities and partners such as English Nature and coastal defence groups have been working towards achieving the High Level Targets since their publication in November 2000.

All operating authorities have been tasked with producing a Policy Statement for Flood and Coastal Defence to show that they are committed to delivering the Government's aims and objectives. The Agency has completed this task and is supporting the other operating authorities in the completion of their statements.

The target for the provision of flood warnings includes a number of actions for the Agency to achieve in conjunction with local authorities, emergency services and other partners:

- **develop a method for categorising the flood risk to an area for flood warning purposes;**
- **determine where a flood warning service can be provided and the appropriate dissemination arrangements using the method developed;**
- **determine and publish flood warning service standards for each area at risk from flooding;**
- **report to DEFRA on achievement of service standards.**

Indicative Flood Plain Maps are now published annually by the Agency and can also be accessed on the Agency website. These maps are further supported around the coastline by 'Shoreline Management Plans' (SMPs) that address both flood risk and coast erosion issues. The SMPs are due to be reviewed from April 2002.

The Agency is currently in the process of designing and implementing the National Flood and Coastal Defence Database. This system will store all data relating to flood and coastal defence such as data relating to the location and condition of all flood defence assets and

information relating to flood plains. It will be used to hold all operating authorities data and will be available to these authorities via the internet.

The Agency is assisting English Nature with the compilation of Coastal Habitat Management Plans. There are currently three of these plans being piloted in the South East Region for the Solent, Dungeness & Pett Levels and the North Kent Marshes.

The Agency is currently starting to develop Catchment Flood Management Plans (CFMPs), which will identify flooding issues and solutions on a catchment wide basis. Within this process the Agency is also developing a method to assess flood risk that will examine management options and socio-economic impacts of flooding.

The Regional Planning Guidance for the South East (March 2001) reiterates the importance of flood risk by providing a framework for the policies and guidance that local authorities should include in local authority development plans relating to flooding. The planning pressures in the South East are likely to increase regulatory activity by the Agency on flood risk matters and will need an increased focus to be placed on flood risk by planning authorities. Climate change scenarios will also need to be taken into account when planning in the long term.

## Monitoring and Review

The Agency has recorded the number of flood warnings on an annual basis in the past. As explained previously, the flood warning system is being progressively improved and from September 2000 a new staged warning system was introduced. In the future, therefore, we will have more data recorded from the new system of flood warnings.

Due to the limitations of the number of flood warnings as a flooding indicator, we hope to be able to provide data on other flooding indicators in the future. However, arrangements for monitoring and review will not be known until these are developed.





## Summary of challenges for the Region

The environmental issues and indicators have illustrated the intense pressure that the Region's environment is under. The Region's high population density and people's lifestyle expectations are exerting many stresses upon the South East's environment and its management. This affects the availability of critical resources, the quality of all environmental media - land, air and water - and the health of the natural environment including biodiversity and fisheries.

Additional development will intensify current problems, although concentrating the majority of future development in urban areas should produce a more sustainable pattern of development and economic activity. However, this also raises new environmental management challenges, such as urban air quality issues, pressures for urban re-modelling and the regeneration of brownfield sites. In particular many of the Region's urban areas have developed alongside rivers and the coast in areas vulnerable to flooding. Development of these sites may require flood compensation and surface water management measures, remediation of contaminated land and improvements to degraded urban rivers.

The trend towards smaller household size is likely to lead to higher levels of water consumption and waste generation per head of population. Most of the Region's waste is currently sent for disposal in landfill sites. However, landfill void space continues to be used up at a faster rate than it is being created. A radical change in waste practice is needed to implement the Government's waste hierarchy and meet the requirements of the EC Landfill Directive. This should place more emphasis on minimisation and the efficient use of re-usable resources.

Water quality is a particular problem where sewage treatment works discharge into smaller and more environmentally sensitive rivers where water company discharge standards are already tight and challenging to meet. Further development would exacerbate this.

There are also 'natural' drivers upon the state of the environment. The periods of drought seen in the Region during the 1990's, for example, have been a major pressure on water resources, water quality, biodiversity and fisheries. Climate change could also potentially challenge our view of what development is sustainable in the Region.

Over the past years the UK has experienced exceptional climatic extremes including the wettest winter period (December 1994 to

February 1995) and the driest summer (June to August 1995) on record. The average temperatures over the period have been the highest on record since 1845. These extremes have already exerted significant pressures on the freshwater environment and presented real management challenges. Predicted long-term climate change scenarios have potentially serious implications for the state of the freshwater environment, flood risk and the management of water resources.

The Agency is approaching global warming by investing in research to predict the effects and, by using its regulatory powers, to reduce emissions from greenhouse gases from the major industrial processes. The proposed EC Water framework Directive should provide a mechanism to integrate water resources and water quality issues, and should take into account the likely effects of climate change.

## Future drivers

Over the next five years a number of factors will be important in influencing the management of the environment and the monitoring of environmental quality. The challenge for the Agency in partnership with a variety of organisations is to adapt to these changes and to manage these pressures to achieve a sustainable and balanced environment.

There are a number of pieces of new or proposed legislation that will have a significant effect on future environmental management, for example:

- **EC Habitats Directive** - this has recently been enacted and includes the requirement on the Agency to review its authorisations to identify the potential impacts on protected wildlife sites.
- **Contaminated Land Regulations** - these will include the requirement to identify contaminated sites, with 'special' sites being identified in close consultation with the Agency.
- **EC Directive on Integrated Pollution Prevention Control (IPPC)** - this will directly impact on the control of polluting activities. The control of currently unregulated processes or processes operating under other regimes will be phased in over the next seven years placing an increasing emphasis on the 'polluter pays' principle.



- **Development and Flood Risk (PPG 25)** - the new PPG will strengthen the approach of restricting development within the floodplain.
- **EC Landfill Directive** - this requires significant changes in how waste is managed including the diversion of large quantities of municipal biodegradable wastes from landfill and a complete ban on co-disposal landfills.
- **EC Water Framework Directive** - this will replace a number of existing Directives, integrate management of water flows with the ecological quality of the aquatic environment and introduce the requirement for river basin planning.

Throughout this report we have highlighted future actions being driven by policies, plans and strategies produced by a number of organisations, such as the Government's Air Quality and Waste Strategies, the Regional Planning Guidance, Biodiversity Action Plans and water companies' Water Resource Plans. The Environment Agency is itself developing strategies which will influence the approach to environmental management and monitoring in the future including, for example, our updated Environmental Strategy and Water Resources Strategies.

The Environment Agency published *The Environmental Vision* in 2001. This states our

long-term goals for the environment and a sustainable future. Our Corporate Strategy is expected to be released in Autumn 2002.

The Agency's updated Water Resources Strategies were published in 2001 set the long-term framework for sustainable water resources management in the Region. Alongside this work, the Agency's Catchment Management Strategies (CAMS) will provide a more detailed catchment-based review of water resources.

## Future Monitoring

It is proposed that we will regularly monitor and document changes in the indicators identified in this State of the Environment Report and where appropriate develop additional indicators. The report will be updated periodically on a topic by topic basis. The direction and significance of change will allow us to assess the progress towards achieving the Agency's goal of a better environment for present and future generations. It will also allow us to monitor the implications of a range of strategies, action plans and initiatives, including the Regional Sustainable Development Framework (RSDF), Regional Planning Guidance (RPG) and Regional Economic Strategy (RES).



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# GLOSSARY AND ABBREVIATIONS

## Glossary

**Above Ordnance Datum (AOD)** - land levels are measured relative to the average sea level at Newlyn in Cornwall. This average level is referred to as 'Ordnance Datum'. Contours on Ordnance Survey maps of the UK show heights in metres above Ordnance Datum.

**abstraction** - removal of water from surface or groundwater.

**abstraction licence** - licence issued by the Environment Agency under s.38 of the Water Resources Act 1991 to permit removal of water from a source of supply. It can limit the quantity of water taken daily.

**Agency** - Environment Agency.

**Agenda 21** - a comprehensive programme of worldwide action to achieve more sustainable development for the next century. UK Government adopted the declaration at the UN Conference on Environment and Development (the Earth Summit) held in Rio de Janeiro in 1992.

**alien** - plant or animal not native to the country concerned.

**ammonia** - a chemical found in water often as the result of discharge of sewage effluents. High levels of ammonia affect fisheries and abstractions for potable water supply.

**aquifer** - layer of porous rock able to hold or transmit water.

**Area of Outstanding Natural Beauty (AONB)** - designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1949, to conserve and enhance the natural beauty of the landscape, mainly through planning controls.

**Asset Management Plan 3 (AMP3)** - the third Asset Management Plan produced by the Water Companies for the Office of Water Services (OFWAT). It sets out the water industry investment programme for the period 2000 to 2010.

**augmentation** - the addition of water by artificial input. Usually to 'top up' low flows in the summer by either groundwater pumping or via reservoir release.

**baseflow** - the flow in a river derived from groundwater sources.

**Best Practicable Environmental Option (BPEO)** - can be applied to any aspect of pollution control used to indicate the waste disposal choice having the least impact on the environment. It does not refer to cost; the BPEO may be the most expensive.

**Biochemical Oxygen Demand (BOD)** - a standard test which measures over 5 days the amount of oxygen taken up by aerobic bacteria to oxidise organic (and some inorganic) matter.

**biodiversity** - the variability among living organisms. This includes diversity within species, between species and between ecosystems.

**brown field site** - land which has previously been used for built development.

**catchment** - the total area from which a single river collects surface run-off.

**civic amenity site** - facility provided by a Local Authority for householders to take bulky household waste, garden wastes and other household wastes which are not normally taken by vehicles on domestic waste collection rounds.

**coliform (faecal)** - a group of bacteria used as indicators of possible contamination of water by sewage.

**Combined Sewer Overflow (CSO)** - an overflow structure which permits a discharge from the sewerage system during wet weather.

**consent (discharge)** - a statutory document issued by the Environment Agency under Schedule 10 of the Water Resources Act 1991 as amended by the Environment Act 1995 to indicate any limits and conditions on the discharge of an effluent to a controlled water.

**controlled waste** - defined by the Control of Pollution Act 1974, Part 1 Section 30. It includes household, industrial and commercial waste.

**culverts** - piped watercourse, drain or covered channel carrying water across or under a road, canal, embankment etc.

**cyprinid fish** - fish of the family Cyprinidae (e.g. roach, bream, carp and chub). Pike, perch, eel and some other fish species are not cyprinids.

**diffuse pollution** - pollution without a single point source e.g. acid rain, pesticides, urban runoff etc.

**dissolved oxygen (DO)** - the amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important, but highly variable, indicator of 'health' of a water. It is used to classify waters.

**ecosystem** - a functioning, interacting system composed of one or more living organisms and their effective environment, in a biological, chemical and physical sense.

**effective rainfall** - effective rainfall is the amount of rainfall remaining after evaporation and transpiration (by plants) losses which will be effective in recharging groundwater and sustaining baseflows to rivers.

**eutrophication** - the enrichment of water by nutrients, such as compounds of nitrogen or phosphorus. It causes an accelerated growth of algae and higher forms of plant life.



## CONTACTS:

### THE ENVIRONMENT AGENCY HEAD OFFICE

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS32 4UD.  
Tel: 01454 624 400 Fax: 01454 624 409

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

[www.environment-agency.wales.gov.uk](http://www.environment-agency.wales.gov.uk)

### REGIONAL ENVIRONMENT AGENCY OFFICES IN THE SOUTH EAST REGIONAL GOVERNMENT BOUNDARY

#### SOUTHERN

Guildbourne House  
Chatsworth Road  
Worthing  
West Sussex BN11 1LD  
Tel: 01903 832 000  
Fax: 01903 821 832

#### THAMES

Kings Meadow House  
Kings Meadow Road  
Reading RG1 8DQ  
Tel: 0118 953 5000  
Fax: 0118 950 0388



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