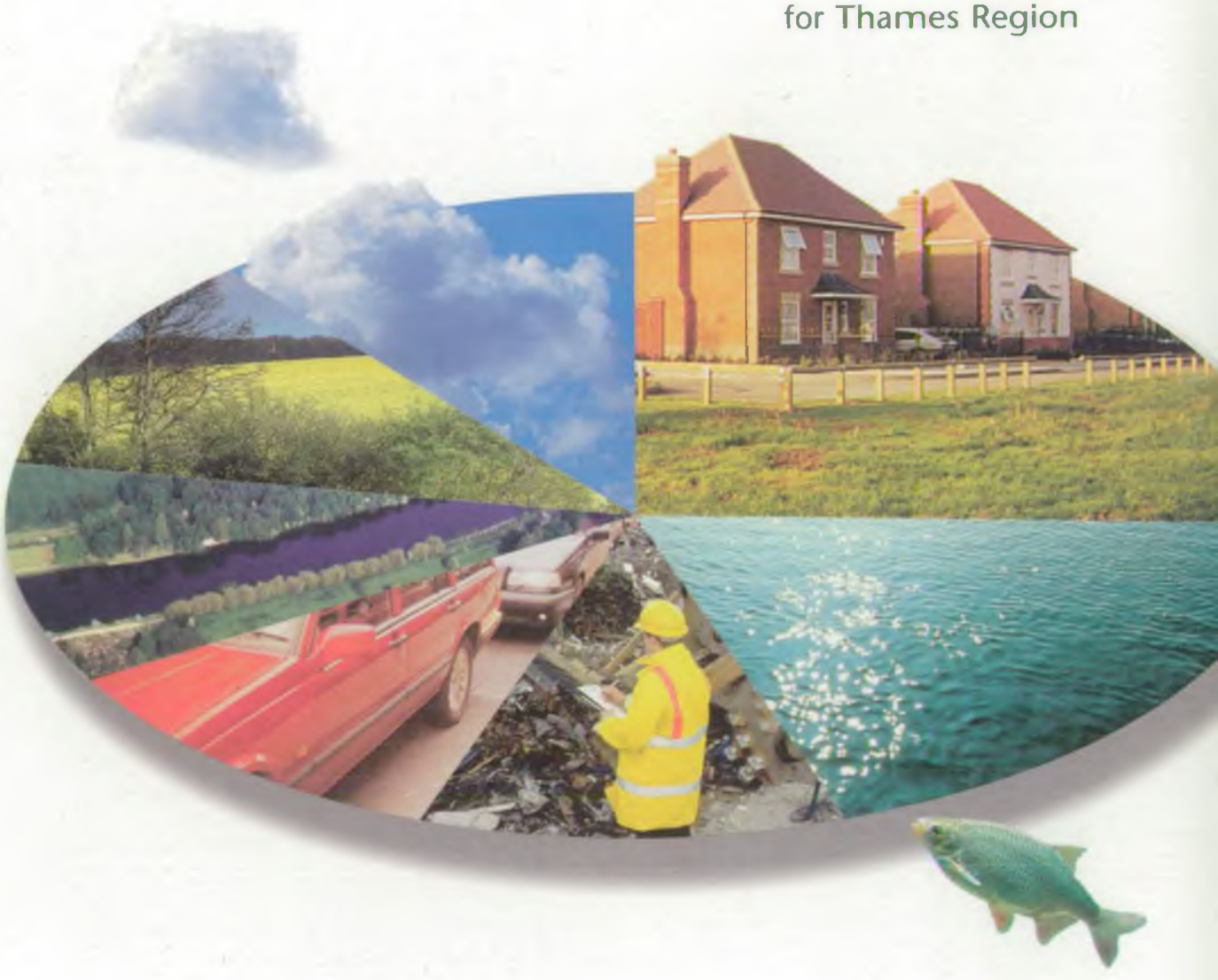
EA - Thames

The Environment Agency's

State of the Environment Report

for Thames Region



SEPTEMBER 1998

ENVIRONMENT AGENCY

170

ENVIRONMENT AGENCY

Information Services Unit

Please return or renew this item by the due date

Due Date

Preface

The Environment Agency has a 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 published in 1996. This is being followed up by a series of national sectoral reports, the first of which was recently published and covers the freshwater environment.

Thames Region faces particular challenges because of the demands and expectations of its 12 million inhabitants. In the light of these exceptional pressures we feel it is appropriate to look in detail at the environment in Thames Region and we have, therefore, produced this Report which builds on our national initiatives.

This Report provides us with the opportunity to make meaningful information on the state of the environment in this Region available to everyone. The information in this Report will also be used as a baseline for measuring the state of our environment in future years. Much of our work involves responding to the current state of the environment and the pressures acting upon it, we need to monitor this continually to measure our success. The results of this monitoring will be used to update this Report.

The Agency cannot, of course, act alone in managing the environment. We are already working with partner organisations to assess the state of the environment and we are working to develop these partnerships further. In the future, we also expect other new initiatives such as the formation of the Regional Development Agencies to provide a further focus for this work.

This report should be particularly useful for all those with a particular interest in the environment in this Region and should be of interest to everyone who lives and works here. I hope that you will find the information in the report of value and I would welcome your comments on it.

Chris Birks

Regional General Manager

Report contents

The report is divided into five main parts

1. Background to the Report

A summary of the context of the report. *page 7*

2. Thames Region's environment

A description of the Region, its physical structure, natural resources, population, economy and administrative framework. *page 9*

3. The Key environmental indicators

The key environmental indicators covering:

- the state of the environment;
- the pressures on the environment;
- responses to the state and pressures.

The indicators will be used to measure future change. *page 16*

4. Major issues for the Region

The major issues facing the Region, as raised by the indicators, are presented under the following themes:

- addressing climate change;
- conserving the land;
- managing water resources;
- delivering integrated river-basin management;
- managing waste;
- enhancing biodiversity and managing freshwater fisheries;
- improving air quality and regulating major industries.

A case study on the unique and important environment of the Tidal Thames is also included. *page 40*

5. The way forward

A summary of the key challenges for the Region and recommendations for future state of the environment reporting in the Region. *page 60*

Appendices

All information contained in this report was correct at time of going to press - 18th August 1998.

Indicators included in this Report

Key State Indicators

Key Pressure Indicators

Key Response Indicators

1. Background to the Report

The Agency summarises its duties, powers and interests in its national vision:

"A better environment in England and Wales for present and future generations"

To achieve this vision, the Agency emphasises cooperation, education, pollution prevention and, when necessary, vigorous enforcement of the appropriate regulations.

1.1 The role of The Environment Agency

Our duties, powers and interests include pollution prevention and control, flood defence, water resources, waste regulation, fisheries, navigation and the conservation and enhancement of the natural beauty and amenity of inland and coastal waters. In the case of many of these, including air pollution and the decontamination of land, we share a role with others, particularly local authorities.

At the heart of all our work is the aim of achieving sustainable development, which involves the integration of human needs and the environment in which we live.

It is important to remember that we are not responsible for regulating every aspect of the environment and for certain issues other organisations are primarily responsible. A guide to the our duties, powers and interests is given in Appendix I.

1.2 State of the environment reporting

A sound scientific understanding of what the state of the environment is at any one time, and how it is responding to the many and varied pressures that are placed upon it, is critical to achieving a high quality environment. Our success will be measured by how far we have been able to protect and improve the state of the environment as a result of direct actions, or as a result of our influence over the action of others.

We produced a national overview of the state of the environment in April 1996, called *The Environment of England and Wales – A Snapshot*. The information in the Snapshot is available on our website (http://www.environment-agency.gov.uk), which is regularly updated. We are currently undertaking a programme of more detailed reports on the state of different sectors of the environment. The first of these is *The State of the Environment in England and Wales: Fresh Waters*, this will be followed by the state of the land and coastal environments.

At a local level, we produce Local Environment Agency Plans (LEAPs). The preparation of these starts with an assessment of the state of the local environment. LEAPs are our management plans for identifying, prioritising and solving local environmental issues related to our functions, taking into account the views of our local customers.

1.3 The Agency's state of the environment report for Thames Region

The purpose of this Report is to:

- promote and increase awareness of the state of the Region's environment, and the pressures acting upon it;
- assist in highlighting some of the most critical environmental issues for the Region;
- provide an integrated snapshot of the state of the environment against which future changes can be measured using key indicators.

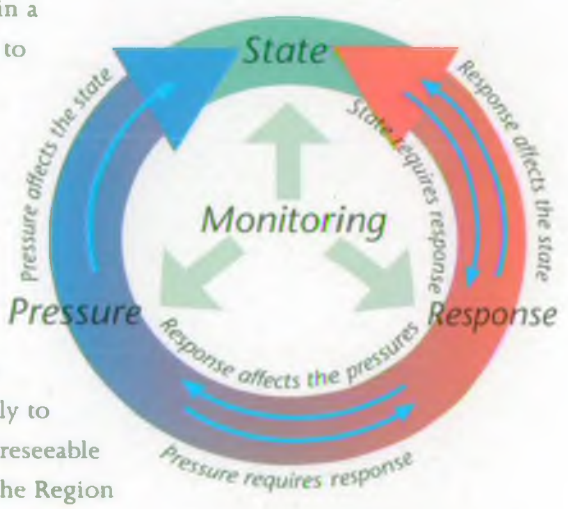
This Report will also provide an educational resource and will highlight the environmental data that is available. The process of producing this

Report has highlighted gaps in our data which will be considered when prioritising future data acquisition.

This Report covers our Thames Region, one of the Agency's eight Regions covering England and Wales. Environmental data is collected by a multitude of different organisations and we have not sought to present it all here. Instead, the report concentrates on our specific areas of environmental responsibility. However, where appropriate this is set in a wider environmental context to provide a more meaningful commentary.

This report presents environmental data for the Region using a state-pressure-response format which is illustrated in the diagram (*see also section 3*). This includes data which is unlikely to change significantly in the foreseeable future but helps to describe the Region and also indicators against which future change can be measured. The indicators can only give a flavour of the environmental data available and cannot reflect all of our work. This Report also highlights some of the issues facing the Region which are of greatest concern, for example, where the current state of the environment is unacceptable and where the pressures on the environment are increasing.

This is the first *State of the Environment Report* covering Thames Region and there are inevitable gaps in the information we wish to present, but this does not invalidate the approach. It is envisaged that this Report will be reviewed every two years, with progress against the key environmental indicators being presented. Additional indicators will be included in future reviews when relevant information has become available.



For information, a guide to sources of information and references are included in Appendix II. Contact details are included at the back of this Report.

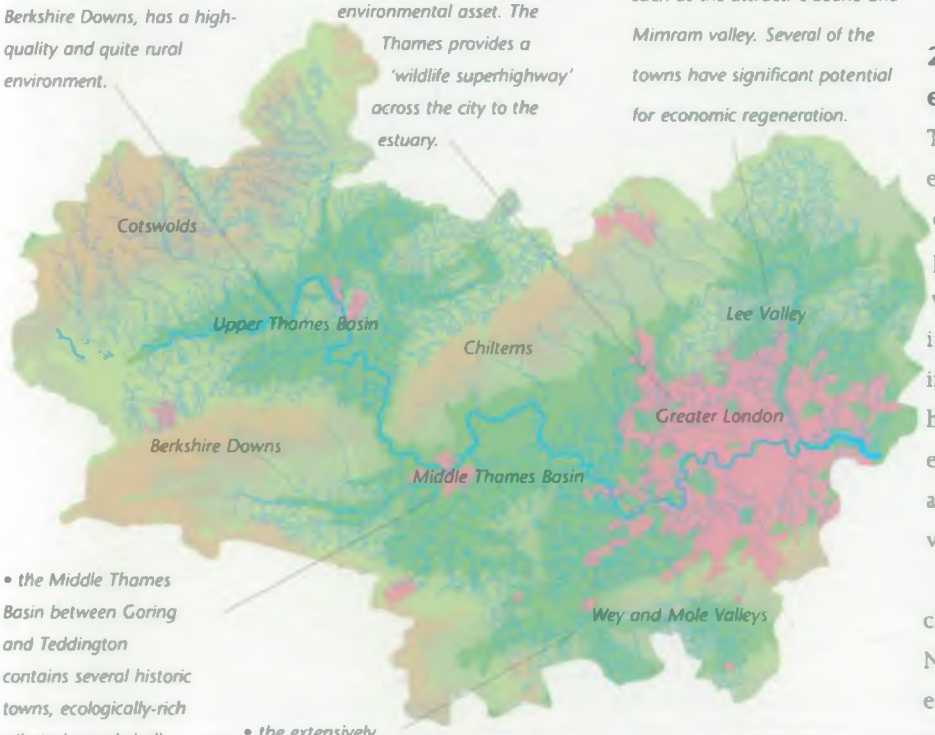
We are keen to hear your comments on this State of the Environment Report and a feedback questionnaire is available from our Regional office for you to record your comments.

2. Thames Region's environment

2.1 Overview of the Region

Thames Region covers the basin of the River Thames and its tributaries. The Regional boundary contains many of the resources required to sustain its 12 million people including living space, water resources, the route for sewage treatment and disposal, and to a lesser extent the space for waste disposal and is therefore self sufficient in many ways. However, its resources are limited and under severe pressure from its high population. As a result, parts of the Region rely heavily on the re-use of resources. It therefore makes sense for the Thames Region, perhaps more than any other Agency region, to consider the state of its environment as a Regional entity as part of our approach to sustainable development.

The western parts of the Region are predominately rural, with towns concentrated along the M40 and M4 motorway corridors. In the north and south eastern parts, urbanised land uses tend to predominate, although considerable areas of rural land remain. The eastern part is dominated by Greater London which is heavily urbanised and constrained by the Green Belt.



• the Upper Thames Basin, lying between the hills of the Cotswolds, Chilterns and Berkshire Downs, has a high-quality and quite rural environment.

• the London conurbation, where the network of parks and river corridors are an important environmental asset. The Thames provides a 'wildlife superhighway' across the city to the estuary.

• the valleys of the Upper and Middle Lee and their tributaries, such as the attractive Beane and Mimram valley. Several of the towns have significant potential for economic regeneration.

• the Middle Thames Basin between Goring and Teddington contains several historic towns, ecologically-rich tributaries and chalk streams in an attractive landscape. Nearer London, the Thames valley has extensive areas of gravel workings and numerous reservoirs.

• the extensively developed downland valleys of the rivers Mole and Wey to the south and south west of London including towns such as Crawley and Guildford.

2.2 Physical characteristics and environmental assets

To place the current state of the environment in context, we must first consider the natural environment, particularly the physical features over which we have no control and the important environmental assets, including landscape, biodiversity and heritage features. The current environment makes the Region an attractive place in which to live and work.

More than 40% of the Region is classified as an Area of Outstanding Natural Beauty (AONB), Green Belt or enjoys some other form of environmental protection. The protection and enhancement of areas of high quality natural environment and the opportunities for improving quality of life and urban regeneration, particularly in London, represent key issues for the Agency and its partners.

The physical characteristics of the Region

Geology

The expanse of low ground draining the Thames – the London Basin – comprises mainly London Clay. This is bounded by Chalk uplands – the Berkshire Downs, Chilterns, Hampshire Downs, Hog's Back and North Downs. The Region is bounded in the west by the Cotswolds, with the steep limestone scarp slope on one side and the long gentle dip slope to clay vales on the other. The Region is bounded to the south of London and the North Downs by the heavy clays and sands of the Weald.

The chalk is the major groundwater resource for the Region, along with important contributions from the Cotswold Limestones, the Lower Greensands of the Weald and the perched water table in the river gravels which overlay part of the Region.

(Source of data: British Geological Survey)

Topography

The topography of the Region is strongly influenced by the structure of the underlying geology and the effects of glaciation and the Region's drainage pattern. The Region varies in height from the Thames Estuary at sea level to parts of the Cotswolds, Chilterns, Berkshire Downs and North Downs which rise to approximately 300m above sea level. (Source of data: Ordnance Survey)

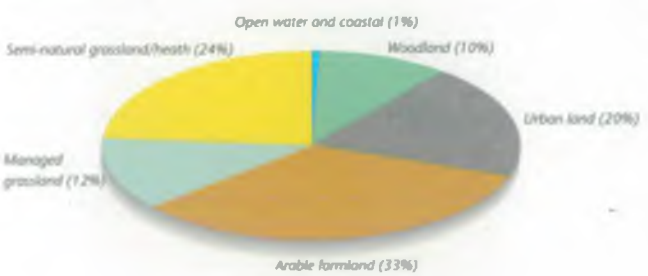
Rivers

The Region includes the River Thames and its tributaries, including the Kennet, Thame, Loddon, Wey, Colne, Mole and Lee. There are 5,330km of Main River in the Region. The area of the fluvial floodplain in the region is 70,000ha. (Source of data: Environment Agency)

Land cover

This map shows the main pattern of urban areas in the Region, the arable land in the more rural parts to the north and west and the more wooded areas in Surrey, Berkshire and Hampshire. The Tidal Thames and the reservoirs and lakes of the Lee Valley, South West London, Colne Valley and the Cotswold Water Park are clearly visible. The proportions of land uses within the Region are shown in the pie chart. (Source of data: Institute of Terrestrial Ecology)

Land cover



Rainfall

Thames Region is amongst the driest areas in the UK. It receives an average of 690mm rainfall per year, of which only 250mm is effective recharge for rivers or aquifers. The rest is lost through evaporation and transpiration.

(Source of data: Environment Agency and Meteorological Office)

The environmental assets of the Region

Green Belt

The London conurbation and Oxford are surrounded by Green Belt. This aims to prevent inappropriate development, protect open areas between towns and the character of settlements. Within London, open areas are afforded similar protection by the designation of Metropolitan Open Land. *(Source of data: local authorities)*

Areas of Outstanding Natural Beauty and Environmentally Sensitive Areas

The Region includes parts of five Areas of Outstanding Natural Beauty (AONBs) – Cotswolds, Chilterns, North Wessex Downs, Surrey Hills and Kent Downs – and parts of two Environmentally Sensitive Areas (ESAs) covering some of the upper Thames tributaries and the Cotswolds. ESAs include agricultural landscape where traditional management practices help conserve the visual, ecological or historical characteristics. AONBs cover 3,454sq km of the Region (26.8%) and ESAs cover 656sq km (5.1%).

(Source of data: Countryside Commission & MAFF)

Sites of Special Scientific Interest

There are 456 Sites of Special Scientific Interest (SSSIs) within the Thames Region covering 353sq km (2.7% of the Region). The proportion of the SSSIs within the Region which contain at least some of the following broad habitat types is: grassland 58%; heathland 15%; wetland 50%; woodland 61%; geological/industrial 18%; tall herb 3%; coastal/cliff 1%. There are also 4

Special Protection Areas (SPAs) and 13 Special Areas of Conservation (SACs) that may be designated in the Region.

(Source of data: English Nature)

EC designated fisheries

The European Community (EC) Freshwater Fisheries Directive (78/659/EEC) 'on the quality of waters needing protection or improvement in order to support fish life' provides a statutory basis for the protection of water quality in certain rivers. The length of river in the Region designated as Salmonid fishery is 443.4km and Cyprinid fishery is 976.6km. (Source of data: Environment Agency)

Countryside Character Areas

The Countryside Character Programme is a joint initiative by the Countryside Commission and English Nature covering England. The Character Areas cover the whole countryside and not just designated areas. A series of descriptions which analyse the area's character and identify the main forces for change have been produced as part of the initiative. The Character Areas complement the Natural Areas identified by English Nature which focuses on the nature conservation characteristics of these areas.

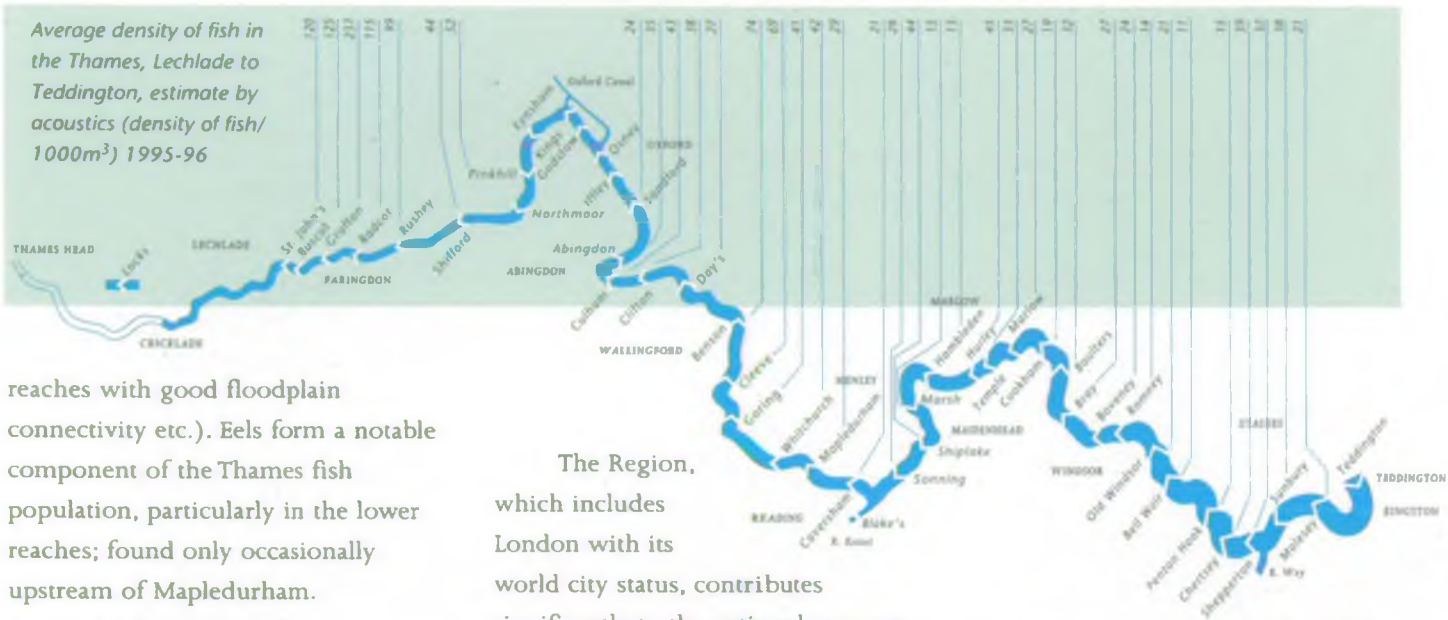
(Source of data: Countryside Commission & English Nature)

Landscape status of London's river channels

The increasing expansion of London over the past 200 years has left a legacy of urban development upon the river landscape. Very few rivers have escaped the influence of urbanisation, with many being artificially controlled to reduce the risk of flooding. Of the river channels surveyed between 1992-96, 29% were natural, 56% were artificially surfaced and 15% were culverted. The 'lost rivers' found within central London such as the Fleet, Tyburn and Effra are of particular note, as they have long since been culverted and in most cases now form part of the sewerage network. (Source of data: Environment Agency)

Fish density along the River Thames

Baseline data is presented for 1995 which shows fish abundance for most reaches of the Thames between Buscot and Teddington. A hydroacoustic survey technique was used to produce these quantitative figures; sampling fish inhabiting mid-water environments of the main river. Abundance is patchy, though generally greater for the upper reaches. Boom boat electrofishing revealed a general dominance of roach, bleak and perch – species typically dominant in degraded riverine environments (channelised and impounded). Localised high quality fisheries are often associated with areas of high quality riverine habitat (i.e. backwaters, weir streams/bypasses,



Average density of fish in the Thames, Lechlade to Teddington, estimate by acoustics (density of fish/ 1000m³) 1995-96

reaches with good floodplain connectivity etc.). Eels form a notable component of the Thames fish population, particularly in the lower reaches; found only occasionally upstream of Mapledurham.

(Source of data: Environment Agency)

2.3 Economy and population

The Thames Region is already intensively developed and high levels of development continue. The Region has less than 10% of the land area of England and Wales, but contains nearly a quarter of the population, generates more than a quarter of Gross National Product and has a similar percentage of all construction work.

The estimates of household growth in Thames Region are set out in the Regional Planning Guidance for the South East and South West (RPG9 and RPG10) for the period 1991-2006. However, the Government's consultation document *Household Growth – Where shall we live?* which is based on its 1992 household projections, predicts a substantially higher requirement for the period 1991-2016. For most of Thames Region, this means an increase in construction from approximately 32,600 new dwellings per annum to 35,900.

The Region, which includes London with its world city status, contributes significantly to the national economy. It is also at the forefront of many new industries such as information technology, biotechnology and advanced engineering. Some 88% of the working population in the Region is employed in the service sector.

Key facts and figures	England and Wales	Thames Region (% of England and Wales
Area (sq km)	150,000	13,000 (8.6%)
Population (millions, 1994)	52.0	12.0 (23.1%)
Population Density (number per sq km)	347	923
Households (millions, 1994)	23.4	5.0 (23.5%)
Total number of planning applications per year	426,000	109,000 (25.8%)
GNP (£m) per year	506,000	138,000 (27.4%)

A major issue is how to cope with the scale and pattern of future development and economic activity. This has been the focus of a separate Agency report *Thames Environment 21*

The Environment Agency's Strategy for Land Use Planning in the Thames Region. This sets out the following vision for the Region and gives practical guidance on the range of environmental issues associated with new development.

"To secure an overall enhancement of the quality of the environment of the Thames Region through the land use planning system.

This will be achieved by:

- ensuring that new development contributes to the quality of the environment;
- preventing future erosion of the Region's intrinsically rich heritage, man-made and natural;
- promoting the restoration of damaged environments;
- contributing to the sustainable management of the Region's natural resources."

The theme of sustainable development is also at the heart of the consultation document *A Sustainable Development Strategy for the South East* produced by SERPLAN (London and South East Regional Planning Conference). This strategy aims to achieve a synthesis between encouraging economic success and

maintaining a high quality environment.

2.4 Administrative framework

We work closely with a range of partners, including those involved in the land use planning process: the Department of Environment, Transport and the Regions (DETR); Government Offices; Regional Planning Conferences; London Planning Advisory Committee (LPAC); and local planning authorities. We also regularly work alongside other Government Agencies, such as English Nature, the Countryside Commission and English Heritage and at a local level with conservation groups, Local Agenda 21 groups, sport and recreation groups, landowners, developers, industry and commerce.

Local authorities are especially important partners, and they have a particular interest in state of the environment reporting. We have worked with several local authorities in the Region, as well as organisations such as LPAC, to provide information for their state of the environment reports and environmental indicators. The Region includes parts of over 100 local authorities, as shown in the map, including significant areas of:

- 9 county councils;
- 33 London boroughs (including the City of London);
- 7 unitary authorities; and
- 38 districts councils.

This Report has been compiled using the operational boundary of the Region within which we collect data and manage the environment.

However, where local authorities cross our regional boundaries we ensure that one Region is the main point of contact.

The new London Assembly and Regional Development Agencies will be important new partners for the Agency and they will be particularly important to our future work on state of the environment reporting. It is proposed, for example, that the London Assembly should make a regular audit of London's local environmental quality and suggest ways of improving it.

Local Authorities map

County boundaries

Unitary authority boundaries

District and London Borough Boundaries

3. The key environmental indicators for the Region

3.1 Reporting framework

We have developed a series of environmental indicators for the Region in discussions with a range of external organisations. These will be used to measure future change. A state-pressure-response framework is used to present the indicators in a meaningful way:

- **'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.

The selection of the key indicators is based on a number of criteria, including:

- the importance of the indicator to illustrate a key aspect of the Thames Region environment;
- its 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.

We present 39 indicators in this report, including 14 state indicators, 15 pressure indicators and 10 response indicators. Many of these indicators are related to one another, for example the amount of rainfall (*see indicator S3*) affects river flows and the quantity of groundwater (*see indicators S5 and S10 respectively*), which in turn affects water quality (*see indicator S6*). Where indicators are related to one another, they are highlighted throughout the report. We collect the majority of data used for the indicators, although some of the data has been obtained from other organisations.

In some cases, the data required for a key indicator is not currently available. It is hoped that some of this data can be included in future editions of the *State of the Environment Report*. A list of potential indicators for the future is included under each of the sections on state, pressure and response.

We are in the process of developing a national set of indicators. Some of the indicators in this report are likely to be included in the national core indicators set and it is hoped that they will become widely used throughout the Region. For example, indicators will be increasingly used in Local Environment Agency Plans (LEAPs). It must be remembered, however, that the indicators can only give a flavour of the environmental data available and the range of our work.

3.2 State of the environment

In the past there has been no comprehensive or fully integrated means by which the 'state' of the environment, as a whole, is assessed. This is partly because, quite reasonably, many of the standards which apply to environmental materials have evolved independently to protect man, or aspects of the environment, against specific risks. Assessing the 'state' of the environment at a point in time is clearly a very complex undertaking.

One approach to differentiate between the different aspects of the state of the environment is to distinguish between the three environmental media:


land


air


water

This approach has been used to categorise the key state indicators included in the Report.

We hope to have data on a number of potential indicators in time for future editions of the Regional *State of the Environment Report*. For example, more data will be available on contaminated land sites within the Region and the recently developed National Fisheries Classification scheme will enable fishery quality in the tributaries to be summarised. It is also hoped that more information on the distribution of key biodiversity species and species which indicate local importance will be available in two years time.

Nationally we are developing a 'Viewpoints' approach to environmental monitoring. This provides a new framework within which data relating to the state of the environment can be assessed and reported. However, the timing of this report has precluded the full integration of the Viewpoints framework into this Report, but we aim to do so in future editions. There are six Viewpoints that have been identified:

- land use and environmental resources;
- biological populations and biodiversity;
- compliance with standards and targets;
- health of the environment;
- long-term reference;
- aesthetics.

Key State Indicators

S1 Area of urban land

S2 Air quality: concentration of nitrogen oxides

S3 Quantity of rainfall

S4 Number of heavy rainfall events

S5 Quantity of river flows

S6 Chemical river water quality

S7 Biological river water quality

S8 Tidal Thames water quality: dissolved oxygen

S9 Radiation levels in the vicinity of nuclear sites

S10 Quantity of groundwater

S11 Groundwater levels in London

S12 Groundwater quality: concentration of nitrates

S13 Numbers of salmon returning to the River Thames

S14 Distribution of key biodiversity species

Potential State Indicators for the Future

- Area of closed landfill sites
- Area of contaminated land and number of major sites in the Region
- Area of floodplain developed
- Air quality: the concentration of other pollutants
- Length of classes national fisheries classification scheme
- Distribution of other key indicator species

State indicators

Indicator S1.

Area of urban land

The map shows the land classified as urban in the Region from Institute of Terrestrial Ecology data. This represents 2,516sq km or 19.6% of the Region. However, projections from the DETR, based on the 1991 census data indicate that within the Government for the South East's area, 13.3% was urban in 1991 and was predicted to increase to 13.6% in 1996. This compares with 10.6% and 10.9% respectively for the whole of England. This indicator will require consistently updated information and is likely to reflect a longer term change than some of the other indicators.

Present patterns of development are characterised by decentralisation and dispersal from urban areas. This leads to the Region's population being heavily dependant on cars for trips between home, school and work and for shopping and leisure activities. This trend, which has accelerated in recent years, is being challenged in SERPLANs recently published *A Sustainable Development Strategy for the South East* as unsustainable (*see indicator P4*). The cost of this pattern include physical damage to the environment, pollution and congestion which imposes significant additional costs on the regional economy. SERPLANs emerging strategy seeks to produce a more sustainable pattern of development making better use of urban areas and promoting a switch from excessive use of the private car to greater use of public transport.

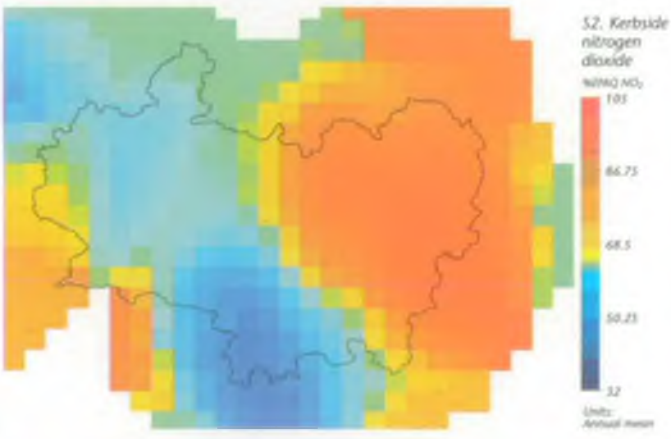
(Source of data: Institute of Terrestrial Ecology, DETR & SERPLAN)

Indicator S2.

Air quality: concentrations of nitrogen dioxide

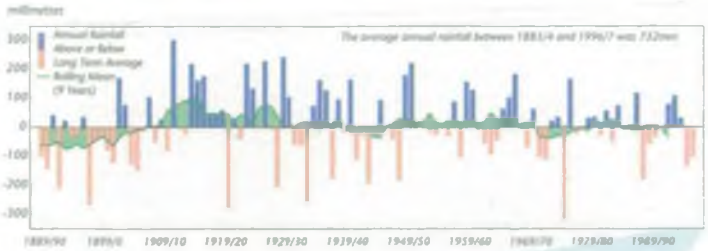
The monitoring of air quality is very complex and the responsibility is split between different organisations (*see section 4.7*). The Government's proposed standards and specific objectives for air quality are set out in the National Air Quality Strategy (NAQS). There are eight pollutants for which a standard limit and objective has been set: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, ozone, fine particles (so called PM_{10} – particles less than 10 microns in size) and sulphur dioxide.

Initially we have selected nitrogen dioxide (NO_2) as an indicator of air quality, although we intend to include all the pollutants included in the NAQS in future editions of this *State of the Environment Report*. Nitrogen dioxide contributes to acid rain, the formation of ground-level ozone and photochemical smogs and is a respiratory irritant at higher concentrations than typical UK ambient levels. More widespread exceedances occur when dispersion is limited by calm weather, particularly temperature inversions. The map presents the emissions which originate from road transport (ie. measured at kerbside monitoring sites) throughout the Region. Road transport was responsible for some 49% of total nitrogen oxide (NOx) emissions in 1995 (DETR) and we expect this proportion to increase as a result both of traffic growth and success in reducing emissions from power stations, the next main source. However, this trend will be complicated by the proportion of diesel and petrol vehicles, the fitting of catalytic converters to new petrol vehicles and the rate of growth in traffic.

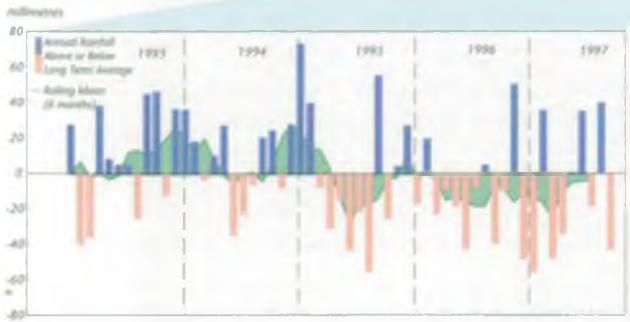


(Source of data: local authorities & National Environment Technology Centre – NETCEN)

S3. Rainfall in the Thames Region, 1889 to 1997



Monthly rainfall over last 5 years



Indicator S3.

Quantity of rainfall

The past three years have seen rainfall well below average, following two relatively wet years. This has resulted in low river and groundwater levels across the Thames Basin (see indicators S5 and S10). Although there has been a prolonged dry spell, this cannot be definitely attributed to climate change, as there have been similar dry spells in the past hundred years as shown by the graph of rainfall going back to 1889.

(Source of data: Environment Agency & Meteorological Office)

Indicator S4.

Number of heavy rainfall events

Rainfall frequency and intensity have a direct effect on flooding incidents. We need to look at long term trends and patterns of rainfall which may create new challenges for the management of flood risk in the Region. The graph shows the number of heavy rainfall events (over 20mm in a day) in three example locations: Swindon, Gatwick and Hampstead. The degree of flooding caused by these storms will depend on the permeability of the ground and river levels at the time of the rainfall and therefore may not be directly associated with specific flooding events.

(Source of data: Environment Agency & Meteorological Office)

Indicator S5.

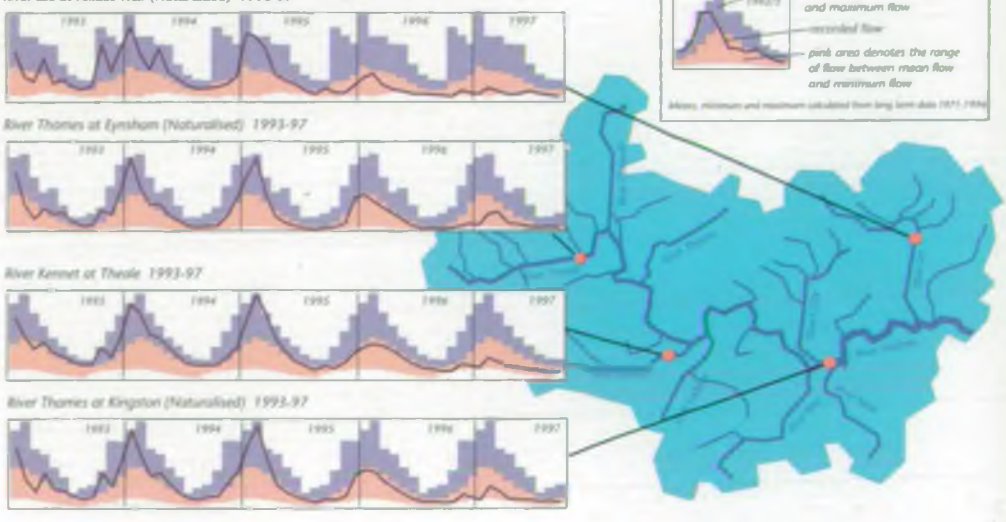
Quantity of river flows

River flows have been widely affected by the drought over the past three years, with flows well below average during 1996 and 1997 (see indicator S3, S6 and S10). Low flows in rivers can have a number of environmental effects, including impacts on fisheries and aquatic habitats and water quality, as well as reducing the volume of water available for abstraction and navigation. Naturalised river flows are given for the River Thames at Eynsham and Kingston, and the River Lee at Fieldes Weir, as the flow in the rivers at these sites is greatly affected by public water supply abstractions (see indicator P8).

(Source of data: Environment Agency)

S4. Number of days per year with rainfall above 20mm, 1989-97

S5. River flows in the Thames Region, 1993-97



Indicator S6.

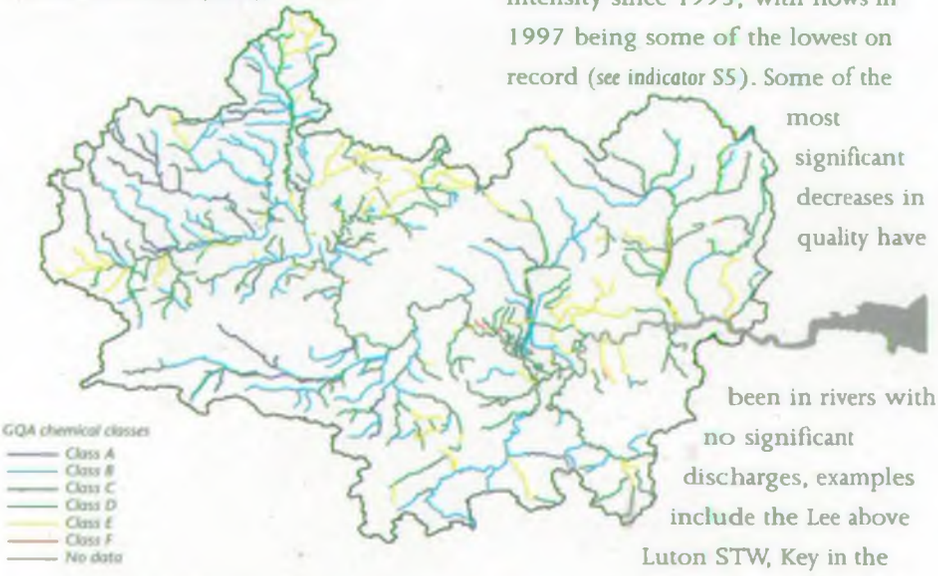
Chemical river water quality

The General Quality Assessment (GQA) scheme is used to assess the quality of rivers, to monitor trends over time and to compare rivers in different areas. The general chemistry component of the GQA is made up of six grades (A to F) defined by standards of dissolved oxygen, biochemical oxygen demand and total ammonia.

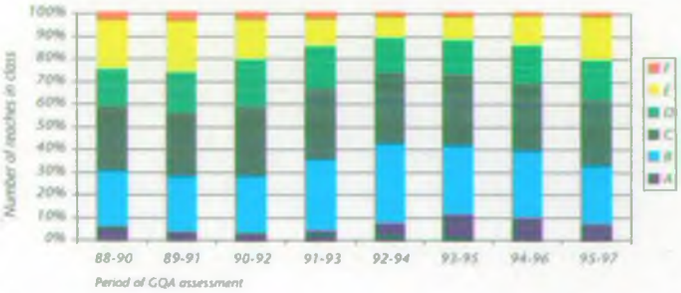
Chemical river quality showed a marked increase between 1990 and 1995. This is due to two main factors: firstly a significant improvement in the quality of the majority of discharges to the Thames and its tributaries (*see indicator P10*); and secondly, a return to average flow conditions for the catchment as a whole following the 1989-91 drought (*see indicator S5*).

Since 1995 river quality has deteriorated markedly. This is almost entirely due to the drought conditions, which has grown in intensity since 1995, with flows in 1997 being some of the lowest on record (*see indicator S5*). Some of the most significant decreases in quality have been in rivers with no significant discharges, examples include the Lee above Luton STW, Key in the Cotswolds and stretches of the Grand Union Canal. Others are due to the lack of dilution of discharges.

S6. Chemical river quality, 1995-97



S6. Thames Region chemical GQA results, 1988-97

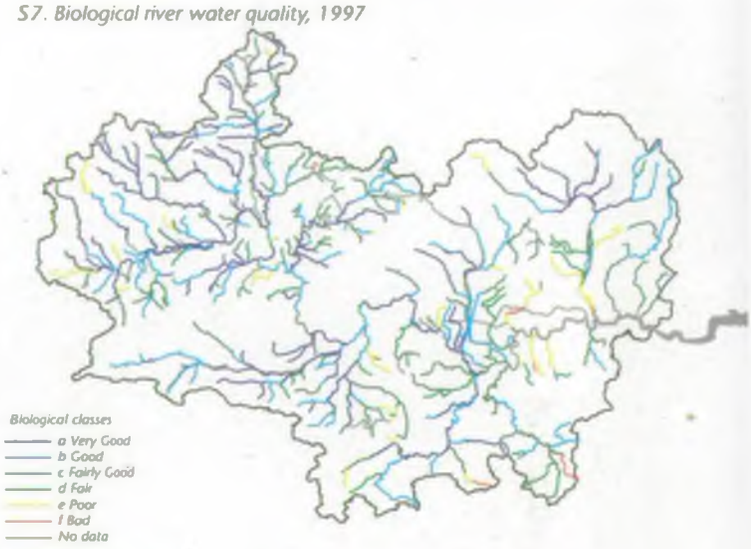


(Source of data: Environment Agency)

Indicator S7.

Biological river water quality

S7. Biological river water quality, 1997

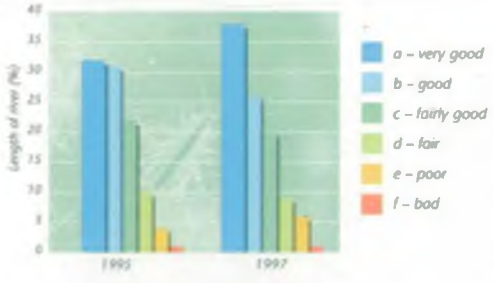


The biological assessment of river water quality provides a broad measure of pollution and is based on monitoring invertebrates which live on the river bed. The graph shows the results for the biological assessment of our rivers in 1997. While the majority of rivers are classed as 'very good' or 'good', poorer water quality is seen around urban areas and below significant discharges.

Improvements in biological river quality since 1995 reflect improvements in the quality of discharges. Reductions in biological river quality result from low flows which reduce the dilution of discharges (*see indicator S5*). When those rivers suffer extreme low flows with drying out, there is a high impact on the flora and fauna, which will take time to recover from.

(Source of data: Environment Agency)

S7. Biological river water quality, 1995 and 1997



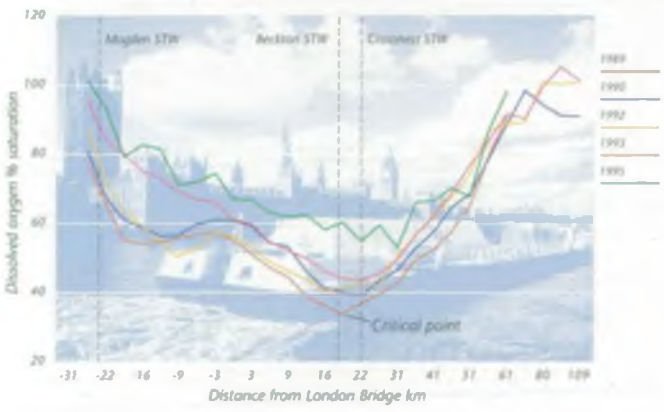
and this usually assures compliance with the dissolved oxygen standards. However, storm sewage overflows may lead to dissolved oxygen depletion in the summer following moderate to heavy rainfall over London. When this occurs, the Thames Bubbler or Vitality are deployed to inject oxygen into the water at critical locations (see indicator R5). The change in dissolved oxygen levels in the Tidal Thames is shown in the graph. (Source of data: Environment Agency)

Indicator S8.

Tidal Thames water quality: dissolved oxygen

One of the components of the water quality classification scheme for the tidal Thames (below Teddington) is the dissolved oxygen level (see section 4.5). During the summer, when freshwater flows are low (see indicator S5) and the river temperatures are high, water quality in the upper and middle reaches of the tideway is increasingly influenced by the discharges from the major sewage treatment works (STW). We have an operating agreement with Thames Water which requires more stringent effluent quality control from the STWs during these critical periods

S8. Dissolved oxygen profile in the Tidal Thames, May-September mean



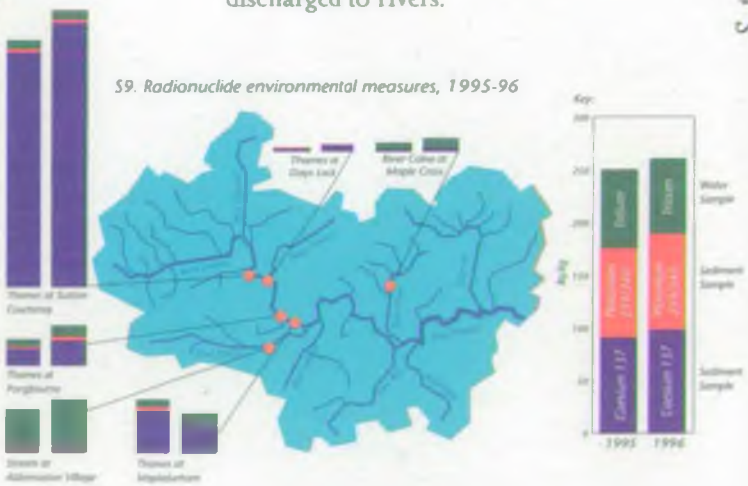
Indicator S9.

Radiation levels in the vicinity of nuclear sites

We are responsible for regulating industrial and other uses of radioactive substances and of disposals of radioactive waste. This duty is performed within the framework of internally accepted standards of radiation safety for members of the public. The standards are translated into statutes and Government policies, which we enforce. We also have powers to require users to minimise the amounts of radioactive waste produced and to dispose of wastes by the most appropriate means. In this way the resulting radiation doses to members of the public are kept very low.

There are seven nuclear sites within the Thames Region and approximately two hundred other users disposing of radioactive waste. Many sites send wastes for handling at other locations in addition to local disposals to sewers, the atmosphere or rivers. Many large hospitals make discharges to sewers where they receive treatment before being discharged to rivers.

S9. Radionuclide environmental measures, 1995-96



We have a programme of environmental monitoring designed to ensure the acceptability of the discharges made by nuclear sites. Data from this programme is shown on the map. In a few cases it is possible to detect small quantities of radioactivity in environmental media. For the Thames at Sutton Courtenay, where caesium-137 has been detected in river sediments, the discharges of this radionuclide have decreased in recent years. Calculations of radiation exposure to members of the public use additional information on the length

of exposure to radioactivity in the environment and their pattern of consumption of local food-stuffs. Radiation doses that result from this material are very small and well below the appropriate limit and recommended values.

(Source of data: Environment Agency)

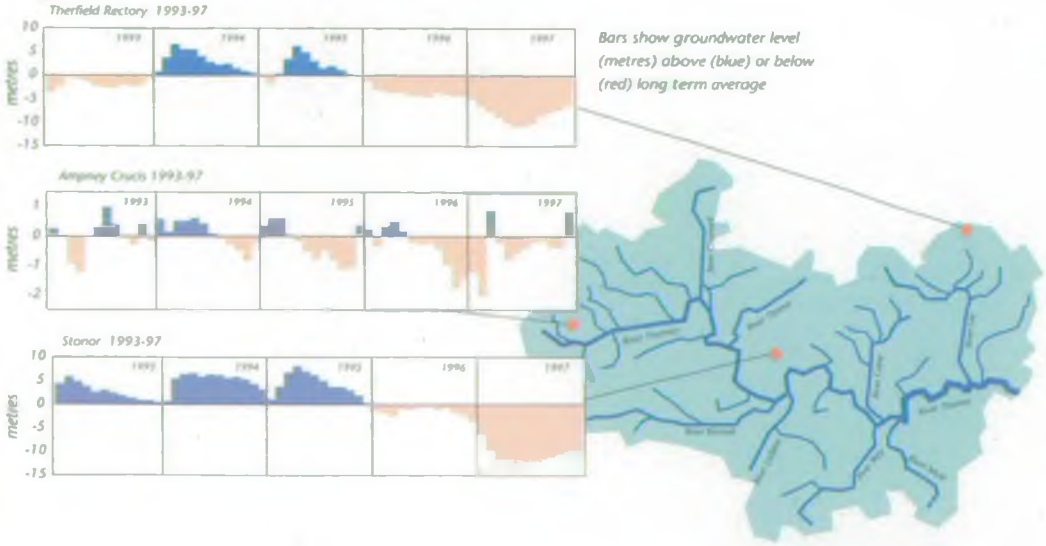
Indicator S10.

Quantity of groundwater

Groundwater is an essential source of high quality water for public and private domestic supplies, and for some industrial uses. It provides over 40% of public supply in Thames Region as well as contributing to the flow of many rivers particularly in the upper catchment (see indicators S5, S12 & P8). The effect of dry weather can be seen very clearly in groundwater levels (see indicator S3). The problem has been particularly acute in the chalk aquifer in the north east of the Region, as demonstrated by the record for Therfield Rectory (see indicator R9).

(Source of data: Environment Agency)

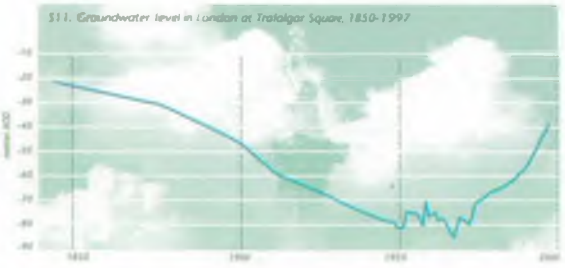
S10. Groundwater levels in Thames Region, 1993-97



Indicator S11.

Groundwater levels in London

During the 1800s water use by industry in the major UK cities led to a lowering of groundwater levels. As industrial activity in cities has declined this century, groundwater levels have been recovering. In London, records of groundwater levels below Trafalgar Square show rapidly rising levels over the past 20 years, with potential problems for the London Underground, services and building foundations. We are working with other interested organisations to control the groundwater levels and realise a small but useful water resource. (Source of data: Environment Agency)



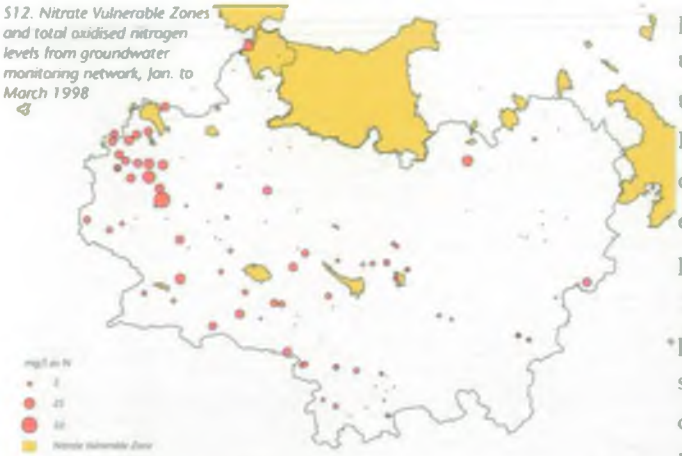
Indicator S12.

Groundwater quality: concentration of nitrate

In Thames Region nearly half of the major aquifers outcrop near the land surface and are consequently at considerable risk from polluting activities. Protection of groundwater from pollution is therefore a very important issue in the Region (see indicators S10 & P8). Industrial, agricultural and urban development all contribute contaminants such as solvents, pesticides and nitrates to groundwater. Decontamination of groundwater is very difficult and expensive.

We are establishing a national network of boreholes and springs to enable a wide range of routine analyses. In Thames Region the network already consists of over 500 private and public supply sources, based on one sample point per 25km^2 covering the major aquifers. In time this network will be extended to cover the minor aquifers. To ensure the consistency of data, each sample point has to meet standard national criteria, and this will enable comparison of data for all aquifers wherever they outcrop in the country. Overall the network data shows that groundwater is generally of good quality, however it is also useful in identifying where pollution from widespread or diffuse activities is occurring. One particular example of this is the increasing pollution from

S12. Nitrate Vulnerable Zones and total oxidised nitrogen levels from groundwater monitoring network, Jan. to March 1998



nitrates used in agriculture. We are required, under the EC Nitrates Directive, to identify waters polluted by nitrates and specifically to define Nitrate Vulnerable Zones. In these zones policies will need to be implemented to prevent the excessive use of nitrates, principally from agricultural sources. Data from the network is used to assist in identifying potential zones. (Source of data: Environment Agency)

Indicator S13.

Salmon returning to the River Thames

There is much evidence that the River Thames once supported a healthy salmon population. However, the pollution of the tidal river during the Industrial Revolution contributed to the extinction of the population in 1833. Happily, the population showed signs of returning during the 1970s. In 1979, Thames Water Authority established the Thames Salmon Rehabilitation Scheme with the long term objective of restoring a self-sustaining salmon population to the river. Good progress has been made and several organisations, including the Agency, are now responsible for the scheme.

In 1986 the Thames Salmon Trust was set up to provide finance for the scheme and has been a great success with more than £1million raised to date. The Rehabilitation Scheme includes fish rearing and stocking, construction of fish passes and monitoring programmes to evaluate progress.

The confirmed minimum number of salmon returns is based on fish taken in traps, rod and line, mortalities and electro-fished. This probably represents 60-70% of the run. There have been recent reports that salmon returns are falling across Europe, details of this trend will be included in future editions of the *State of the Environment Report*.

(Source of data: Environment Agency)

S13. Number of salmon returning to the River Thames, 1974-97

Indicator S14.

Distribution of key biodiversity species

We seek to protect and enhance habitats and associated species through our day to day activities and responsibilities and by working in partnership with other organisations. The species identified in the UK Steering Group report on biodiversity which are considered to be threatened require specific attention (see section 4.7). However, these species cannot all be used as indicators because baseline distribution data is not yet available or if it is available the monitoring schemes in operation are not repeated frequently enough. The indicator species have therefore been selected on the basis that we already know where the populations exist and updated information on distribution is likely to be available on a regular basis.

The species selected also reflect our particular interest in river corridors and their floodplains and include not only 'short' list species, but are also those from the 'long' list (see section 4.7). However, other species could have been chosen which are not included on any of the biodiversity

lists but are equally important in terms of monitoring sustainability. As information becomes available, other species will be included in future editions of the *State of the Environment Report*. Where the information is available, the distribution of the indicator species is shown by their occurrence by Local Environment Agency Plan (LEAP) area *(see indicator R6 for the names of the LEAP areas)*.

Otter

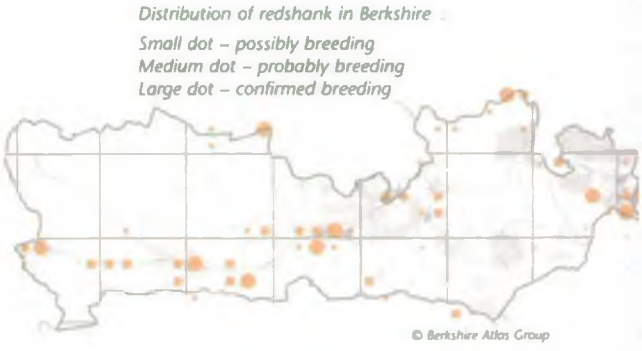
The European otter is one of Britain's largest mammals and were formerly widespread throughout the UK, but underwent a rapid decline from the 1950s to 1970s effectively being lost from the Midlands and South East by the 1980s. However, the decline now appears to have halted and sightings are being reported in former habitats. The decline was caused by pollution of watercourses, insufficient prey, impoverished bankside habitat features needed for breeding and resting and incidental mortality, primarily by road deaths and drowning in eel traps.

Bittern

The bittern is a large, brown heron-like bird and is a declining, localised and rare breeding species. It is confined almost entirely to lowland marshes in Norfolk, Suffolk and Lancashire dominated by common reed, where it feeds principally on amphibians. The UK population had declined to 15 or 16 males in 1994 from a peak of 70 pairs in the late 1960s, when in bred in 8 counties. Numbers are boosted in winter by continental immigrants (usually less than 100). The decline has largely been caused by loss of suitable reedbeds through succession, inappropriate management and fragmentation; degradation of habitat through water pollution, pesticide and heavy metal pollution; food availability, especially of eels, affected by inappropriate habitat management and pollution, salt water intrusion into coastal reedbeds and problems due to a small population size.

Redshank

This bird species with relatively long orange-red legs is frequently seen in Thames Region, but only has a tenuous hold as a breeding species. It is commonly associated with floodplain grazing meadows. In Berkshire, redshank have been recorded throughout the year and are typically reported from about 15 different sites. Breeding is spread thinly across the county in suitable marsh and gravel pit locations such as Freemans Marsh, Brimpton, Thatcham Marsh and Theale Gravel Pits. The creation of reserves at Eversley, Theale and Woolhampton, with active management programmes should



provide suitable habitat to enable redshank to continue to breed at these sites. It is hoped that we will have information for the whole Region for future editions of the *State of the Environment Report*.

Club-tailed Dragonfly

This medium-sized, yellow-green and black dragonfly with a noticeable club-shaped tail, is found along slow-flowing rivers or in adjacent woodlands. The species is found in small pockets, but can occur in very large populations where the habitat is suitable such as from Lechlade to below Windsor. Smaller populations breed on some tributaries, such as the Kennet and Loddon. Threats to this species include water pollution, excessive dredging and loss of woodland within easy reach of the river.

Scarce Chaser

This dragonfly typically occurs in river floodplains, water meadows and occasionally gravel pits. Although locally abundant where it does occur, this species is scarce throughout its range in southern and eastern England. A new breeding colony has been discovered on the River Wey in Surrey and Hampshire. Threats to the species include shading of habitat through uncontrolled growth of marginal trees; low flows resulting in high water temperatures and deoxygenation; inappropriate river management, such as removal of fallen trees and weed cutting; and pollution.

(Source of data: Environment Agency & Berkshire Atlas Group)

3.3 Pressures on the environment

The pressures on the environment arise from both controllable and non-controllable sources. Some pressures relate to geographic position, the nature of the countryside, and the population density and distribution. Some pressures arise directly from controlled releases of substances to the atmosphere, to the aquatic environment, and into and onto land. Pressures also arise from the abstraction of materials from the environment, most notably – but not exclusively – that of water. We do not control all these activities solely, or even jointly.

The following six categories are used as a framework for assessing pressures, or 'stresses and strains', on the environment:

natural forces: these include climate variations such as the extent and rate of change in sea level, changes in weather and rainfall patterns and temperature extremes. They also include other natural pressures, such as radiation from naturally occurring radon, which may require action to mitigate or ameliorate their potential effects;

societal influences: these are perhaps the greatest and most embracing pressures on the environment. They range from the size and distribution of the population, the number of households, the pattern of energy consumption, the nature and frequency of transport, planned changes in land use, recreational practices and activities, plus changes in public attitudes and perceptions of environmental matters;

abstractions and removals: these include the removal of water, minerals, and materials, such as peat, (and perhaps even the cropping of trees, which cannot rapidly be replaced) where the quantities, the processes involved, the timing, or the rate of removal are sufficient to require some form of control;

usage, releases and discharges: these include emissions from point sources to the environment plus the cumulative input from diffuse sources such as fertilisers and pesticides. They are measured by the quantity used or discharged with regard to their potential environmental impact;

waste arisings and disposals: these include the by-products of industry and society including solid and liquid wastes. The creation and disposal of such materials creates pressures on the environment, however, the manner in which they are managed (reused and recycled) can provide an additional resource;

illegal practices (accidents and non-compliance with regulations): these include pollution incidents affecting air, land and water; fly-tipping; organised environmental crime; and recorded breaches of compliance with existing environmental licences.

The key pressure indicators included in this report are categorised by this framework.

There are a number of potential indicators we hope to have data in time for the next edition of the *State of the Environment Report*.

Key Pressure Indicators

P1 Long term change in temperature 

P2 Rate of water leakage 

P3 Rate of water demand 

P4 Projected housing development 

P5 Number of planning applications 

P6 Passenger transport and vehicle traffic 

P7 Boat traffic on the non-tidal Thames 

P8 Volume of water abstraction and consumption 

P9 Demand for aggregates 

P10 Number of sewage treatment works compliant with consent 

P11 Emissions to air from major industries 

P12 Amount of waste arisings 

P13 Capacity of waste management facilities 

P14 Volume of waste to landfill 

P15 Number of water pollution incidents 

Potential Pressure Indicators for the Future

- Population living in unprotected flood risk areas 
- Development proposed in flood risk areas 
- Number of properties flooded for return period/event 
- Number of contacts which need to be made when a flood warning is issued 
- Number of flood risk locations in each catchment 
- Recreational use of the River Thames footpath 
- Emissions of methane to air from landfill sites 
- Emissions of CO_2 to air from Part A processes 
- Amount of waste transportation by mode 
- Amount of sewage sludge produced 

Pressure indicators

Indicator P1.

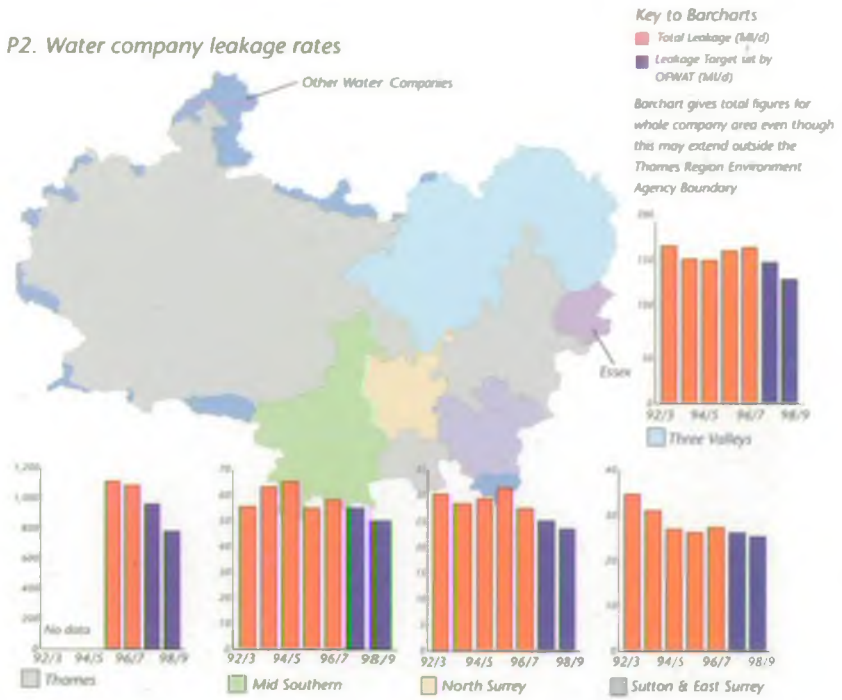
Long term change in temperature

The climate is a fundamental natural pressure on the state of the Region's environment (see section 4.2). Pending the development of more precise indicators in future reports, the Central England temperature record puts changes in average temperatures in an accurate context. The graph shows that temperatures are rising, though similar events have occurred in the past. This indicator reflects a longer term change than some of the other indicators.

(Source of data: University of East Anglia, Norwich and the Hadley Centre)

P1. Central England temperature record, 1659-1997

P2. Water company leakage rates



Indicator P2.

Rate of water leakage

During the very dry summer in 1995, leakage rates from water company pipes became a prominent issue, particularly for those companies whose leakage rates were considered to be unacceptably high. In 1997, the water industry regulator OFWAT, set mandatory leakage targets for each of the water companies. Water companies are now working hard towards achieving these targets, and ultimately moving towards economic levels of leakage.

(Source of data: OFWAT and water companies)

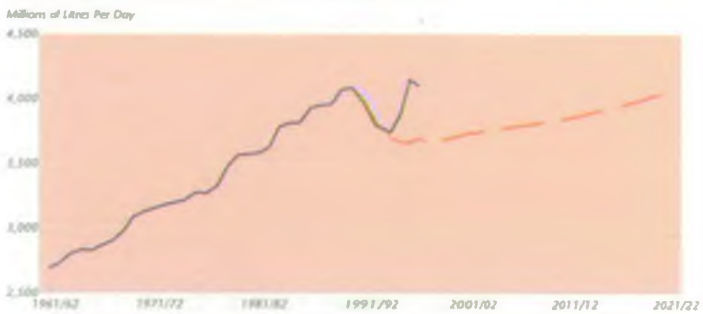
Indicator P3.

Rate of water demand

Public demand for water in Thames Region has risen by over 50% since the early 1960s, and is forecast to increase beyond the year 2000. Whilst water companies in 1993 forecasts a gradual increase in water consumption, the very dry weather in 1995/6 caused water use to increase dramatically (see indicator S3, S5, S10 & P8). Much of this rise was as a result of increased garden watering and other external uses. The very cold winter in 1995 also resulted in many more burst water mains than usual.

(Source of data: Environment Agency and water companies)

P3. Actual and forecast demand for water, 1961 to 2021



Indicator P4.

Projected housing development

The Government has asked the South East Region Planning Conference (SERPLAN) to provide advice on housing requirements in the region to 2016 taking into account the latest Government household projections. In producing their projection, SERPLAN has questioned the technical assumptions underlying the Government's projections. This matter will be debated at a public inquiry due to be held next year. The advice will feed into revised Regional Planning Guidance (RPG) for the South East. This indicator is likely to reflect longer term change than some of the other indicators.

P4. Projected housing development (1991-2016)

	1994 Regional Planning Guidance (RPG9) Projection	*Latest Government Household Projections*	*Latest SERPLAN Projections*	
			Lower Level	*Upper Level*
London	*433,325*	*629,000*	*629,000*	*629,000*
Rest of South East	*991,675*	*1,103,000*	*875,000*	*914,000*
SERPLAN Area	*1,425,000*	*1,732,000*	*1,504,000*	*1,543,300*

(Source of data: SERPLAN and DETR)

Indicator P5.

Number of planning applications

In the Thames Region, local planning authorities make just over 100,000 planning decisions per annum. This is double the number of decisions made in most of our other Regions. The number in Thames Region has been relatively static during the period 1991/92 to 1996/97. We are a consultee for certain types of development and we commented on approximately 5.4% of the number of decisions made by local authorities in 1996/97, compared with 3.5% in 1993/94.

(Source of data: Environment Agency, DETR and local authorities)

P5. Number of planning authority decisions and Agency consultations in Thames Region, 1993/94 - 1996/7

Indicator P6.

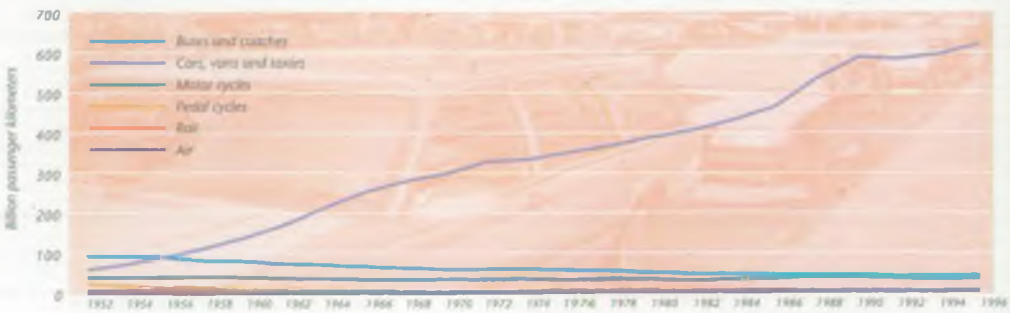
Passenger transport and vehicle traffic

Transport exerts pressures on the environment in many ways. Road transport accounts for over 90% of passenger travel within Great Britain, and for over 80% of the freight moved. Vehicles emit many gases, particulate materials and other substances into the atmosphere (*see indicators S2 and P9*). This is not directly our responsibility, but we must understand the different sources and relative quantities of different chemicals in order to assess the general state of the environment. Road construction also places pressures on the environment and traffic noise is a major nuisance in some areas.

P6. Forecast of motor traffic in Great Britain, 1996-2025

Car use for passenger transport has risen over the last 40 years and

P6. Passenger transport and vehicle traffic in Great Britain, 1952-96



P6. Average distance travelled per person per year by region of residence:, 1994-96

motor traffic is predicted to increase by a further 52–82% by the year 2025. The lower and upper forecasts are based upon different assumptions about changes to Gross Domestic Product and fuel prices.

People living in London generally travel less, 5000 miles per year compared to 8,000 miles for the residents of the rest of the South East. Furthermore, the average distance travelled by London residents has decreased in the last ten years in contrast with the increase in other areas of Great Britain. Londoners also travel fewer miles by car, using this mode for 66% of milage, compared to the Great Britain average of 82%. On average every resident of the South East outside London travelled nearly 6,000 miles a year by car. This is twice the level of use by London residents and the highest level in Great Britain. The level of car ownership is also highest in the South East outside London. The Thames Region is therefore under particularly high pressure from road transport.

Whilst the distanced travelled by each London resident by car may be relatively low, in considering the environmental impact of car traffic the effects of population density, commuters from outside London and the type of journey are all important and result in, for example, the episodes of poor air quality in London (see indicator S2). (Source of data: DETR)

Indicator P7.

Boat traffic on the non-tidal Thames

We are responsible for navigation on 217km of the River Thames between Cricklade near the source and Teddington Lock where the river becomes tidal. The navigational role of the River Thames has changed over time. Originally it acted as a natural trade route, but the development of the railway system in the middle of the last century led to its decline as a commercial link. Today the Thames is an important recreational asset.

The popularity of the river was at its greatest between 1973 and 1981, with a peak of 1,163,305 craft movements in 1980. At present the total number of boat movements seems to be static, but the number of visiting boats is rising.

(Source of data: Environment Agency)

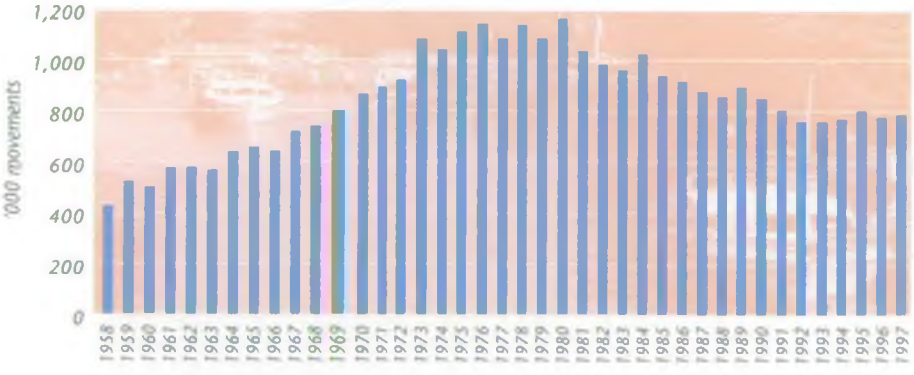
Indicator P8.

Volume of water consumption and abstraction

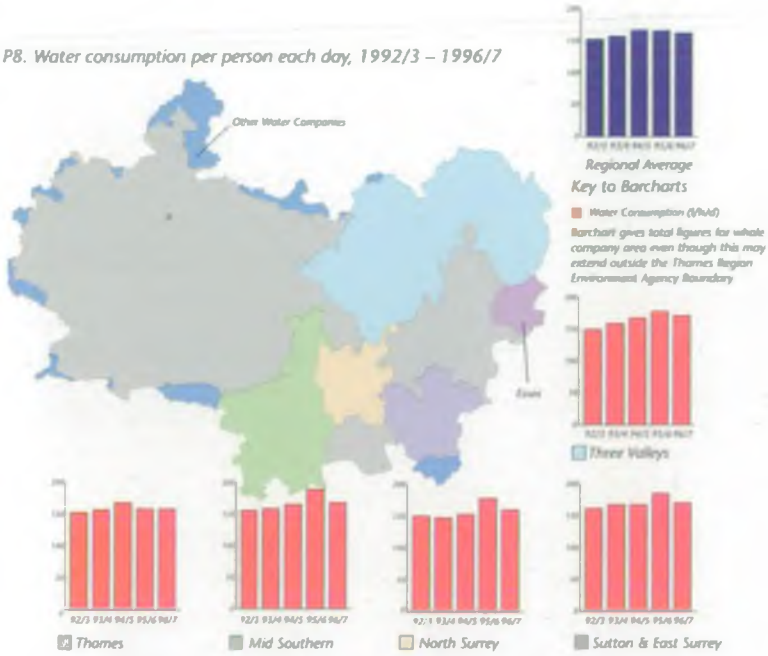
About half of the volume of water abstracted in Thames Region comes from non-tidal rivers and streams, with the rest being taken from tidal abstractions and groundwater in equal proportions. Of the non-tidal abstractions, the majority of the water is used for public water supply. Tidal abstractions are mainly used for cooling water in power generation.

The average domestic consumption of water per person per day in the Thames Region is 163 litres (1996/7). This is 10 litres per person per day higher than consumption in 1992/3. This increase is due to many factors, particularly: the increase in use of household appliances such as washing machines, dishwashers and

P7. Boat traffic on the non-tidal Thames, 1958-97

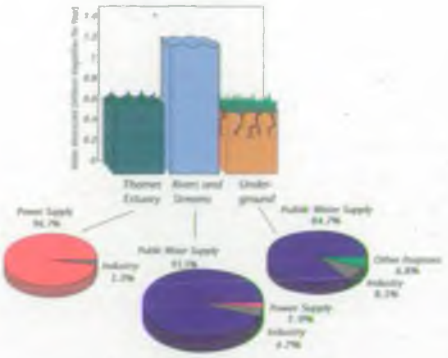


P8. Water consumption per person each day, 1992/3 – 1996/7



P8. Water abstraction in Thames Region

Water is abstracted from:



power showers; the increase in garden watering and car washing; and the reduction in household occupancy rates (lower occupancy households tend to use more water per person).

(Source of data: Environment Agency & water companies)

Indicator P9.

Demand for aggregates

Government advice published in 1994 provides a framework for aggregate supply until 2006. This predicts a substantial increase in the demand for aggregates in the South East region. As a result, minerals planning authorities in the South East are expected to make a provision of 420 million tonnes of sand and gravel from local land sources between 1996-2006. However, there is expected to be a 33% shortfall of local land won sand and gravel during 1992-2006. This shortfall will need to be met by importing marine aggregates and crushed rock, together with recycling and use of secondary materials. This indicator is likely to reflect a longer term change than some of the other indicators.

P9. Comparison between sand and gravel sales and permissions in the South East Region, 1984-1996

The graph compares the South East regional apportionment with sales and permissions over the last 13 years. Whilst the flow of permissions was erratic, the 13 year total for sales (361.3 million tonnes) and permissions (358.0 million tonnes) were similar. The average annual sales figure for the 13 year period is 27.8 million tonnes, slightly below the current regional apportionment figure of 28.0 million tonnes. However, over the recent six years 1991-96, average sales were only 22.6 million tonnes.

The balance between different sources of aggregates, the total volume demanded and the amount of recycling and use of secondary materials all have implications for the environment. The winning of sand and gravel, for example, has the potential to cause a range of environmental impacts, including loss of habitat, water pollution and changes in groundwater levels and flows.

(Source of data: DETR & SERAWP)

Indicator P10.

Number of sewage treatment works compliant with consent

A major influence on the quality of the freshwater rivers in the Region is the discharge from sewage treatment works. As of April 1998, we had over

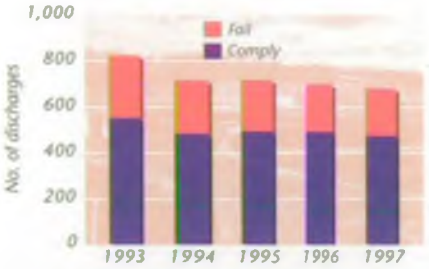
7,000 consented discharges in the Region. This includes approximately 4,500 septic tanks which discharge to ground and more than 400 urban sewage treatment works which discharge into rivers. These sewage works range in size from Boarstall in Oxfordshire discharging 4m3/day to Maple Lodge Sewage Treatment Works which discharges approximately 350,000m3/day into the river Colne at Watford. There are approximately 1,900 private discharges of treated sewage, which do not have a significant effect on major rivers, but are of local importance to small tributaries particularly in the South East Area of the Region.

The urban and village sized treatment works are owned and operated by Thames Water (TW). As well as being a pressure on the rivers, the discharges are a key component of the Region's freshwater environment, since the whole Region is dependent on the re-use of water to serve the large population (*see section 4.4*).

The graphs show the compliance of both water utilities and private and trade discharges. Over the last ten years, there has been a marked improvement in the quality of TW's treated sewage discharges. The overall quality of the effluent has shown a very significant improvement. It has been estimated that the mean biochemical oxygen demand (BOD) load discharged from all TW's sewage works reduced by 30% between 1990 and 1995 and the mean load of ammonia reduced by 24%.

P10. Water utilities sewage works compliance, 1993-97

P10. Private and trade discharge compliance, 1993-96



(Source of data: Environment Agency)

Indicator P11.

Emissions to air from major industries

Industries with the greatest potential to pollute the environment are subject to a system of Integrated Pollution Control (IPC). Two lists of processes have been prescribed by regulations for control: Part A processes are controlled under IPC by the Agency; Part B processes are controlled at a local level with regard to their discharges to the atmosphere under a system of Local Authority Air Pollution Control (LAAPC) (*see section 4.7*). There are approximately 150 Part A processes authorised in the Region and these fall into the following industrial types:

- fuel and power (30);
- metals (15);
- minerals (5);
- chemical (80);
- waste (15);
- others (5).

Releases to the environment from Part A processes are estimated and compiled in a Chemical Release Inventory (CRI). The releases to air of NAQS substances from Part A processes in Thames Region are summarised in the table.

Thames Region only produces a relatively small proportion of the total emissions from all Part A processes in England and Wales. The Region has few major industrial processes relative to its population and economic activity. However, air quality is also effected by emissions from other sources, for example, approximately three quarters of total carbon monoxide emissions

P11. Releases of NAQS substances from Part A processes (1996)

Substance	England and Wales tonnes	Thames Region tonnes	percentage of England and Wales total
Sulphur dioxide	1,104,467	48,743	4.4%
Nitrogen oxides (as NO_2)	577,902	21,214	3.7%
Carbon monoxide	165,000	20,180	12.2%
Particulates	43,345	1,636	3.8%
Benzene	947	37.7	4.0%
Lead	116	2.0	1.7%

Note: – lead occurs in several CRI groups and this is therefore an estimate
– not all particulates are PM_{10}, but future reporting will pick up PM_{10}'s only
– the quantity of particulates includes an estimate for Didcot A

P11. Staged limit reductions in Didcot A compare with actual releases

P12. Amount of waste arising, 1987-1996

and half of the total nitrogen oxides emissions are from road transport (see indicator S2). Didcot Power Station is one of the most significant Part A installations in the Region and the graph shows how emissions of sulphur dioxide and oxides of nitrogen from Didcot A have decreased over the last five years and how a staged reduction in limits is planned for the future.

(Source of data: Environment Agency)

Indicator P12.

Amount of waste arisings

The total amount of controlled waste produced in the Region in 1996 was approximately 19 million tonnes. As data on waste arisings is produced by local authority area, this total is based on the waste arisings for each of the main counties that form part of the Thames Region*, as well as Greater London. The types of waste which make up this total are:

- **type A:** inert waste (48%);
- **type B:** industrial and commercial waste (23%);
- **type C:** household waste (29%);

The amount of waste in each of these categories produced in the Region* over the last six years is shown in the graph. The amount of household waste produced per capita in the Region* was approximately 0.47 tonnes in 1996 (see indicators P13, P14 and R2).

(Source of data: local authorities & SERPLAN)

* Note the following are included: Berkshire; Buckinghamshire; Hampshire; Hertfordshire; London; Oxfordshire; and Surrey.

Indicator P13.

Capacity of waste management facilities

There is a growing need for facilities other than landfill to recover or dispose of waste in the Region (see section 4.6). The capacity of existing waste management facilities other than landfill and the additional potential capacity from proposed facilities are shown in the table (see indicators P12, P14 and R2). (Source of data: local authorities and SERPLAN)

Indicator P14.

Volume of waste to landfill

Many waste types can be landfilled safely and landfill may remain the best option for some inert wastes and for wastes which are difficult to incinerate or recycle. However, landfilling, particularly of putrescible (organic) waste, has the potential to release pollutants into the water, soil and air. The Government's target is to reduce the amount of landfilled waste from 70% of all controlled waste to 60% by 2005.

In Thames Region*, some 69% of waste is sent to landfill sites. However, it is predicted that available void space at many existing sites will be exhausted early next century. This will leave London, South Buckinghamshire and Hampshire with especially pressing waste management

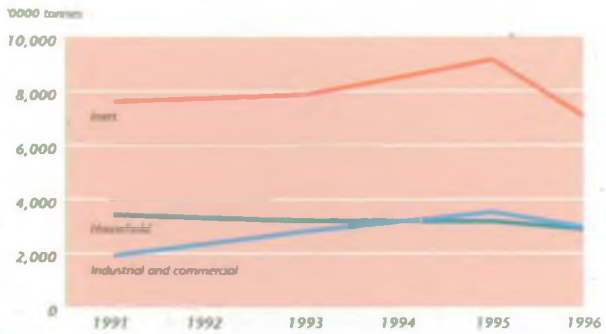
P13. Capacity of existing waste management facilities other than landfill in the Region* (1996)

Household/ Commercial Incineration	Special Waste Incineration	Clinical Waste Incineration	Green Composting	Material Recovery Facilities	Treatment Plants	Other	Total
1,020	0	0	50	185	150	887	2,292

capacity in thousand tonnes

* Note the following are included: Berkshire; Buckinghamshire; Hampshire; Hertfordshire; London; Oxfordshire; and Surrey.

P14. Volume of waste to landfill, 1991-96



problems. The existing and potential landfill capacity within the Region* is approximately 220 million m^3, sufficient for approximately 5 years at the current rates of production and exportation of waste. Some landfill sites are restricted in the range of material they can accept because of the potential for groundwater pollution and generally only accepts inert waste (see indicators P12, P13 and R4 and section 4.6).

(Source of data: local authorities and SERPLAN)

* Note the following are included: Berkshire; Buckinghamshire; Hampshire; Hertfordshire; London; Oxfordshire; and Surrey.

Indicator P15.

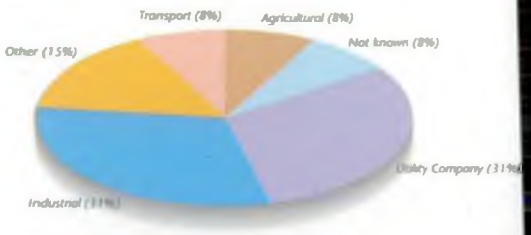
Number of water pollution incidents

A significant pressure on the aquatic environment is the number and severity of pollution incidents. The total number of all reported pollution incidents in inland waters has risen, more or less continuously, in recent years. The increase in reports is partly due to an increased public awareness of water quality issues. A freephone number (0800 80 70 60) has been available since 1994 to enable the public to report pollution incidents and the line is managed 24 hours per day. Many of the incidents are relatively minor and some cannot be subsequently substantiated. Since 1990 the number of substantiated pollution incidents has been recorded separately.

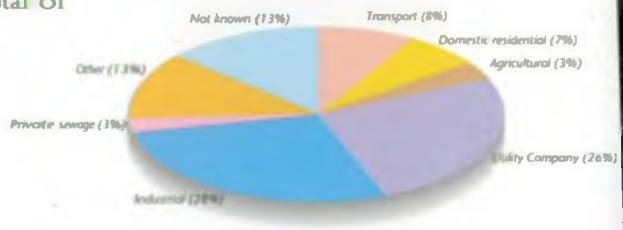
Pollution incidents are classified into one of four categories depending on their significance, category 1 are the most serious and category 4 are the least serious. In 1997, there were a total of 2,823 substantiated pollution incidents in Thames Region, of which only 133 posed a serious threat to the environment (category 1 and 2 incidents). The total number of incidents and the number of category 1 and 2 incidents has declined steadily since 1994 by 16% and 23% respectively. Incidents are classified by their sources. The majority of the category 1 and 2 incidents were from industry and sewage treatment works.

(Source of data: Environment Agency)

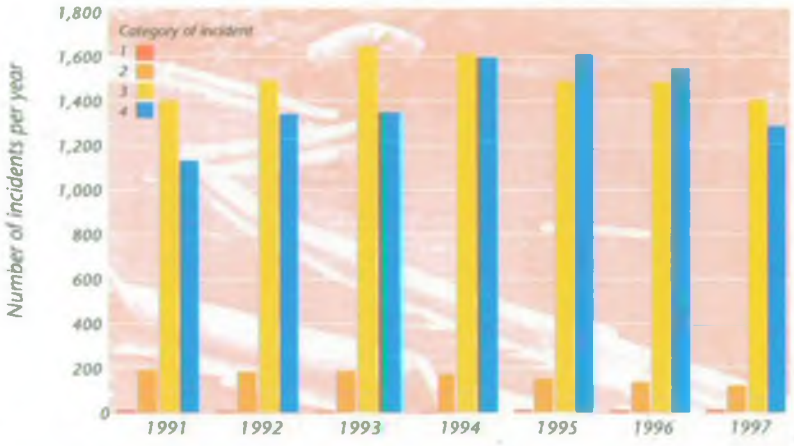
P15. Source of category 1 pollution incidents, 1997



P15. Source of category 2 pollution incidents, 1997



P15. Number of water pollution incidents by category, 1991-97



3.4 Responses to the state and pressures

The response indicators illustrate actions or activities intended to address the current state of the environment, or the pressures acting upon it. These responses may be actions we undertake or that other organisations, or individuals, are responsible for. The response indicators have been divided into four categories:

technical reaction: these include technical solutions to improve the state of the environment or reduce the pressures acting upon it, such as the construction of flood defences, recycling waste and the installation of pollution abatement measures;

management and policy response: these include the national, regional and local policies, plans and programmes that we produce. One of the most important of these are LEAPs which set out our commitment to a programme of local action;

economic measures: these include taxes, charges and other economic instruments aimed to achieve environmental benefits. Examples that are already used, or may be introduced, include the landfill tax, taxation on leaded petrol and road charging;

advice, education and enforcement: this category includes much of our everyday work. Advice and education is central to our proactive approach to environmental management, examples of which include pollution control visits, educational material for school children and comments on planning applications. However, enforcement action is also used, when appropriate, and where we have been given such powers.

There are a number of potential indicators we hope to have data on for the next edition of the *State of the Environment Report*.

Key Response Indicators

R1 Number of Thames Barrier closures against tidal surges

R2 Number of fluvial and tidal flood warnings issued

R3 Number of river reaches benefiting from environmental enhancements implemented by flood defence

R4 Amount of waste recovered

R5 Use of the Thames Bubbler

R6 Number of Local Environment Agency Plans completed

R7 Proportion of river reaches receiving maintenance

R8 Number of water level management plans completed

R9 Number of low flow rivers under study or remediated

R10 Proportion of rivers for which a landscape assessment has been undertaken

Potential Response Indicators for the Future

- Amount of waste minimisation/recovery by type
- Amount of landfill gas used for energy generation
- Area of restored landfill sites by use
- Reduction in releases from Part A processes
- Number of LEAP actions implemented
- Income from landfill tax
- Economic benefit from completed fluvial and tidal flood defence schemes
- Number of companies advised about waste management
- Number of pollution control visits

Response indicators

Indicator R1.

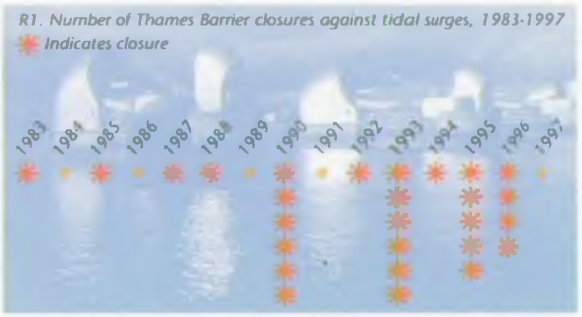
Number of Thames Barrier closures against tidal surges

The control of flooding in the lower part of the River Thames, where the main threat is from the sea is one of our important responsibilities. Under certain weather conditions surge tides occur and these can present a major threat when combined with a high 'spring' tide. The main defences are a number of movable flood gates, the most notable of which is the Thames Barrier, sea walls upstream of the Barrier and 32km of embankments downstream.

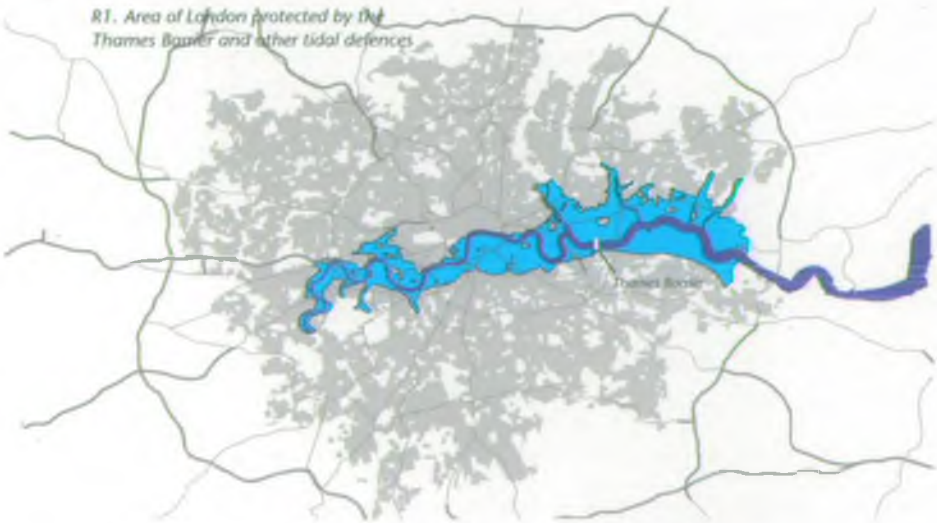
Without effective defences, when the surge enters the Thames Estuary there is danger of flooding along most of the tidal river as far as Teddington. Such a flood could engulf much of central London, presenting a threat to life, flooding the underground system, disabling freshwater and sewer systems, power, gas and vital telephone and data services and causing severe damage to thousands of homes, shops, business and buildings in the heart of the Capital. The area protected by the Thames Barrier is shown on the map.

The Thames Barrier has been closed 28 times to protect London from tidal flooding between 1983 and 1997. High tide levels in central London are rising by some 60cm each century. Increased tide levels are being caused by a combination of factors including rising sea levels, increasing storminess and tidal variation, the downward tilting of the south east corner of England and the settlement of London on its bed of clay.

(Source of data: Environment Agency)



R1. Number of Thames Barrier closures against tidal surges, 1983-1997
Indicates closure



R1. Area of London protected by the Thames Barrier and other tidal defences

Indicator R2.

Number of fluvial and tidal flood warnings issued

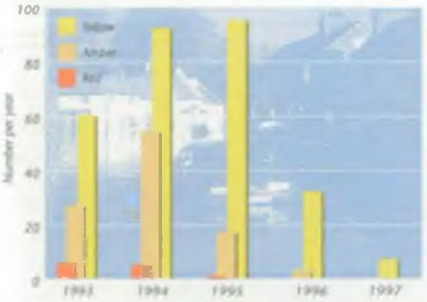
The risk of flooding from the rivers and the sea is with us all the time. It can happen very quickly, often with very little warning. The flood warning services which constantly monitor rainfall, river levels, tides and sea conditions issues colour-coded warnings. The colour tells people who live or work near a river or the sea how severe the flooding is likely to be.

- **Yellow:** flooding to some low-lying farmland and roads near rivers or the sea.
- **Amber:** flooding to isolated properties, roads and large areas of farmland near rivers and the sea.
- **Red:** serious flooding affecting many properties, roads and large areas of farmland.

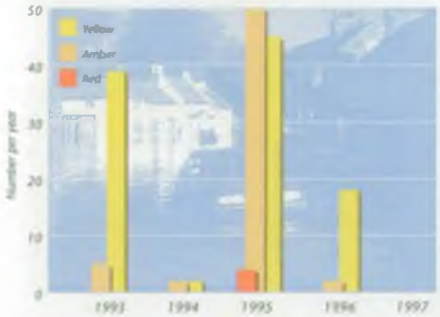
The number and severity of non-tidal flood warnings reflects the storminess and amount of flood-producing rainfall in the Region. There are also distinct flood seasons in the Thames Region. Heavy rainfall is more likely to cause flooding in the winter in the more rural west, while in London and the east of the region most flooding is caused by summer thunderstorms. The Easter 1998 floods affecting the River Cherwell catchment in Oxfordshire show these general rules can be broken.

In London tidal flooding

R2. Number of fluvial flood warnings in West Area, 1993-97



R2. Number of fluvial flood warnings in North East/South East Areas, 1993-97



warnings, not severe enough to warrant closure of the Thames Barrier (*see indicator R1*), are issued when car parks, roads and other areas of open land are threatened by flooding from a high tide. *(Source of data: Environment Agency)*

R2. Number of tidal flood warnings, 1993-97

Indicator R3.

Number of river reaches benefiting from environmental enhancements implemented by flood defence

We have a duty to promote the conservation and enhancement of natural beauty and amenity of inland and coastal waters. One of the ways we carry out this duty is to incorporate environmental enhancements into flood defence schemes and programmes of work. The number of river reaches benefitting from environmental enhancement works implemented by flood defence staff during the period 1 April 1997 to 31 March 1998 was 47 (the Region includes 1047 reaches for the definition of works).

(Source of data: Environment Agency)

Environmental enhancements at Bean Brook

Indicator R4.

Amount of waste recovery

It is currently estimated that around 5% of household waste is recycled or composted in the UK and in the Thames Region. This is far short of the Government's target of 25%. In the Thames Region* public sector recycling (including energy from waste) accounts for approximately 1.2 million tonnes of waste per year. *(see indicator P12).*

The proportions of iron and other scrap metals recycled have remained static over the last ten years. In contrast, there have been marked increases in the amount of glass, and metal cans recycled. Capacity for refining recycled materials and specifications for products manufactured can all constrain the levels of recycling achieved.

The Government encourages waste to energy production by incineration and the collection of landfill gas. There has been a sharp increase in the amount of energy recovered from wastes resulting from the financial support through the non-fossil fuel obligations. Even so, the contribution of waste to energy remains small *(see indicator P13).*

There are two major municipal waste incinerator plant in the Thames Region: Edmonton in North London; and Lewisham in South East London. These electricity generating facilities have a throughput of approximately 555,000 and 420,000 tonnes per year respectively. A third unit is in operation at Slough power station which provides electricity to the local industrial estate, nearby households as well as the national grid *(see indicator P11).* *(Source of data: local authorities and SERPLAN)*

* Note the following counties in addition to Greater London are included: Berkshire, Buckinghamshire, Hampshire, Hertfordshire, Oxfordshire and Surrey

Indicator R5.

Use of the Thames Bubbler

Discharges of storm water from combined sewage overflows (CSOs) following heavy rainfall are a pressure on water quality in the Tidal Thames

during summer months (*see indicator S8 and section 4.5*). This combined drainage system receives both foul drainage from domestic and industrial premises and surface water runoff from impermeable areas, for example, roads, roofs, pavements, car parks. The sewers, designed in the mid-nineteenth Century, have inadequate storage capacity to cope with flows generated from heavy rainfall. In order to prevent sewage backing up in the system and overflowing in properties and onto streets, overflow weirs within the sewers were constructed to allow drainage out of the system directly into the Tidal Thames. Of the 36 consented storm sewage discharges, the four at Hammersmith, Lots Road (Waltham Green), Western Pumping station (Chelsea Bridge) and Heathwall (near Grovenor Bridge) are the most significant.

R5. Number of days the Bubbler was used, 1992-97

Severe deoxygenation following the operation of these CSOs has caused several major fish mortalities between 1973 and 1986. In 1989, the Thames Bubbler, a craft capable of injecting up to 30 tonnes of oxygen per day, came into operation. The Thames Bubbler, and the Vitality which has also recently been deployed, are owned by Thames Water and operated at our request. Data from nine automatic water quality monitoring stations (AQMS) between Kew and Purfleet, along with rainfall data, is used to assist the deployment of the Thames Bubbler and Vitality. (Source of data: Environment Agency)

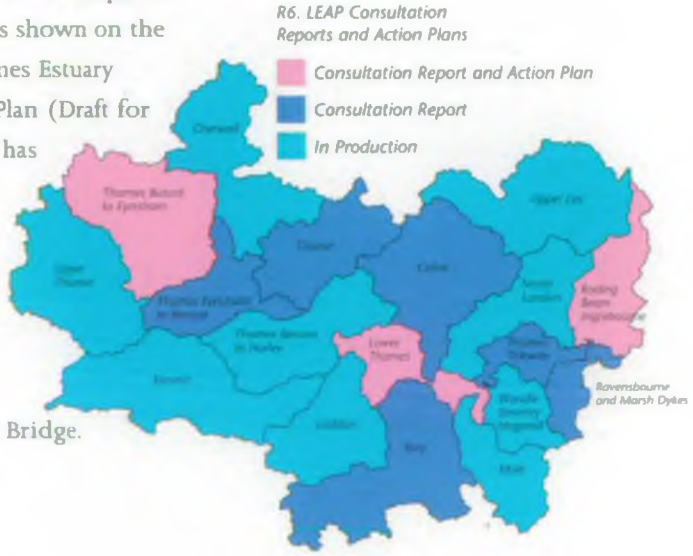
Indicator R6.

Number of Local Environment Agency Plans completed

Local Environment Agency Plans (LEAPs) are non-statutory documents covering the full range of the our responsibilities and are being produced for all catchments within the Region. LEAPs detail proposals for local environmental management and action on the ground and are initially published as a Consultation Report followed by an Action Plan. There are 18 LEAP areas in the Thames Region of which 9 have completed Consultation Reports and 3 have completed Action Plans as shown on the map. The Thames Estuary Management Plan (Draft for Consultation) has also been published by the Thames Estuary Project, in which the Agency is a partner, covering the Thames downstream of Tower Bridge.

(Source of data: Environment Agency)

R6. LEAP Consultation Reports and Action Plans



Indicator R7.

Proportion of river reaches receiving maintenance

Thames Region has 5,200 km of main river and in 1997, 33% of this total length received maintenance such as clearance of vegetation, desilting or the removal of debris and blockages. These works are important for maintaining river flows and preventing flooding during periods of high rainfall. (Source of data: Environment Agency)

Indicator R8.

Number of water level management plans completed

The flooding of land adjacent to watercourses (the floodplain) is a natural process which can have benefits for the environment. In particular the flooding of some wetland areas is important to maintain wetland species which contribute to the Region's biodiversity (*see indicator S14*).

We have agreed a list of 98 wetland sites in Thames Region with English Nature, mostly Sites of Special Scientific Interest (SSSIs), which will benefit from a Water Level Management Plan (WLMP). At the end of 1997, WLMPs had been completed for 26 sites and work has started on recommendations for 16 sites in accordance with priorities agreed with English Nature. Key actions include water level monitoring, building of new sluices and ditching works. The Region expects to complete another 10 plans in 1998/99. In the future, the *State of the Environment Report* will report on the success of WLMP in protecting important local habitats and aquatic species. (Source of data: Environment Agency and English Nature)

R9. Status of low flow rivers

R10. Coverage of river landscape assessments

Indicator R9.

Number of low flow rivers under study or remediated

We are working with water companies on the alleviation of low flows in some rivers (known as ALF rivers) which have suffered from long term abstraction at unsustainable levels. Studies to identify ways of alleviating the problem are carried out (*see indicators S3, S5, S10 and P8*). Funding to implement relief measures is provided by the water companies and/or ourselves. (Source of data: Environment Agency)

Indicator R10.

Proportion of rivers for which a landscape assessments has been undertaken

Landscape assessments are an important tool for providing detailed information on the character of the rivers. The Regional coverage of landscape assessments has in the past has been largely dictated by the location of flood defence works. London is perhaps the best covered, along with other eastern parts of the Region. A rolling programme of assessments is planned, but this is dependent upon the availability of funding. (Source of data: Environment Agency)

4. Major issues for the Region

4.1 Identifying the major issues

In our *Environmental Strategy* we set out environmental goals across nine key themes. These are the principal and immediate issues which we, in partnership with other groups, will focus on:

- addressing the causes and effects of climate change;
- conserving the land;
- managing water resources;
- delivering integrated river-basin management;
- managing waste;
- enhancing biodiversity;
- managing freshwater fisheries;
- improving air quality;
- regulating major industries effectively.

This *State of the Environment Report* has provided an opportunity to review some of the major issues facing the Region within these nine key themes. The indicators in the previous section have assisted this process by illustrating where any of the following criteria apply:

- the state of the environment is currently not meeting its standard or targets;
- the state of the environment is considered to be unacceptable;
- a pressure is having a detrimental effect on the state of the environment;
- a pressure is rising and may have a detrimental effect on the state of the environment in the future;
- a response is required to address one of the above.

The table opposite illustrates the interrelationship between these themes and the state-pressure-response indicators in section 3. The major issues for the Region raised by the indicators, and some of the actions that are being taken to address them, are discussed in more detail below.

4.2 Addressing climate change the evidence for climate change

As one of the principal 'natural' drivers upon the state of the environment, climate change pervades all other issues, acting as a pressure by changing rainfall patterns, increasing the frequency of severe weather conditions and contributing to sea level rise. Secondary effects will impact on water resources, flood risk, biodiversity, air, land and water pollution and landscape quality.

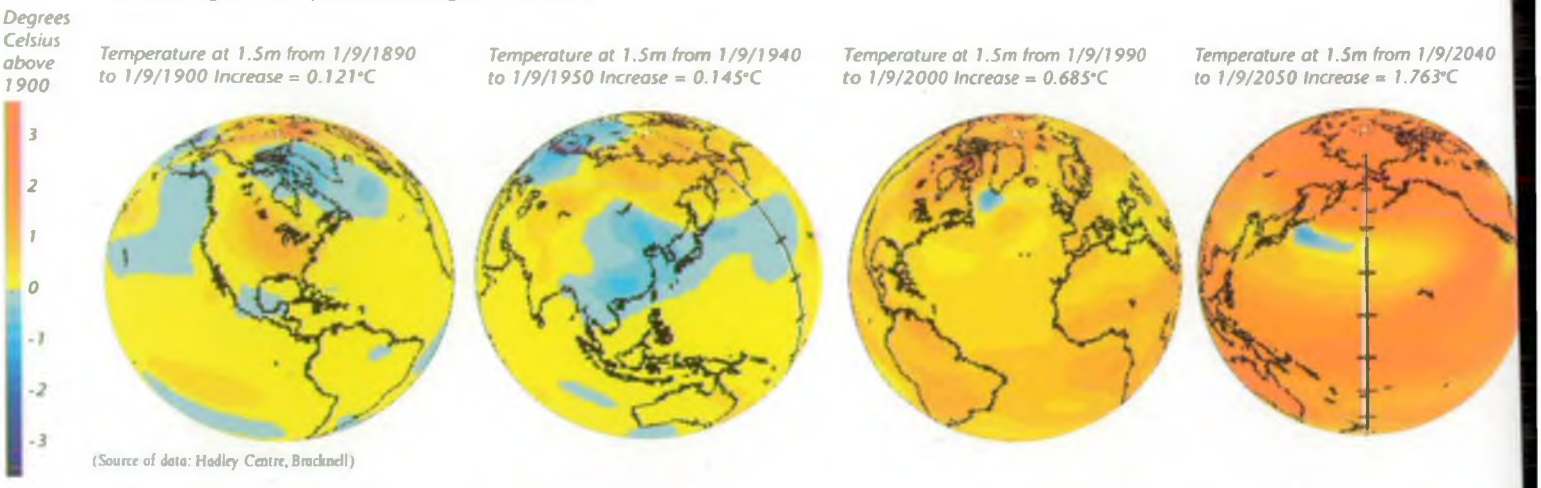
While the world's climate is constantly changing due to natural influences, there is now good evidence that global warming is occurring because of human activity. Indicator P1 has shown the sequence of high temperatures recorded locally during the 1980s and 1990s. These record temperatures correlate strongly with the increased emission of greenhouse gases, including carbon dioxide, methane and nitrous oxide.

Although water vapour acts like a greenhouse gas and cannot be controlled, climate models predict that, if the current rate of emissions of these three greenhouse gases is maintained, the average global temperature would rise by 2.5°C by the end of the next century. The illustration shows estimates of global

Relevant indicators to the major issues

Issues	State	Pressure	Response
Addressing Climate Change	• *a natural driver on the state of the environment, including rainfall (S3) and frequency of severe weather events (S4).* • *potential secondary effects on water resources (S5 and S10), biodiversity (S14) and water quality (S6, S7 and S8).*	• *climate change as a pressure is indicated by long term temperature change (P1).* • *one of the pressures on climate change is emission of greenhouse gases (P11).*	• *climate change may have an effect on flood risk, how it is managed will be of critical concern to the Region (R1 and R2).*
Conserving the Land	• *a significant proportion of the Region is already urbanised (S1).* • *existing development and infrastructure affects the state of local air quality (S12), biodiversity (S14), water quality (S6, S7, S8) and the impact of heavy rainfall (S4).*	• *pressures include housing development (P4), demand for water resources (P3 and P8), car transport (P6), demand for aggregates (P9), sewage effluent (P10), energy generation (P11), waste arisings and disposal (P12, P13 and P14) and pollution incidents (P15).*	• *responses include protection against flooding (R1 and R2), recycling waste (R4), managing water quality (R5), providing design guidance (R10) and remediating low flows (R8).*
Managing Water Resources	• *resources include river water (S5) and groundwater (S10) which are dependent on rainfall (S3).*	• *pressures include increased water demand (P3 and P8), which is affected by the number of households (P4), leakage rates (P2) and drought (P1).*	• *responses include remediating low flows (R9).*
Delivering Integrated River-Basin Management	• *the water quality of the Region's rivers (S6, S7 and S8) and groundwater (S12) are under pressure.* • *river flows also affect water quality (S5) and heavy rainfall affects flooding (S4).*	• *pressures include urban development (P4 and P5), sewage effluent (P10) and pollution incidents (P15).*	• *managing the Tidal Thames including the Thames Bubbler (R5).* • *managing flood risk including the Thames Barrier (R1), flood warning (R2), river maintenance and enhancement (R3 & R7).*
Managing Waste	• *the Region is heavily urbanised and therefore produces significant volumes of waste (S1).*	• *the amount of waste produced (P12), the need for additional waste management facilities (P13) and amount of waste going to landfill (P14) all place pressures on the environment.*	• *recycling is one of the most important responses to managing waste in the Region (R4).*
Enhancing Biodiversity and Managing Freshwater Fisheries	• *the Region's existing resources are represented by key species including mammals, birds, invertebrates and fish (S13 and S14).*	• *there are a numerous pressures including: temperature change (P1), housing development (P4), water abstraction (P8), sewage effluent (P10), air pollution (P11) and pollution incidents (P15).*	• *responses include environmental enhancements (R3), water level management plans (R8) and remediating low flows (R9).*
Improving Air Quality and Regulating Major Industries	• *local air quality, represented by nitrogen dioxide levels, is generally poorer in urban areas (S2).* • *radiation doses resulting from nuclear site discharges are well within appropriate limits (S9).*	• *vehicle emissions are a major source of local air pollution (P6).* • *the Region has relatively few Part A IPC processes and emissions to air are comparatively low (P11).* • *landfill sites are a potential source of methane (P14).*	• *local authorities are principally responsible for local air quality, but we also have a role to play (see section 4.8).*

Modelled global temperature change, 1900-2050



(Source of data: Hadley Centre, Bracknell)

temperature changes from the beginning of this century to the middle of next century. Carbon dioxide levels in the atmosphere have risen by about 25% over the last 200 years, from 280 to 356 parts per million. Methane levels in the atmosphere have doubled over the last 100 years. Nitrous oxide levels are also rising.

Adapting to climate change

The effects of climate change are not yet precisely known, but it would appear that Thames Region is particularly vulnerable to climate change for the following reasons:

- Thames Region is one of the driest areas in the UK (*see indicator S3 and section 4.4*);
- a large proportion of the Region's rivers are groundwater fed (*see indicator P8*) and some predictions suggest generally less groundwater recharge;
- agriculture will change due to the impact on soils and moisture levels. This will affect the quantity and types of crops grown;
- a northward migration of plant and animal species will require recognition in conservation strategies;
- reduced river flows will change the amount of dilution available for effluents and discharges with consequent effects on the quality of rivers (*see indicator S5 and S6 and section 4.5*). More stringent discharge standards may be required and water quality standards may be reviewed as a result;
- low river flows could adversely affect migratory fish (*see indicator S13*) and restrict navigation and lock openings;

- a rise in sea level will ultimately reduce the effectiveness of the Thames Barrier and other tidal defences (*see indicators R1 and R2*). Although not an immediate problem, we are investigating land subsidence and sea level rise in the Thames Estuary but it will probably take several years for the level of change to be accurately quantified.

Reducing emissions of greenhouse gases

At the international conference in Kyoto in December 1997 the Government agreed to a reduction of 8% of all greenhouse gases by 2012 relative to a 1990 baseline. This includes: carbon dioxide (CO_2); methane; nitrous oxide; hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6). Examples illustrating how such a reduction can be achieved include:

- the control of IPC processes such as National Power's new £400m, 'B' power station at Didcot. This uses combined cycle, natural gas-fired turbines which have low sulphur dioxide and nitrogen oxide (NOx) releases (*see indicator P11 and section 4.8*). This modern station's high efficiency and the use of natural gas will release much less carbon dioxide than the equivalent conventional coal or oil-fired stations that it replaces;
- the minimisation of waste sent to

landfill to reduce methane emissions (*see indicator P14*). We monitor methane emissions at specific sites and assess how to improve the estimation of total emissions. Once this is complete it will become a useful indicator of a pressure causing climate change;

- the reduction in generation and use of energy from carbon sources. Generation of energy from renewable sources and improved energy efficiency should be basic components of sustainable resources use;
- the reduction of the number of journeys made and the distances travelled by car (*see indicator P6*).

Actions for the future

There is still uncertainty about the effects of climate change but any changes are likely to be significant to our environment and its management. Monitoring environmental indicators will help us to detect any occurrence of climate change. This will enable us to distinguish between global influences on our water environment, and controllable local effects, for example, abstraction. Research is underway and the results will feature in future editions of this *State of the Environment Report*.

The need to develop a strategy for managing the changing environment of the Thames Region is perhaps the most important challenge we face. Climate change may come to challenge our vision for the Region and what development can be regarded as sustainable.

4.3 Conserving the land

Pressure for development

Twelve million people, or 23% of the population of England and Wales, live in Thames Region creating intense pressure on the natural environment. Although the population growth of the Region is expected to decline quite rapidly past the year 2000, demand for dwellings and employment will continue to grow (*see indicator P4*).

An indicator of the health of the economy and development pressure is the number of planning applications received by planning authorities. At the peak of the development boom of the late 1980s there were 680,000 planning applications per annum nationally, this has now declined to an average of 480,000. Planning authorities in Thames Region make more than 100,000 planning decisions every year, indicating the high level of development pressures (*see indicator P5*).

The DETR recently published *Household Growth – where shall we live?* which predicts that the number of households will increase dramatically, in the period 1991-2016. Some 4.4 million houses will be required nationally, which means an additional 10,000 houses per annum in the South East.

Effects of urbanisation

The predicted level of development could have local, national and even global environmental effects, which are of concern to us, including:

- increased demand for public water supply;
- increased flood risk;
- increased rates of surface water run-off;
- threat to floodplain habitats and biodiversity;
- fragmentation of river corridors;
- increased demand for aggregates;
- increased waste production;
- threat to the integrity of the landscape;
- deterioration in local air quality;
- contribution to global warming;
- pollution threat to land and water.

Several of these issues are discussed under the other environmental themes.

Urbanisation can have several effects on flood risk. Flooding is a natural and desirable phenomenon where it occurs without risk to human life and property. However, the ability of floodplains to function in this way has been eroded over the years as the land in them has been developed and river channels become restricted. Inevitably, these restricted channels cannot accommodate large storm flows and serious flooding of developed areas can occur. Protecting urban areas at risk from flooding is expensive, for example operating the Thames Barrier, issuing flood warnings and maintaining watercourses (*see indicators R1, R2 and R7 respectively*). Flood

defence works can only reduce and not eliminate flood risk and are inherently unsustainable structures. We therefore promote policies to local authorities to prevent further development in floodplains.

A greater number of brownfield sites are being redeveloped, a trend that is supported by Government policy. Many of these brownfield sites are susceptible to flooding as they are located in low lying urban areas. Many sites are also contaminated and their remediation prior to redevelopment offers opportunities for improving the urban quality. Local authorities play a major role in bringing such sites back into use. We provide expertise to assess the risk of pollution and to advise on the disposal of waste.

The Campaign for the Protection of Rural England's (CPRE) 'Tranquil Areas' initiative highlights the gradual growth of urbanisation and its impact upon the environment. Since the 1960s England has lost an area of rural tranquillity (18,868sq km), almost the size of Wales. Comparisons between the 1960s and the 1990s for South East England clearly show how London affects the whole region and the road network provided the main corridors of erosion, for example, Berkshire has lost 21% of its tranquil areas since the 1960s.

Development within the Region's environmental capacity

SERPLAN's recently published "*A Sustainable Development Strategy for the South East*" seeks to provide for the needs of the Region's population while living within the Region's environmental capacity by adopting the following principles:

- development should make urban areas more attractive, and encourage regeneration and renewal in order to reverse unsustainable decentralisation trends;
- water resource availability is a critical factor which can only partially be offset by reductions in leakage and water conservation measures. Proposed levels of development could raise serious problems for water resources in the medium to long term. Water resources strategies must recognise that solutions must be robust to fluctuations in rainfall and potential climate change;
- regional demand for other natural resources must be reduced, for example the use of aggregates (*see indicator P9*);
- the impositions of development on the environment, including pollution and waste disposal, must be minimised. Flood risk must be considered when locating new buildings and infrastructure schemes;
- sustainable design for housing, commercial and infrastructure developments needs to incorporate new and improved technologies and environmentally friendly processes;
- additional discharges from new developments, including sewage and urban run-off, should not cause environmental problems in receiving waters. For example, the planned development at Basingstoke includes proposals to discharge into the high quality and sensitive River Loddon.

Tranquil Areas in the South East

(Source of data: CPRE & Countryside Commission)

4.4 Managing water resources

Balancing water use and environmental needs

Water is a fundamental need of the Region's population for domestic, industrial and agricultural purposes. In addition, rivers, streams and lakes provide habitats for plants, fish, and other aquatic species. Management of river flow and water levels is also required to:

- maintain navigable waterways;
- dilute effluent from industry and sewage works;
- provide for recreation;
- maintain and enhance the aesthetic value of natural waterways.

Groundwater meets about 40% of public water supply in the Region (*see indicator S8*). It also sustains the baseflow of rivers and provides most of the flow in a river during summer and autumn, and during periods of drought.

The dry bed of the River Misbourne at Chalfont St. Giles

Our principle aim for managing water resources is to achieve an appropriate balance between the needs of abstractors and those of the environment. There has been an increase in the number of locations where authorised abstractions are perceived to be causing or have the potential to cause environmental problems. We are reviewing abstraction licences which could impact on SSSI's, Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). We are also working with water companies to reduce licensed abstraction where the ecology is being affected and to undertake further investigations where the impact of abstraction is uncertain (*see indicator R9*). Since 1989 action has been taken to reduce abstraction and restore flows in the rivers Misbourne, Ver, Darent, Pang and Letcombe Brook.

Drought and climate change

Prolonged drought periods since the late 1980s have exacerbated the problem of summer low flows (*see indicators S3, S5 and S10*). Some headwater streams have ceased flowing and groundwater levels in some areas have fallen to record minima. The combined effects of low freshwater flows to the lower Thames below Richmond, together with low tides, have also restricted navigation for some craft during recent summers.

We have been working closely with water companies to develop agreed Drought Management Plans. These set out the broad range of actions and the circumstances under which different actions may be triggered. Actions include:

- environmental monitoring and enforcement;
- public information and awareness;
- enhanced leakage control and pressure management;
- temporary works to enhance supplies;
- appeals for restraint;
- restrictions and drought authorisations.

Climate change is potentially an important issue in the Thames Region (*see section 4.2*). It could impact on water resources in the next 25 years and beyond through changes to rainfall, evaporation and temperature. Secondary impacts include changing water demand due to changes in the duration and frequency of hot and dry summers. Changes in agricultural water requirements may also occur if the patterns of land use in the Region alter significantly.

Water demand

Current Government estimates indicate a potential requirement for more than 1 million new homes in the Thames Region by 2016 (*see indicator P4 and section 4.3*). Future development will place additional pressures on water resources. Future increases in demand can, to some extent, be managed through changing trends in water use, better leakage control and the promotion of water efficient appliances (*see indicator P8*). Nevertheless, in many areas, future development may necessitate new infrastructure to reallocate existing resources. In the longer term, growth in demand may require new strategic water resource schemes which may be environmentally and socially contentious and take a long time to implement. Where this is the case, levels of planned new development may need to be tempered until adequate and reliable water resources can be secured.

Future strategies

Increased water demand creates an extra impetus to explore opportunities to conserve water and to adopt water efficient practices, including:

- reducing leakage from water mains;
- promoting water efficient appliances;
- introducing water efficiency measures in the design and management of private gardens and landscaped areas;
- adopting soil moisture management for small and large-scale irrigation of agricultural land.

Significant gains in water efficiency are also being made for many industrial uses, especially where sites convert to or install closed-systems and use water recycling technology.

We have adopted a 'twin track' approach to the management and future development of water resources. This requires water companies to use their existing licensed resources effectively prior to the development of new resources to meet any future supply imbalance. This approach recognises the uncertainties in planning to meet future water demands and the long lead times required to develop new schemes. Any new water resource development proposals will be subject to rigorous environmental assessment.

Against this background, further investigations are being progressed on potential new water resources development schemes. These include:

- developing bulk transfers of water from existing suppliers;
- developing new groundwater sources in the London Basin, which would also alleviate the problems of rising groundwater levels in central London;
- artificially recharging groundwater, using available winter river flows;
- developing new strategic reservoir schemes, such as those being investigated by Thames Water and Essex and Suffolk Water;
- investigating potential inter-basin transfers of water, such as from the River Severn to the Thames.

We are working closely with OFWAT and the water companies to develop the water companies' strategic business plans prior to OFWAT's water price review in April 2000. We are also reviewing our published national and regional water resource development strategies.

We sponsor, support, and undertake collaborative research including: the effects of climate change; ecologically acceptable flows, groundwater recharge, greywater recycling; dual flush toilets; and socially acceptable and environmentally effective metering. We also have a major role in environmental education and technology transfer, including the promotion of water efficiency in new and existing homes.

4.5 Delivering integrated river-basin management

To manage the environment effectively, it is important to consider all of its facets, and the problems and potential threats to it, in an integrated way. This approach is particularly relevant to river-basins which pose many challenges which cannot be considered in isolation. The Local Environment Agency Plan (LEAP) process is an example of how we are delivering our wide range of responsibilities in an integrated way (*see indicator R6*). The ways we deliver effective flood defence, manage water quality and manage recreation and navigation are used as examples of some of the interrelated issues that we have to consider. A case study on the Tidal Thames is also included to illustrate our approach to integrated river-basin management.

Case study: The Tidal Thames

This case study on the Tidal Thames illustrates the Agency's approach to integrated river basin management, the importance of partnership and the interrelationship between different aspects of the environment.

The River Thames can justly be described as London's greatest natural asset and is now regarded as one of the cleanest metropolitan rivers in the world. It is not only a site of great historical interest, but is also an amenity and recreational resource, and a valuable focus for riverside development. However, it is only in the last forty years that we have really begun to appreciate the value of the river. Before this, loss of habitat due to encroaching buildings and pollution had substantially downgraded the ecology of the river.

Despite the improvements that have been made, our public perception study of the Tidal Thames confirmed that most Londoners still believe that the Thames contains little, if any life. Typically, the floating rubbish and muddy colour of the river are cited as evidence of its apparently 'inert' state. Rubbish can indeed be a problem at times, but it is almost entirely a 'cosmetic' one, of no significant risk to human or animal life. The mud colour of the river is entirely a consequence of the natural estuary processes of erosion and deposition.

The maintenance and further rejuvenation of the Tidal Thames is a major challenge, particularly as no single organisation is responsible for its comprehensive environmental management. The task of integrating the various organisations with an interest in the Tidal Thames has been started in recent years through the processes of producing the Thames Tideway Local Environment Agency Plan and Thames Estuary Management Plan.

History of the clean up of the Tidal Thames

1800 *Up to 3,000 fish caught in the Thames sold in London fish markets per year.*

1831 *London's first cholera epidemic occurred resulting in over 6,000 deaths.*

1843 *Abolition of cesspits and the development of water closets which discharged into the Thames caused deterioration in quality.*

1849 *Fish had completely disappear from the London reaches of the Thames.*

1856 *Stench from the river during heat wave provokes action from the House of Commons.*

1864 *Completion of interceptor sewers which carried London's sewage eastwards to be discharged on the ebb tide.*

1878 *The Thames pleasure steamer Princess Alice sank in the vicinity of Beckton outfall, deaths were accelerated by the septic conditions.*

1882 *A Royal Commission was set up and resulted in new treatment methods at Beckton and Crossness.*

early 1900s *Further decline in water quality due to industrialisation and increased population.*

1939-1945 *Bomb damage to sewers and sewage works during the Second World War led to further pollution.*

1920-64 *River devoid of oxygen during summer.*

1949 *The Thames Survey Committee began investigations into siltation and pollution of the Thames.*

1950s *Surveys confirmed that there were no established fish populations between Fulham and Tilbury.*

1966 *10% minimum dissolved oxygen standard implemented.*

1974 *Improvements in sewage treatment works, diversion of some industrial discharges and introduction of biodegradable detergents led to a gradual improvement in water quality and the return of the first salmon.*

1979 *Salmon Rehabilitation Scheme commenced, involving introduction of young fish and construction of fish passes at weirs.*

1980s *Thames Bubbler introduced and Automatic Quality Monitoring Station (AQMS) installed.*

1993 *Record return of 338 salmon.*

Case study: The state of the Tidal Thames

Water quality

Water quality standards

The Tidal Thames is divided into three reaches for water quality management purposes: freshwater; brackish; and marine. Each of these reaches has a different salinity range and supports different biological communities, however these zones are not static and their boundaries fluctuate with the tide and changes in flow. Water quality objectives are applied to the Tidal Thames which reflect its potential ecological and amenity value. Appropriate chemical and biological standards have been set in order to achieve the overall water quality objectives. These standards incorporate Regional targets for dissolved oxygen and temperature along with statutory limits imposed by EC Directives for various dangerous and polluting substances.

Achievement of water quality standards

Compliance with these standards is assessed on a quarterly basis. Since 1995, the dissolved oxygen standards have only failed during two quarters (spring and summer 1997) in the Upper and Middle reaches. Poor water quality persisted for long periods following storm events. However, deployment of the 'Thames Bubbler' and other oxygenation techniques prevented oxygen levels falling low enough to cause significant fish mortalities.

Dissolved oxygen profile

Following rainfall, discharges from London's

Wildlife and conservation

The Tidal Thames is a unique wildlife corridor, running through the country's biggest and busiest conurbation. The corridor provides a wide range of habitats from shingle and mudflats to grazing marshes. It also provides continuity, linking the different habitats and maintaining a wide variety of animal life.

Fish

The Tidal Thames supports important recreational and commercial fisheries, including one of the largest UK estuarine commercial eel fisheries. A total of 116 species have been recorded, including salmon, dace, smelt, sole, bass, sand-smelt and shad. It is one of the most important nursery areas for young marine fish in the southern North Sea. Indeed, it is the premier UK nursery for Dover Sole. Smelt, now a rare species in Europe, has returned in strength. Salmon first returned in the 1970s and since 1982 have returned regularly.

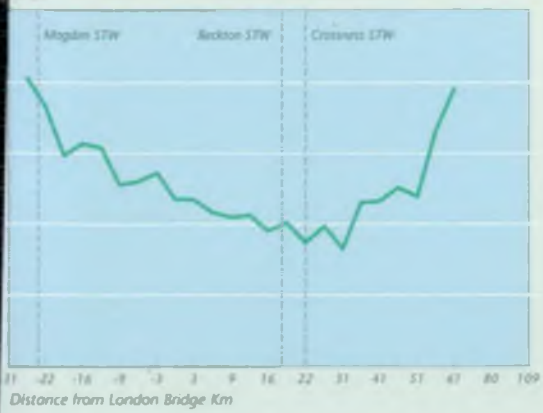
Birds

Birds are a good visual indicator of water quality and the abundance of fish and invertebrates in the river. Nearly 300,000 water birds over-winter in the greater Thames area making it the most important estuarine complex for birds in the UK. The number of wildfowl and waders are of international and national importance, as the Thames is part of their migratory routes. At least four species, including the cormorant and lesser black-backed gull, are present in nationally significant numbers, representing more than 1% of the British wintering population. There are also regionally significant numbers of species such as shelduck and dunlin, and 15 species have full 'red data book' status.

Invertebrates

Macroinvertebrate communities form an important part of the Tidal Thames

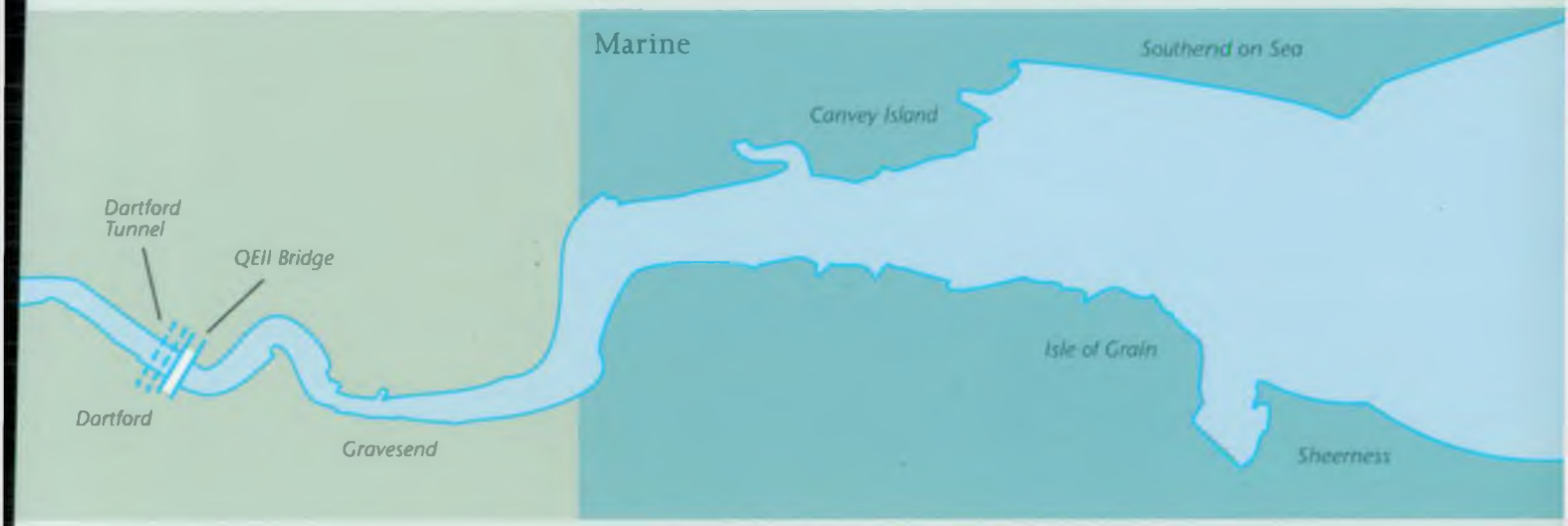
Oxygen Profile May- September Mean 1995



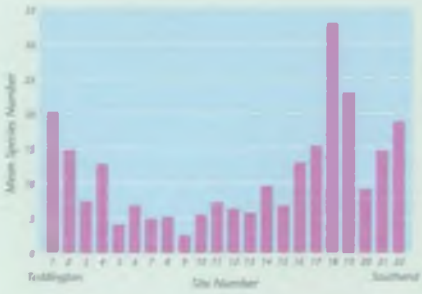
combined drainage system can produce rapid decreases in dissolved oxygen (DO) levels. The severity of the resulting DO 'sag curve' depends on such factors as rain intensity and duration, river temperature and freshwater flow at Teddington. The worst case scenario results from Summer thunderstorms when river temperatures are high and flows low. The graph illustrates the dissolved oxygen profile, May to September mean, along the Tidal Thames.

Bathing waters

There are three EC designated bathing waters in the Southend area which are assessed for compliance with mandatory coliform standards. The bathing water season is from May to the end of September, and 20 samples are taken at each site. 95% compliance is required per season, so one failure out of 20 samples is permissible. Between 1993 and 1997 all three bathing waters passed except Thorpe Bay in 1994 which achieved 90% (2 failed samples out of 20).



Thames Estuary Macro Invertebrates
Mean Species Number 1990 - 93



ecosystem and are vital for the maintenance of both bird and fish populations. We sample the intertidal and subtidal communities at 22 sites, from the tidal limit at Teddington Weir (site 1) to Sea Reach, near Southend (site 22). Of the 350 freshwater, estuarine and marine macroinvertebrate species recorded, the mean number of species present at any one site shows a marked change along the Tidal Thames. This is largely due to changes in salinity, tidal flow, sediment type, habitat diversity and water quality.

Archaeology

The Thames foreshore is London's most extensive archaeological site. We can trace the development of the river and its hinterland from the earliest human settlement into one of Europe's busiest waterways. Archaeological remains are fragile and are constantly degraded by the tides. Any disturbance of the foreshore may damage or destroy these valuable remains.

Landscape

The Tidal Thames has a unique identity, forming a unifying element through very different parts of the city. The river landscape has a far from consistent character and changes daily with the ebb and flow of the tide. Along its length there is a transition from the narrower, more verdant upstream reaches, the distinctive metropolitan character of the middle reaches and the expansive downstream landscapes of the estuary.

Case study: Pressures and responses on the Tidal Thames

Pressures on water quality

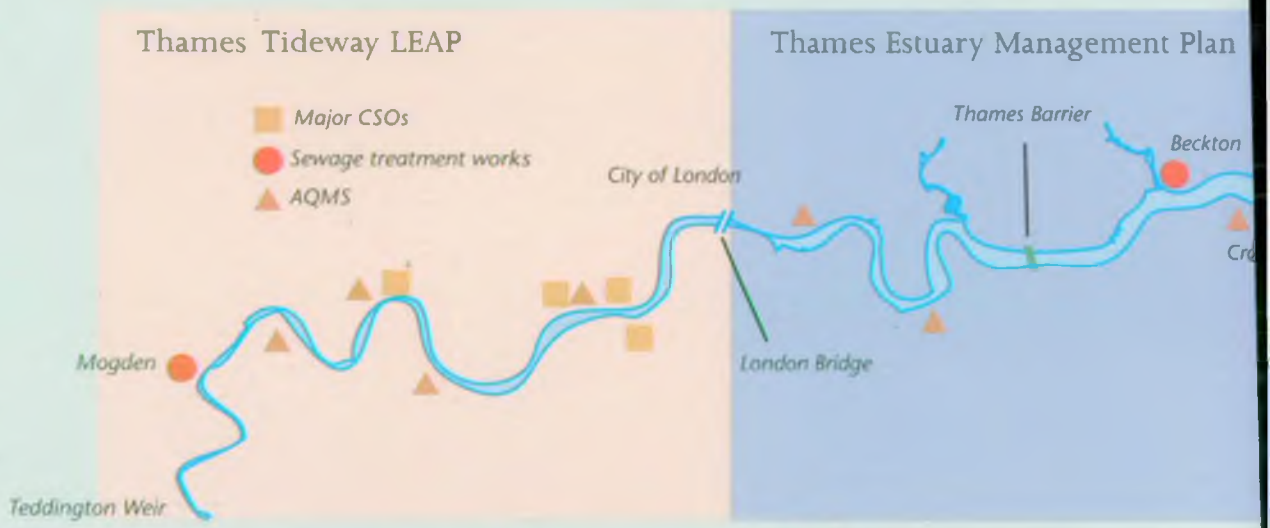
An estuary is a complex system of interacting processes. The most important indicator of water quality in the Tidal Thames is dissolved oxygen. This, and other aspects of water quality, are affected by:

- **insufficient flows** of freshwater over Teddington Weir, as a result of abstraction upstream for drinking water supplies, drought, etc., particularly in the summer. This results in low dilution and longer retention of pollutants before they are flushed out to sea;
- **combined sewer overflows** (CSOs) which discharge sewage effluent and storm overflows following heavy rain;
- **effluent discharges** from the various STWs serving London;
- **water temperature** which is influenced by climate and industrial discharges and affects the speed of chemical reactions, microbiological activity and the solubility of gases;
- **suspended solids**, which enter via rivers, sewage and industrial discharges and from the sea.

Other pressures

Encroachment of riverside development onto the bed of the river and the foreshore results in damage to or loss of valuable habitats and archaeological remains, speeds up river flow increasing erosion, and increases flood levels and the tidal range by narrowing the river.

Contaminated riverside sites also pose a threat of river pollution. Well managed development provides an opportunity to bring these sites back into productive use, whilst safeguarding the environment.



Responses to manage water quality

In order to sustain the improvements in water quality, the pressures on the tideway are closely monitored and interactively managed. Crucial to the management of the dissolved oxygen levels in the summer months is an **Operating Agreement** between Thames Water and the Agency covering:

- improved STW effluent standards;
- operation of the Thames Bubbler and Vitality for the alleviation of the effects of storm discharges;
- the suspension of abstraction above Teddington in order to provide extra flow in the tideway at critical times.

Monitoring Water Quality is also an important part of the management strategy for the Tidal Thames:

- regular sampling of the Tidal Thames is carried out at a range of sites and for a large number of parameters.

- the installation of nine automatic monitoring stations between Kew and Purfleet – the AQMS Network – ensures that immediate information is available on the essential water quality parameters, allowing remedial action to be taken.
- the use of rain radar and weather data, which is used with the AQMS data to assist the deployment of the Thames Bubbler and Vitality.

Other responses

Thames Clean – the problem of litter is being tackled through a joint initiative led by the Tidy Britain Group with the support of the PLA, Environment Agency, Thames Water and the London Borough of Richmond.

Tidal Thames Encroachment Policy – we have formulated a policy on Tidal Thames encroachment which is promoted to developers and planning authorities.

Thames Archaeological Survey – we have jointly funded the Thames Archaeological Survey with the Museum of London and English Heritage. This initiative aims to chart the whole of the tidal foreshore between Teddington and the Thames Barrier.

Invasion of non-native animals and plants, such as Chinese Mitten Crab, Japanese Knotweed and Himalayan Balsam, causes native species to be crowded out and the destruction of natural habitats.

Proposals for a barrage and the recreational closure of the Thames Barrier would have to be considered on their merits, but are likely to have significant negative impacts on the Tidal Thames environment.

Poor perception of the Tidal Thames as a dirty river with no wildlife results in people not taking care to protect it.

Coordination of the numerous organisations which have an interest in the Tidal Thames makes its management a particular challenge.

Access and recreation are important to utilise the Tidal Thames as a valuable educational resource. However, any improvement in access must be done in a safe and sensitive way, to protect the environment and visitor alike.

Shipping and river traffic provides for a healthy river economy, however, the environmental impacts also need to be considered.

Commercial and recreational fishing – the Agency now has new sea fisheries responsibilities and will be working to conserve and protect sea fish stocks from unregulated commercial fishing.

Uncontrolled 'mudlarking' poses a threat to the archaeological value of the foreshore and can cause erosion.

Riverbank Design Guidance – we have produced the Tidal Thames Landscape Assessment and Design Guidelines which subdivides the Thames into 'character reaches' and summarises appropriate forms of riverside development. We have also produced a best riverside practice portfolio – Partnership in Planning.

Access Policy for the Tidal Thames – we are developing an access policy that will identify where access to the foreshore should be maintained, promoted or restricted based on environmental and safety considerations.

Vegetation and habitat mapping using 'CASI' – we are using an aerial photographic technique to map land cover and vegetation types along the Tidal Thames.

Habitat and environmental improvements – we encourage developers to work in partnership to realise environmental enhancements, examples of this approach include the former Bell Green Gas Works and the Millennium site in Greenwich.

Education initiatives – we raise awareness of the Tidal Thames and promote its protection and enhancement by: information leaflets; displays at key locations (e.g. Thames Barrier and the London Aquarium); school trips to the foreshore; and river inspections and seminars.

Tidal Thames Sea Fisheries Action Plan – we are reviewing the status of the sea fishery and developing new Sea Fisheries Byelaws as part of our new responsibilities.

Managing flood risk – we operate and maintain defences, including raised river embankments and flood gates at strategic points such as the Barking Barrier and Thames Barrier, which protects property worth more than ten billion pounds.

Management Plans – The Tidal Thames Local Environment Agency Plan (LEAP) and the Thames Estuary Management Plan are the mechanisms by which the Agency and its partners intend to develop integrated local action plans for the Tidal Thames.

Flood Defence

We make 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 (*see indicator R3*). The Maidenhead, Windsor and Eton Flood Alleviation Scheme, which is the largest inland flood alleviation scheme undertaken by the Agency, is an example of where it has been necessary for a major scheme to reduce flood risk. The scheme comprises a new 11.5km flood alleviation channel and incorporates considerable ecological enhancement.

Extensive maintenance works to watercourses (*see indicator R7*) and previous improvement schemes, are carried out by our internal workforce. In addition channels are kept free from debris and blockages, and excessive growth from vegetation controlled. Where flooding in imminent, despite these measures, we operate a Flood Warning service (*see indicator R2*). The workforce is deployed on emergency response work that includes operating defences and control structure and ensuring that flows are maintained without blockages occurring. The Thames Barrier is by far the largest of these structures and together with the Thames tidal defences protects the homes and businesses of 1.2 million people (*see indicator R1*).

River water quality

We have a clear duty to protect and improve the water quality, thus planned degradation is not an option but as quality generally becomes better, further improvements become more difficult to achieve. Uses which require water quality of a certain standard are many and varied, for example, drinking water supply, fisheries, boating, bathing, amenity and abstractions for industry or agriculture. However, these uses must be balanced against the ecological value the water quality supports.

The water quality of rivers in the Thames Region is generally good. There are very few river reaches of poor quality, with only 1% of reaches where chemical GQA was grade F in 1997 (*see indicator S5*). There are few obvious severe water quality problems

Proportion of river flow that is treated effluent, 1997

Note:
About 70% of treated wastewater comes from sewage treatment works. The rest comes from a variety of sources including fish farms (7%), power stations (4%), water treatment (3%), agriculture (3%), quarrying (3%) and industry (3%).

Key:
The whole bar represents the total flow in the river. The red part represents the proportion of river flow which was treated wastewater in 1997. The dotted line shows the long term average proportion of treated wastewater.

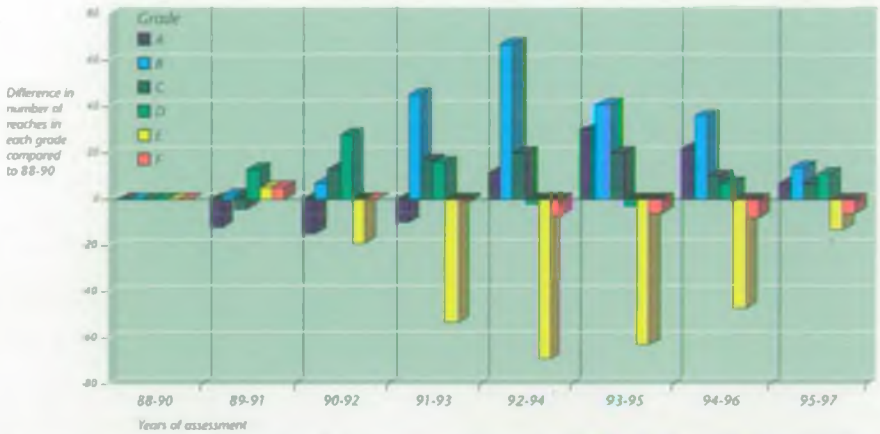
in Thames Region, but the state of the water is under intense pressure from the Region's population (*see sections 4.3 and 4.4*). The pressure is illustrated by the high proportion of the Region's river flows that are made up of treated effluent. During dry summer periods many rivers can be made up of over 90% treated sewage. This demonstrates how essential the returned effluent is, not only for re-use by people, but to provide flows in rivers.

As treated sewage can effectively become the main source of some rivers, the effluent must be treated to

an extremely high standard to maintain water quality. In some cases housing developments will increase pressures and further improvements in effluent quality will impose ever larger costs on the water consumer.

Water quality in the Region has been heavily influenced by recent droughts (*see indicator S3*). Comparing river flows and water quality over the last decade shows that the periods of below average river flow in 1991/92 and 1996/97 coincide with poorer water quality. Using the period 1988-1990 as a baseline, the changes in the number of reaches in each chemical water quality grade show an obvious

Difference in number of reaches in each chemical GQA grade compared with 1988-90 assessment



improvement from 1990 to 1994 as the number of reaches in grade E decreased and the number of reaches in grade B increased. As flow decreased in 1996/97 (*see indicator S5*) the quality approaches that of the 1988-90 period.

There has been a continual improvement in the quality of discharges during the last eight years, so despite the severity of the drought in 1997/98 quality has improved compared to 1990 (*see indicator P10*). Uncertainty about climate change makes it very difficult to set appropriate discharge consent standards. If we plan for the worst case then the cost burden on water users would be enormous. However, if we do not take climate change into account we could find a rapid deterioration in the quality of our rivers.

Diffuse sources of pollution, such as urban drainage and run-off from agricultural areas can have a detrimental effect on water quality, for example causing low dissolved oxygen and nutrient enrichment. The problem is particularly severe on the Tidal Thames, which is why Thames Water's water oxygenating vessels were put into service (*see case study and indicators S8 and R5*). Long term solutions to the problem of London's urban drainage are being investigated.

Nutrient enrichment of rivers from point and diffuse discharges which may lead to eutrophication which causes accelerated growth of algae and plant life, is also a key issue in Thames Region. This is partly being addressed by phosphate reduction of major sewage treatment work discharges. The reduction of phosphate from agricultural land is not currently under our control.

The protection and improvement of water quality in Thames Region is a complex task. It requires the consideration of factors whose behaviour is often difficult to predict. In addition, we are also required to take account of the costs and the benefits of proposed improvements.

Recreation and navigation

The Region is rich in inland waters, rivers, canals, lakes and flooded gravel pits which act as magnates to people

in their leisure time. We aim to ensure that whilst protecting the environment, good use is made of these waters for all kinds of activities – angling, birdwatching, boating, canoeing, diving, rowing, walking or simply river watching. The promotion and provision of riverside walks and recreation areas for picnicking has increased public access to the Region's rivers. Likewise the establishment of the Thames Path, a major project in which we continue to be heavily involved, has opened up the River to a wider public audience.

The Thames Path starts near the source of the Thames at Kemble in Gloustershire and goes right down to the Thames Barrier at Woolwich, approximately 340km. We have installed sensors to monitor the movement of people along the Thames Path at four locations. These highlight the demands placed upon the river as a natural recreational resource, with some of the more popular locations visited by well over 1000,000 people a year. As more data becomes available, this could be used as an indicator in future editions of this *State of the Environment Report*.

We are the navigation authority for the non-tidal Thames upstream of Teddington. This is arguably the most famous, as well as the busiest, inland navigation in the country and the many competing demands for this invaluable resource creates a significant management challenge. Whilst the number of boat movements is less than at the river's peak of popularity in the 1970's and early 1980's (*see indicator P7*), there are still approximately 30,000 registered and visiting pleasure boats on the 217km of navigable river – about 7 metres per boat, but fortunately they do not all use the river at the same time.

4.6 Managing waste

We are responsible for regulating the treatment, storage and disposal of controlled waste which consists of industrial, household and commercial waste. The key objectives for waste and waste management are to minimise the production of waste and the pollution arising from waste.

Waste disposal

The majority of controlled waste produced in the Thames Region is currently sent to landfill (*see indicator P14*). However, regardless of how well they are located and engineered, landfills have the potential to release chemicals into rivers and groundwater, and to generate significant quantities of methane, a greenhouse gas (*see section 4.2*). Landfill void continues to be filled at a faster rate than it is created due to the increasing difficulty of identifying environmentally acceptable new sites and the high level of waste arisings. At the current rates, landfill capacity in the South East could be exhausted by 2010. For a more sustainable approach, a radical change in practice will be required to reduce the quantity of waste going to landfill, through minimisation, re-use, recycling and treatment (*see indicators P13 and R4*). That change in approach will enable the management of remaining landfill, for the long term for the disposal of residues and untreatable wastes.

London has a particular problem in that most of its waste is exported to neighbouring counties for disposal. Reducing the amount of untreated waste disposal to landfill will require a greater consideration of waste minimisation, re-use and recycling. The minimisation of the distance waste is transported also needs to be considered and the impact of road transfer lessened by increasing the use of river and rail transfer.

Future waste management

The London Planning Advisory Committee (LPAC) has published advice on waste planning in London which seeks to establish links between waste management and economic development opportunities to implement the Government's Strategic Guidance for London (RPG3). The approach of LPAC, along with SERPLAN, is in line with international and European Union advice, and

follows Government guidance in the 1995 White Paper *Making Waste Work*. This advice includes targets for the recycling or composting of 25% of household waste by 2000, and reducing landfilling of controlled waste from 70% to 60% by 2000. The Government's guidance states that the preferred methods of waste management should follow the waste hierarchy:

Reduction:
minimising the amount of waste which is produced

Re-use:
best known is the milk bottle

Recovery:
recycling, composting and energy from waste

Disposal:
landfilling or land raising

A mobile tyre-pyrolysis process which converts waste tyres to oil.

Local authorities across the Region recognise the major challenges that waste management in Thames Region presents. The implementation of the hierarchy is by no means straightforward, with local people often vigorously opposing the construction of new waste management facilities such as waste-to-energy plants.

An additional issue to consider is the arrangement of municipal landfill contracts. In 1997 municipal landfill contracts indicate that 5.52 million tonnes of domestic waste will be disposed of to landfill, representing 26% of the total municipal waste arisings in England and Wales. However, municipal waste contracts are mainly long-term, which raises problems in achieving government waste targets as the contracts to dispose of waste to landfill have already been let.

Monitoring waste

We have a key role to play in the improvement of information about waste management and have a statutory role in providing formal advice on the content of the national waste strategy. In consultation with the DETR, we have prepared a work plan to form the basis of advice for the Department. This plan includes a national waste survey of industry and commerce, the results of which will provide a more certain basis for future policy development.

Other elements of the work plan include trying to better understand other waste streams. A Life Cycle Assessment programme to assist with establishing Best Practicable Environmental Options (BPEOs) for particular waste streams, and the development of a National Waste Classification Scheme.

The results of this work will not only be used to advise the Secretary of State, but to assist local authorities in the consideration of regional planning guidance and the preparation of development plans. The information must also serve the needs of industry which produce waste and the waste management industry which develops and operates waste treatment, recovery and disposal facilities.

4.7 Enhancing biodiversity and managing freshwater fisheries

In June 1992, more than 150 Heads of Government attended the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, called the Earth Summit. One of the key outcomes was the Convention on Biological Diversity. This reflected a general concern that human activities are changing and destroying habitats, natural ecosystems and landscapes on an increasing scale. It recognises that biodiversity should be treated as a global resource to be protected and conserved according to principles of ecological, economic and social sustainability.

The UK published four strategies in response to the Earth Summit including a Biodiversity Action Plan which has the overall aim *'to conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms'*. These strategies provide a clear agenda for conservation activity in the UK,

covering the work of the government agencies, industry, agriculture, and the voluntary conservation organisations.

Biodiversity is, in its broadest sense, 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 a maximum number of different species occur in a given area, but ensuring that populations of the species and varieties that would naturally occur in such an area are present.

The UK Steering Group Report identified species considered to be threatened. This generated a 'long' list of 1,250 species, from this list a second list of 400 species was drawn up (known as the 'middle' list) and finally a priority list of 116 species (the 'short' list). The report sets out detailed action plans for the 116 priority species and for 14 key habitats. The 'short' and 'middle' species lists have now been combined and the next tranche of action plans are due to be published later this year.

Out of the 116 species, we are responsible for actions for 53 species and 7 habitats from the short list in the UK Steering Group Report. The report identified key opportunities for enhancing biodiversity including a number, such as the control of diffuse pollution, management of waste water discharges, sympathetic watercourse management and adoption of soft coastal engineering practices, that are particularly relevant to us.

Biodiversity species in the Thames Region

We have so far identified 18 species out of the 53 from the short list that occur in Thames Region, these are as follows:

- water vole*;
- European otter;
- pipistrelle bat;
- bittern;
- great crested newt;
- creeping marshwort*;
- starfruit*;
- allis shad;
- twaite shad;
- sand lizard;
- white clawed crayfish;
- southern damselfly;
- little whorlpool ram's-horn snail;
- glutinous snail*;
- freshwater pea mussel*;
- depressed river mussel;
- desmoulin's whorl snail*.

(*indicates that the Agency is the national contact for the species)

There are also many species associated with the wetland environment on the 'middle' and 'long' lists which our activities could have an effect upon and therefore also have to be considered when we are undertaking our duties (see indicator S14).

The Region's contribution to enhancing biodiversity and managing fisheries

Actions identified in the UK Steering Group Report can largely be delivered as a result of work programmes implemented primarily for other purposes using 'best practice principles'. For example, the water quality improvements required under the Urban Waste Water Treatment Directive will, if our latest proposals for sensitive area status are accepted by the DETR, be of direct benefit to biodiversity in waters that host priority species such as crayfish, freshwater pearl mussel, twaite and allis shad, as well as to several chalk rivers.

The reduction in sulphur dioxide emissions proposed in the current review of electricity supply industry authorisations will be of direct benefit to key species suffering the effects of acidification. Biodiversity requirements are also specifically addressed in major programmes such as the Asset Management Plan (AMP) investment programme for the water industry, where several chalk streams are proposed for investment to address the effects of abstraction.

Environmental appraisals and the preparation of Environmental Statements for major flood defence capital works ensure that biodiversity requirements are addressed in the options appraisal and scheme design (see indicator R3). The current programme of Water Level Management Plan preparation will also consider biodiversity needs at nearly 400 wetland sites influenced by our activities (see indicator R8). Local Environment Agency Action Plans (see indicator R6) are being used at a local level to implement specific Agency actions and objectives required by the UK Plan, as well as Species Action Plans (SAPs) and Habitat Action Plans (HAPs).

In addition, our conservation staff are involved in a number of other projects and activities to enhance biodiversity including:

- co-funding projects to establish the distribution of relevant species and habitats – our staff are acting as the national contact points for several short list species;
- bidding for funding and overseeing implementation of prioritised action plans;
- raising public awareness of biodiversity issues, through participation in Local County Biodiversity Action Plans (BAPs), media events etc;
- implementing actions, within the UK Plan, SAPs and HAPs where appropriate with other organisations and individuals.

River Cole

Of the 60 collaborative projects undertaken between March 1997 and March 1998, 43 involved habitat enhancement works, of benefit to a wide variety of species, including such activities as:

- berm creation, to restore marginal fringes in an impoverished watercourse (with London Borough of Barking and Dagenham);
- channel narrowing and weir removal, to enhance chalk stream habitat (with Dacorum Council);
- creation of a reedbed as part of a new wetland site (with RSPB);
- restoring water level control on an SSSI for invertebrates and waders (with a local landowner).

Black poplars, Thistle Brook

The following five of the enhancement schemes were aimed at particular biodiversity species:

- relict wet woodland restoration to protect Desmoulin's snail (with London Borough of Hillingdon, London Wildlife Trust and English Nature);
- pond creation and restoration, to create breeding habitat for great crested newt and ruddy darter (with Herts & Middlesex Wildlife Trust);
- pollarding of black poplar, to promote longevity (with a local land owner);
- reinstatement of a river meander, to create an island refuge for water voles in an urban area (with a local authority);
- creation of a reedbed on our land, to create a breeding habitat for bitterns (with RSPB).

Examples of other projects included part-funding of an otter project officer, monitoring and maintenance of bat boxes, study of mink and water voles to help provide best practice guidelines for water vole conservation and the production of a county BAP prospectus.

Many of the enhancement works we carry out have both conservation and fisheries benefits, however some of the specialist contributions made by our fisheries staff include:

- monitoring the health and number of fish in over 1,500km of riverine fisheries;
- improving fish habitat and create new ones, such as pools, ledges, covers and riffles;
- responding to emergencies that may endanger fish or fisheries;
- assisting fish that are at risk by removing the cause of the pollution and as a last resort removing them to safer waters;
- restocking depleted rivers or developing new fisheries;
- installing fish passes to help salmon, trout, coarse fish and eels to reach their spawning grounds.

Good progress has been made over the last decade to achieve the objective of the Thames Salmon Rehabilitation Scheme to secure a self-sustaining population of Atlantic

Fish pass

salmon for the Thames and its tributaries. Salmon now pass regularly through the Tidal Thames to fresh water (*see indicator S13*). The work of the Thames Salmon Trust has enabled a series of passes to be built over weirs between London and Reading to allow access to spawning and nursery areas. Facilities to rear the progeny of returning salmon so they can be released into nursery streams and a monitoring scheme have also been set up.

4.8 Improving air quality and regulating major industries

Managing air quality

The Government, recognising that the quality of air that we breathe is crucial to us all, established a new framework for improving air quality and set this out in the Environment Act 1995. This resulted in the UK National Air Quality Strategy published in 1997. The strategy explains the roles of local authorities, industry and the Agency in achieving the Government's air quality targets. The leading role in air quality management rests with local authorities. We play our part mainly through the regulation and control of emissions from the largest, most technically complex and potentially most polluting industrial processes.

Local authorities (including London Boroughs) have to implement the Government's National Air Quality Strategy (NAQS). If the NAQS targets are unlikely to be met by 2005 (as is likely to be the case in some parts of London) then the local authorities will have to declare their own Air Quality Management Areas and develop Air Quality Action Plans (AQAPs). It is proposed that the Mayor of London will also have a duty to produce an Air Quality Strategy Management Plan for

London which will encompass individual AQAPs. We wish to be involved in helping local authorities to develop these AQAPs. We could help to identify factors affecting air quality in the local area, to generate and evaluate options for air quality enhancement and therefore inform decision making by local authorities, the Mayor and ourselves. It is likely that the Region's major air quality problems will be in London where NO_2 and particulate targets will be compromised by traffic (*see indicator S2*). The most dominant effect of processes we regulate will be that of SO_2 to the east of London where a number of power stations and a refinery are just beyond the boundary of the Thames Region (*see indicator P11*).

Regulating major industries

Under the Environmental Protection Act 1990 (EPA90) two lists of processes have been prescribed for control: Part A processes are controlled under Integrated Pollution Control (IPC) by the Agency; Part B processes are controlled at a local level with regard to their discharges to the atmosphere under a system of Local Authority Air Pollution Control (LAAPC). For Part A processes Best Available Techniques Not Entailing Excessive Cost (BATNEEC) must be used by operators to prevent, minimise or render harmless releases to the environment. Additionally, the overall effect on the environment must be minimised. Also EPA90 requires that the releases from these processes should not compromise air quality standards, which are currently set for

NO_2, SO_2, lead and suspended particles.

The UK National Air Quality Strategy has recently been enacted under the Environment Act 1995. This states that the Environment Agency *"shall have regard to the UK NAQS in exercising its pollution control functions"*. Guidance suggests that generally the application of normal plant upgrading under IPC should meet the objectives of the UK NAQS. However, local circumstances may require further reductions from an IPC process where it is the most cost effective route for effecting reductions.

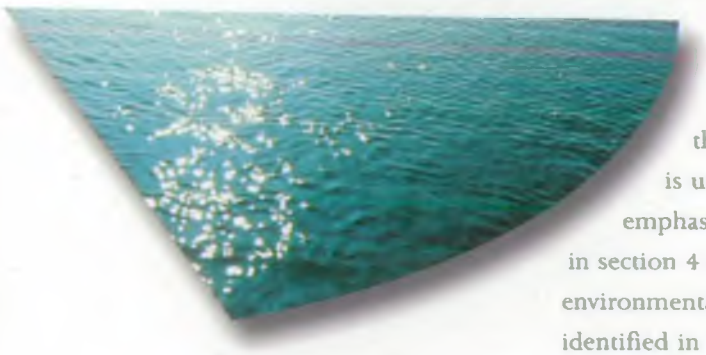
There are approximately 150 Part A processes in the Region which we regulate, including chemical and pharmaceutical manufacturers, incinerators and power stations. However, compared with other Regions, Thames Region has few major industries (*see indicator P11*) and not all Part A installations release to air, and some which do are insignificant. Our Pollution Inspectors are responsible for assessing and authorising these processes to ensure the pollution to the environment as a whole (whether by releases to air, water or land) is minimised. The types of air pollutants released from the different types of processes are set out below:

- combustion processes release NOx, SO_2, CO and particulates;
- metals processes release lead and particulates;
- minerals processes release NOx, SO_2 and particulates;
- chemicals processes can release VOCs and may have on-site boilers;
- incineration processes release NOx, metals and particulates.

There have already been significant improvements to Part A installations in the Region. Combustion processes have been converted to natural gas, low NOx burners are commonly used and gas turbines have been installed to the standards available for new plants (*see section 4.2*). Metals processes have had their abatement plants upgraded. Chemicals processes have higher levels of recycling potential wastes, alternative solvents have been found or abatement has been installed. Incineration plants have had their abatement plants upgraded and new plants have been built to current best standards.

The continuing use of BATNEEC for the Part A processes we regulate will deliver progressive reductions in releases to air and thereby contribute to improved air quality in the Region.

5. The way forward



Summary of the challenges for the Region

The environmental indicators have illustrated the intense pressure that the Region's environment is under. These pressures are emphasised by the issues raised in section 4 and the main Regional environmental management challenges identified in the report which are summarised below.

The Region's high population density and people's lifestyle expectations are exerting many stresses upon Thames Region'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 particularly if the trend towards dispersed patterns of development and economic activity is allowed to continue. Concentrating the majority of future development in urban areas should produce a more sustainable pattern of development, movement 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 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. Water abstraction for public supply affects river flows and groundwater levels, threatening aquatic and wetland habitats. Regional demand for aggregates for construction projects is also high. It is predicted that a third of demand will need to be met by imports. Local extraction of aggregates needs effective management to avoid adverse effects on groundwater levels; flood risk; floodplain habitats and biodiversity; and river corridor landscapes and their continuity.

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. In addition, current practices are wasteful of resources and fail to deal with waste arisings in the most environmentally sound manner. A radical change in waste practice is needed to implement the Government's waste hierarchy. This should place 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 drought in the Region over the last few years has 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.

Mechanisms for action and partnership

This Report presents a snapshot of the state of Thames Region's environment, against this background future change can be measured. It concentrates on the aspects of the environment for which we have a particular interest. However, environmental management responsibilities are split between numerous organisations which all have a slightly different environmental focus. Partnership is therefore essential in working towards the common goal of sustainable development.

For our part, we have an established framework for addressing environmental issues. At a national level the *Environmental Strategy* sets out our policy objectives and priorities. These policy aims and objectives are implemented through the *Corporate Plan* at national, regional and area levels. Finally, Local Environment Agency Plans (LEAPs) provide our commitment to a programme of local environmental improvement. The *State of the Environment Report* will inform all these levels of environmental management in the Thames Region.

Recommendations for future editions of the State of the Environment Report

It is proposed that the State of the Environment Report will be updated every two years. These will include refinements of the indicators presented here, with additional key indicators included where new information has become available. The direction and significance of change since the last report will be reported and some key regional targets identified. In this way we will be able to assess our progress towards achieving the Agency's goal of a better environment for present and future generations.

The *State of the Environment Report* has been produced by the Environment Protection Department under the direction of a Steering Group chaired by Tim Reeder *Regional Environmental Surveillance Manager.*

Project Manager:
Angela Nicholson *Environmental Monitoring and Assessment Team Leader*

Project Team:
Richard Eales *Consultant*
Ann Symonds *Strategic Planner*
Brian Wilson *Scientist (GIS)*
Simon Greener *GIS Technician*

Appendix I:
The Agency's duties, powers and interests

The Environment Agency has a wide range of interests in the areas of water management, waste management and pollution prevention and control. Whilst many of these interests are supported by statutory duties and powers, much of our work is advisory, with the relevant powers resting with other bodies such as local planning authorities. The following table summarises our duties, powers and interests.

Agency Duty:	The Agency has powers to:	The Agency has an interest (but no powers) in:
Water resources The Agency has a duty to conserve, redistribute, augment and secure the proper use of water resources.	• Grant or vary water abstraction and impoundment licences on application. • Revoke or vary existing licences to reinstate flows or levels to surface waters or groundwaters which have become depleted as a result of abstraction, and are subject to a liability for compensation. • Secure the proper use of water resources through its role in water resources planning, the assessment of reasonable need for abstractions and promotion of more efficient use of water resources. • Monitor and enforce abstraction and impoundment licence conditions.	• The more efficient use of water by water companies, developers, industry, agriculture and the public and the introduction of water efficiency measures and suitable design and layout of the infrastructure.
Flood defence The Agency has a duty to exercise general supervision over all matters relating to flood defence throughout each catchment.	• Control, through Land Drainage consents, development within 8m of a Main River (16m for the tidal Thames and tributaries) (Water Resources Act, 1991 Section 109) or construction of a structure that would affect the flow of an ordinary watercourse (Land Drainage Act, 1991 Section 23). • Produce flood risk maps for all main rivers under S105 of the Water Resources Act 1991. • Undertake works to Main Rivers using permissive powers. • Issue flood warnings relating to Main Rivers to the public, local authorities and the police. • Provide and maintain tidal defences in London. • Consent mineral workings within 16m of Main Rivers.	• Granting of planning permission throughout a catchment but especially floodplains where development can significantly increase flood risk. This permission is granted by Local Planning Authorities. • Installation of surface water source control measures e.g. flood attenuation structures. • Supervising the maintenance of ordinary watercourses, which is a Local Authority remit but may impact on Main Rivers. • Installation of buffer zones which reduce flood risk and have significant environmental benefits. • Urban and rural land use and measures that can reduce flood risk or the need for watercourse maintenance.

Agency Duty:	The Agency has powers to:	The Agency has an interest (but no powers) in:
Water quality The Agency has a duty to monitor, protect, manage and, where possible, enhance the quality of all controlled waters including rivers, groundwaters, lakes, canals, estuaries and coastal waters through the prevention and control of pollution.	• Issue discharge consents to control pollution loads in controlled waters. • Regulate discharges to controlled waters in respect of water quality, through the issue and enforcement of discharge consents. • Issue 'works notices' where action is required to reduce the risk of pollution. • Prosecute polluters and recover the costs of clean-up operations.	• The control of runoff from roads and highways. This is a Highways Agency duty. • The greater use of source control measures to reduce pollution by surface-water runoff. • Prevention and education campaigns to reduce pollution incidents.
Integrated pollution control and air quality The Agency has a duty to implement Part 1 of the Environmental Protection Act 1990.	• Regulate the largest technically-complex and potentially most polluting prescribed industrial processes, such as refineries, chemical works and power stations including enforcement of, and guidance on, BATNEEC and BPEO. • Have regard to the government's National Air Quality Strategy when setting standards for the releases to air from industrial processes.	• The vast number of smaller industrial processes which are controlled by Local Authorities. • Control over vehicular emissions and transport planning.
Radioactive substances The Agency has a duty under the Radioactive Substances Act 1993 to regulate the use of radio-active materials and the disposal of radioactive waste.	• To issue certificates to users of radioactive materials and disposers of radio-active waste, with an overall objective of protecting members of the public.	• The health effects of radiation.
Waste management The Agency has a duty to regulate the management of waste, including the treatment, storage, transport and disposal of controlled waste, to prevent pollution of the environment, harm to public health or detriment to local amenities.	• To issue Waste Management Licences and vary conditions. • Suspend and revoke licences. • Investigate and prosecute illegal waste management operations.	• The siting and granting of planning permission for waste management facilities. This is conducted by the waste industry and Local Planning Authorities. The Agency, as a statutory consultee on planning applications, can advise on such matters.
Contaminated land The Agency has a duty to develop an integrated approach to the prevention and control of land contamination ensuring that remediation is proportionate to risks and cost-effective in terms of the economy and environment.	• Regulate the remediation of contaminated land designated as special sites. • Prevent future land contamination by means of its IPC, Water Quality and other statutory powers. • Report on the state of contaminated land.	• Securing with others, including Local Authorities, landowners and developers, the safe remediation of contaminated land.

Agency Duty:	The Agency has powers to:	The Agency has an Interest (but no powers) in:
Conservation The Agency will further conservation, wherever possible, when carrying out water management functions: have regard to conservation when carrying out pollution control functions; and promote the conservation of flora and fauna which are dependent on an aquatic environment.	• The Agency has no direct conservation powers, but uses its powers with regard to water management and pollution to exploit opportunities for furthering and promoting conservation.	• The conservation impacts of new development. These are controlled by Local Planning Authorities. • Protection of specific sites or species, which is a function of English Nature. The Agency does, however, provide advice to Local Authorities and developers to protect the integrity of such sites or species. • Implementation of the UK Biodiversity Plan for which it is the contact point for 12 species and one habitat.
Landscape The Agency will further landscape conservation and enhancement when carrying out water management functions; have regard to the landscape when carrying out pollution control functions; and promote the conservation and enhancement of the natural beauty of rivers and associated land.	• The Agency must further the conservation and enhancement of natural beauty when exercising its water management powers and have regard to the landscape in exercising its pollution control powers.	• The landscape impact of new development, particularly within river corridors. This is controlled by Local Planning Authorities.
Archaeology The Agency has a duty to consider the impact of all of its regulatory, operational and advising activities upon archaeology and heritage, and implement mitigation and enhancement measures where appropriate.	• The Agency must promote its archaeological objectives through the exercise of its water management and pollution control duties.	• Direct protection or management of sites of archaeological or heritage interest. This is carried out by Local Planning Authorities, County Archaeologists and English Heritage.
Fisheries The Agency has a duty to maintain, improve and develop salmon, trout, freshwater and eel fisheries.	• Regulate fisheries by a system of licensing. • Make and enforce fisheries byelaws to prevent illegal fishing. • Promote the free passage of fish and consent fish passes. • Monitor fisheries and enforce measures to prevent fish-entrainment in abstractions. • Promote its fisheries duty by means of Land Drainage Consents, water abstraction applications and discharge applications.	• The determination of planning applications which could affect fisheries.
Recreation The Agency has a duty to promote rivers and water space for recreational use.	• The Agency contributes towards its recreation duty through the exercise of its statutory powers and duties in water management.	• Promotion of water sports. This is carried out by the Sports Council and other sports bodies.
Navigation The Agency has a duty to maintain and improve non-tidal Thames navigation from Cricklade to Teddington.	• Improve, conserve and operate the non-tidal Thames navigation. • Regulate navigation by a system of licensing. • Enforce navigation legislation.	• The management and operation of the Port of London, British Waterways navigations and other navigations within the region.

Appendix II.
Sources of information and references

Sources of information

We have indicated throughout this report the sources of the information used. We are the main source of the data for the key environmental indicators, however we have also used data from other organisations, such as: British Geological Survey, Berkshire Atlas Group, Countryside Commission, DETR, English Nature,, Institute of Terrestrial Ecology, local authorities, MAFF, Meteorological Office (including the Hadley Centre), NETCEN, Ordnance Survey, OFWAT, SERPLAN, University of East Anglia and water companies. Where this data is taken from a document, it is included in the references below. Information has also been taken from some of these organisations websites, including:

- Department of the Environment, Transport and Regions (http://www.detr.gov.uk);
- University of East Anglia, Climatic Change Unit (http://www.cru.uea.ac.uk);
- Meteorological Office (http://www.meto.govt.uk).

We are required by law to maintain a set of Public Registers. Information is held in a combination of paper and computer files which may be inspected at our Regional and Area offices. Our booklet titled *A Guide to the Information Available to the Public* describes the information on the Public Registers and is available from our Regional Office, PR Department. The Contact details for the Regional and Area Offices are included on the back cover of this report.

In addition to the Public Registers, we have the data available for most of the key environmental indicators for which we are the source of the information. Specific inquiries relating to this *State of the Environment Report* should be directed to the Environmental Monitoring and Assessment team of our Environment Protection Department in Reading.

Our Local Environment Agency Plans (LEAPs) are an important source of local information and details of those which are currently available can be obtained from our Area Offices. General information on the work of the Environment Agency is available on our website (http://www.environment-agency.gov.uk) which also has an updated version of *The Environment of England and Wales – A Snapshot.*

References

Bucknall N J, Collins I D, Standley P, & Swash A (ed). The Birds of Berkshire. Berkshire Atlas Group, Reading.

Biffa Waste Services, 1997. Great Britain plc: The Environmental Balance Sheet, an analysis of Britain's waste production and disposal account, with implications for industry and government. Biffa Waste Services.

Department of the Environment, 1993. Countryside Survey, 1990. Main Report. Prepared by the Institute of Terrestrial Ecology and the Institute of Freshwater Ecology. HMSO, London.

Department of the Environment, 1994. Biodiversity: The UK Action Plan. HMSO, London.

Department of the Environment, 1994. Regional Planning Guidance for the South East – RPG9. HMSO, London.

Department of the Environment, 1995. Biodiversity: The UK Steering Group Report 1995. HMSO, London.

Department of the Environment, 1995. Projections of Households in England to 2016. HMSO, London.

Department of the Environment, 1995. Making Waste Work: A Strategy for Sustainable Waste Management in England and Wales. HMSO, London.

Department of the Environment, 1996. United Kingdom National Air Quality Strategy. HMSO, London.

Department of the Environment, 1996. Household Growth: Where Shall we Live? HMSO, London.

Department of the Environment, 1996. The Environment in Your Pocket 1996. DoE, London.

Department of the Environment, 1996. Indicators of Sustainable Development for the United Kingdom. The Stationery Office, London.

Department of the Environment, Transport and Regions, 1997. Digest of Environmental Statistics, No. 19. The Stationery Office, London.

Department of the Environment, Transport and Regions, 1997. Road Traffic Statistics Great Britain, 1997 Edition. The Stationery Office, London.

Department of the Environment, Transport and Regions, 1997. Transport Statistics Great Britain, 1997 Edition. The Stationery Office, London.

Department of the Environment, Transport and Regions, 1997. The National Travel Survey 1994/96. The Stationery Office, London.

Environment Agency, 1996. The Environment of England and Wales: A Snapshot. Environment Agency, Bristol.

Environment Agency, 1996. Tidal Thames Landscape Assessment and Design Guidelines. Environment Agency, Reading.

Environment Agency, 1997. Viewpoints on the Environment. Developing a National Environmental Monitoring and Assessment

Framework. Environment Agency, Bristol.

Environment Agency, 1997. An Environmental Strategy for the Millennium and Beyond. Environment Agency, Bristol.

Environment Agency, 1997. The Water Quality of the Tidal Thames. The Stationery Office, London.

Environment Agency, 1997. The Millennium Riverbank Experience: Greenwich means a new time for a new outlook on riverside development. Environment Agency, Reading.

Environment Agency, 1997. Partnership in Planning: riverbank design guidance for the tidal Thames. Environment Agency, Reading.

Environment Agency, July 1997. Thames Tideway LEAP Consultation Report. Environment Agency, Sunbury-on-Thames.

Environment Agency, 1997. The Tidal Foreshore. Environment Agency, Reading.

Environment Agency, 1997. Thames Region Functional Fact Files: Fisheries Fact File 1/9; Flood Defence Fact File 2/9; Conservation Fact File 3/9; Water Quality Fact File 4/9; Navigation Fact File 5/9; Recreational Fact File 6/9; Water Resources Fact File 7/9; Waste Regulation Fact File 8/9; and Integrated Pollution Control 9/9. Environment Agency, Reading.

Environment Agency, 1998. The State of the Environment of England and Wales: Fresh Water. The Stationery Office, London.

Environment Agency, 1998. The Thames Tideway and Estuary Fact File: Teddington to Shoebury. Environment Agency, Reading.

Environment Agency, 1998. Fish Found in the Tidal Thames Tideway. Environment Agency, Reading.

Environment Agency, 1998. Invertebrate Animals of the Tidal Thames. Environment Agency, Reading.

Environment Agency, 1998. Thames Environment 21: The Environment Agency Strategy for Land-use Planning in Thames Region. Environment Agency, Reading.

Environment Agency, 1998. The Tidal Thames See Fisheries Action Plan. Environment Agency, Crossness.

Environment Challenge Group, 1994. Environmental Measures: Indicators for the UK Environment. RSPB, WWF and New Economics Foundation.

Government Office for London, 1996. Strategic Planning Guidance for London – RPG3.

Government Office for the South East, 1994. Strategic Planning Guidance for the South East – RPG9.

Hertfordshire Environmental Forum, 1996. A Report on the State of the Hertfordshire's Environment, Annual Update 1996.

London Planning Advisory Committee, 1995. State of the Environment Report for London. LPAC, London.

Office for National Statistics, 1998. Annual Abstract of Statistics 1998 Edition No. 134. The Stationery Office, London.

Oxfordshire County Council, 1995. Oxfordshire's Environment – Environmental Monitoring Report. Oxfordshire County Council, Oxford.

SERPLAN, May 1998. A Sustainable Development Strategy for the South East. Public Consultation Draft. SERP 400.

SERPLAN, June 1998. Environment Agency Waste Monitoring Survey Results. SERP 378.

SERWAWP, February 1998. Aggregates Monitoring 1996. SERAWP 230.

Thames Estuary Project, July 1996. Thames Estuary Management Plan – Draft for Consultation. Thames Estuary Project, London.

UK Round Table on Sustainable Development, December 1997. Getting the Best Out of Indictors.

Appendix III.
Symbols, abbreviations and glossary

Symbols

Bq/kg	becquerels per kilogramme
°C	degrees celsius
cm	centimetre
ha	hectare
km	kilometre
km² or sq km	square kilometre
l	litre
l/h/d	litres per head per day
m	metres
m³	cubic metres
m³/d	cubic metres per day
mg/l as N	milligrammes of nitrogen per litre
Ml	megalitre
Ml/d	megalitres per day
Ml/a	megalitres per annum
mm	millimetre
<	less than
>	more than
≥	greater than or equal to
%	percentage
£m	millions of pounds

Abbreviations

AMP	Asset Management Plan
AOD	Above Ordnance Datum
ALF	Alleviation of Low Flows
AONB	Area of Outstanding Natural Beauty
AQAP	Air Quality Action Plan
AQMS	Automatic Quality Monitoring Stations
BAP	Biodiversity Action Plan
BATNEEC	Best Available Technique Not Entailing Excessive Cost
BOD	Biochemical Oxygen Demand
BPEO	Best Practicable Environmental Option
BMWP	Biological Monitoring Working Party
CPRE	Council for the Protection of Rural England
CRI	Chemical Release Inventory
CSO	Combined Sewer Overflow
DO	Dissolved Oxygen
DETR	Department of the Environment, Transport and Regions
EPA90	Environmental Protection Act 1990
ESA	Environmentally Sensitive Area
GQA	General Quality Assessment
HAP	Habitat Action Plan
HMIP	Her Majesty's Inspectorate of Pollution
IPC	Integrated Pollution Control
LA21	Local Agenda 21
LAAPC	Local Authority Air Pollution Control
LPA	Local Planning Authorities
LPAC	London Planning Advisory Committee
LEAP	Local Environment Agency Plan
MAFF	Ministry of Agriculture, Fisheries and Food
MPG	Mineral Planning Guidance
NAQS	National Air Quality Strategy
NETCEN	National Environment Technology Centre
NRA	National Rivers Authority
NVZ	Nitrate Vulnerable Zone
OFWAT	Office of Water Services
RPG	Regional Planning Guidance
RQO	River Quality Objective
SAC	Special Area of Conservation
SAP	Species Action Plan
SERPLAN	South East Regional Planning Conference
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
TEBP	Thames Estuary Benthic Programme
TW	Thames Water
UNCED	United Nations Conference on Environment and Development
VOC	volatile organic compounds
WLMP	Water Level Management Plan

Glossary

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.*

Aggregates – *minerals used in construction.*

Algae – *a diverse group of simple aquatic plants, some microscopic, which can grow in rivers and the sea in great profusion (blooms).*

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 – underground water source – water bearing rock.*

Area of Outstanding Natural Beauty (AONB) – *designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1942, to conserve and enhance the natural beauty of the landscape, mainly through planning controls.*

Asset Management Plan (AMP) – *the Asset Management Plan produced by the Water Companies for the Office of Water Services (OFWAT) to set out the water industry investment programme.*

Best Available Technique Not Entailing Excessive Cost (BATNEEC) – *The level of pollution control required for sites under the EPA90. Includes the technology and management of the site to prevent the release of prescribed substances, or to reduce the releases to a minimum and to render harmless any other substances that might cause harm if released.*

Best Practicable Environmental Option (BPEO) – *The BPEO procedure establishes, for a given set of objectives, the integrated pollution control option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long as well as the short term.*

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

Biodiversity – *variety amongst living organisms.*

Biomass – *a quantitative estimate of animal and/or plant matter.*

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

Catchment Management Plan (CMP) – *an integrated plan for a river catchment*

produced by the NRA.

Coarse fish – *this is a common term for cyprinid fish and other commonly associated species such as pike, perch and eels of angling significance. The term does not normally refer to minor species such as bullhead, stone loach, minnow and stickleback.*

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 waters – *defined by the Water Resources Act 1991 Part III Section 104. They include groundwaters and inland waters, estuaries and coastal waters to three nautical miles from the shore.*

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

Cretaceous – *geological period between 65 and 140 millio years ago*

Culverts – *drain or covered channel carrying water across or under a road, canal 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.*

Effective rainfall – *the amount of rainfall reaching surface and groundwater after the losses to the air by evaporation.*

Effluent – *water discharged from a site which may be contaminated, for example with sewage or waste substances from industrial processes.*

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

Environmentally Sensitive Area (ESA) – *an area designated by MAFF where grant aid is available to support traditional farming methods.*

Eutrophification – *the enrichment by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce disturbance to the balance of organisms present in the water and to the quality of the water concerned.*

Floodplain – *parts of river valleys or coastal plains which are inundated during floods. It includes areas protected by flood defences. Fluvial – pertaining to, or found in rivers.*

General Quality Assessment (GQA) – *a scheme for assessing and reporting environmental water quality. The chemical grades for rivers introduced in 1994 use BOD, Ammonia and Dissolved Oxygen. Other grades for estuarine and coastal waters are being developed and aesthetic components will be measured and graded by a system under trial now. The GQA scheme replaces the NWC classification system.*

Groundwater – *water contained in the void spaces in pervious rocks and also within the soil.*

Habitat – *natural home of plant or animal.*

Hydrogeology – *branch of geology concerned with water within the earth's crust.*

Hydrology – *the study of water and its dynamics.*

Integrated Pollution Control (IPC) – *an approach to pollution control in the UK which takes account of potential effects upon all environmental media. Applies to prescribed processes and uses the principles of BATNEEC and BPEO.*

Invertebrates – *animals without a backbone (e.g. insects, worms and spiders).*

Jurassic – *geological period between 140 and 195 million years ago.*

Landfill site – *site used for waste disposal into/onto land.*

Leachate – *solution formed when water percolates through a permeable medium. Can be mineral-rich, toxic or carry bacteria.*

Levels of service – *minimum standards of flood protection. Appropriate levels of service are calculated according to land use.*

Local Environment Agency Plan (LEAPs) – *the process by which the Agency plans to meet all the environmental issues in a catchment. A consultation plan is published followed by an action plan which is reviewed every five years.*

Low flows rivers – *a river identified by the Agency as having excessively low flows and requiring action to improve the situation.*

Main River – *designated under the Water Resources Act 1991 by the Ministry of Agriculture, Fisheries and Food. Formal consent from the Agency is required for all activities that interfere with the bed or banks of the river or obstruct the flow.*

Microinvertebrate – *an invertebrate of sufficient size to be retained in a net with a specified mesh size, usually about one millimetre.*

Micro-organisms – *general term for any microscopic organism, including algae, bacteria, fungi and viruses.*

Nitrate Sensitive Area (NSA) – *area designated by MAFF with advice from the Agency, where agricultural activities are controlled to reduce nitrate contamination of groundwater.*

Nitrate Vulnerable Zone (NVZ) – *an area where nitrate concentrations in sources of public drinking water exceed, or are at risk of exceeding the limit of 50 mg/l laid down in the 1991 EC Nitrate Directive, and where compulsory, un-compensated agricultural measures will be introduced from 1996 as a means of reducing those levels.*

Palaeogene – *geological period within the Tertiary era which ranges from 2 and 65 million years.*

Percentile – *one of 99 values of a variable dividing its distribution into 100 groups with equal frequencies.*

Permissive powers – *powers which confer the right to do things but not the duty.*

Potable water – water suitable for human consumption.

Radionuclide – *a radioactive atom which emits corpuscular or electromagnetic radiation.*

Reach – *a length of channel*

Return period – *refers to the return period of a flood. Flood events are described in terms of the frequency at which, on average*

a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years e.g. 1 in 50 years.

Riparian – *relating to or situated on the bank of a river or stream.*

River corridor – *land which has visual, physical or ecological links to a watercourse and which is dependent on the quality or level of the water within the channel.*

River Habitat Survey (RHS) – an inventory of physical features of the river and adjacent habitat.

River terrace(s) – *lateral bench between a river channel and its valley sides.*

River Quality Objective (RQO) – *the level of water quality that a river should achieve in order to be suitable for its agreed uses.*

Run-off – *water leaving a river catchment. Normally regarded as rainfall minus evapotranspiration (evaporation and loss of water by plants) but commonly used to mean rainwater flowing across the land (also known as overland flow).*

Salmonid fish – *game fish, e.g. trout and salmon.*

Sewage – *liquid waste from cities, towns and villages which is normally collected and conveyed in sewers for treatment and/or discharge to the environment.*

Site of Special Scientific Interest (SSSI) – *sites of national importance designated under the Wildlife and Countryside Act 1981 by English Nature in England. Sites may be designated to protect wildlife, geology or land forms.*

Source control – *a collective term used to describe the management of run-off at or near the point of impact of rainfall and before it reaches the piped drainage and sewerage systems of urban areas. They include balancing ponds, permeable pavements and underground water butts.*

Source Protection Zones (SPZ) – *a Source Protection Zone is the area over which recharge is captured by an abstraction borehole. SPZs are designated by the Environment Agency and are delineated to protect potable water supplies against the polluting effects of human activity. Special*

Protection Areas (SPAs) – *sites identified by UK government under the EC Directive on the Conservation of Wild Birds (79/409/EC).*

Special Area of Conservation (SAC) – *areas designated under the EC Habitats Directive.*

Statutory Water Quality Objective (SWQO) – *Water Quality Objectives set by the secretary of state in relation to controlled waters.*

Sustainable development – *development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

Trade effluent – *a discharge of water from a commercial or industrial site.*

Tributary – *a stream or river which feeds into a larger one.*

Watercourse – *a stream, river, canal or channel along which water flows.*

Water table – *level below which the soil/rock is permanently saturated.*

THAMES REGION ADDRESSES

REGIONAL OFFICE
Environment Agency
Kings Meadow House
Kings Meadow Road
Reading
Berkshire RG1 8DQ
Tel: 0118 953 5000
Fax: 0118 950 0388

NORTH EAST AREA
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts AL10 9EX
Tel: 01707 632 300
Fax: 01707 632 500

SOUTH EAST AREA
Environment Agency
Swift House
Frimley Business Park
Frimley
Camberley
Surrey GU16 5SQ
Tel: 01276 454300
Fax: 01276 454301

WEST AREA
Environment Agency
Isis House
Howbery Park
Crowmarsh Gifford
Wallingford
Oxfordshire OX10 8BD
Tel: 01491 832 801
Fax: 01491 834 703

For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

ENVIRONMENT AGENCY GENERAL ENQUIRY LINE

0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

ENVIRONMENT AGENCY EMERGENCY HOTLINE

0800 80 70 60

ENVIRONMENT AGENCY

TH-9/98-5k-C-BDSG
Printed on Cyclus Print.
Designed by GRW Marketing Design Ltd.