ANGLIAN REGION
WATER QUALITY REPORT
1995

ENVIRONMENT AGENCY

guardians of the environment

OUR VISION IS:

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

We will:

- By our own actions and by working with and influencing others protect and improve the environment as a whole by effective regulation.
- Value our employees.
- Operate registers openly and consult widely.
- Be efficient and businesslike in everything we do.

OUR AIMS ARE:

- To achieve significant and continuous improvement in the quality of air, land and water, actively encouraging the conservation of natural resources, flora and fauna.
- To maximise the benefits of integrated pollution control and integrated river basin management.
- To provide effective defence and timely warning systems for people and property against flooding from rivers and the sea.
- To achieve significant reductions in waste through minimisation, reuse and recycling and improve standards of disposal.
- To manage water resources to achieve the proper balance between the needs of the environment and those of abstractors and other water users.
- To secure, with others, the remediation of contaminated land.
- To improve and develop salmon and freshwater fisheries.
- To conserve and enhance inland and coastal waters and their use for recreation.
- To maintain and improve non-marine navigation.
- To develop a better informed public through open debate, the provision of soundly based information and rigorous research.
- To set priorities and propose solutions that do not impose excessive costs on society.

SUMMARY

Anglian is one of eight Regions of the Environment Agency. The Agency has responsibilities for the management of waste, the control of pollution and the management of water resources, flood defence, freshwater fisheries, and conservation. It also has obligations for surveillance and duties to publish information on the state of the Environment.

The Agency's principal aim is to protect or enhance the Environment and so play a part in attaining development that is sustainable. One part of this aim is to protect and improve the quality of water by controlling the risk of pollution. This report deals with Water Quality.

We give trends over the past 11 years in the chemical quality of rivers. We demonstrate that water quality has improved by 37% since 1990.

This is matched by an improvement in the biology. The biological quality is the best we have recorded and showed a net improvement since last year and a net improvement of 39% since 1990.

The causes of the improvements in river quality are better effluent quality, and river flows that were higher than those for 1990.

We proposed to the DoE, Statutory Water Quality Objectives for the Cam catchment.

The number of reported Pollution Incidents decreased by 8% from 1994 to 1995. There were 15 of the more serious incidents, compared with 12 in 1994.

A few sites failed criteria for the Dangerous Substances Directive. We report on progress.

We defined 140 Protection Zones for the Groundwater Protection Policy. We advised the Independent Review Panel on the boundaries of Nitrate Vulnerable Zones. The Government announced the designation of 20 Zones in Anglian Region.

We report on our programme of 1500 Formal Visits for Pollution Prevention.

We report trends for Bathing Waters since 1987. In 1995, four Waters failed, including two which have benefitted from big schemes to improve sewage treatment. There were six failures in 1994. The average levels of pollution have continued to improve.

We give trends for the performance of discharges since 1982. 98.4% of the sewage treatment works operated by Anglian Water complied with their Consents, better than last year and maintaining the improvement of recent years.

The number of enquiries of the Water Resources Act Register has increased steadily since it opened in 1985. During 1995, 1500 enquiries were received, an increase of 17% since 1994, which, in turn was a 40% increase on 1993.

We report on our use of computers to improve our efficiency and help take better decisions.

CONTENTS

ABBREVIATIONS

HMIP	Her Majesty's Inspectorate of Pollution
DoE	Department of the Environment
MAFF	Ministry of Agriculture, Fisheries and Food
OFWAT	Office of Water Services
AWS	Anglian Water Services

PART 1: INTRODUCTION

This report covers events and issues in 1995. There is an Index and a Glossary at the back, and a list of abbreviations and acronyms is on the previous page.

This section gives background and an outline of recent and future activities. Our tasks are the joint responsibility of the Region and its Areas. Many more details of local issues and impacts are in our Local Environment Agency Plans.

1.1 Duties

These extend to all Controlled Waters. Controlled Waters include rivers, lakes, reservoirs, groundwaters, estuaries and coastal waters. Our duties include:

- achieve targets for water quality (Water Quality Objectives);
- monitor the extent of pollution;
- conserve and enhance amenity;
- determine and issue Consents for the discharge of wastes;
- maintain Public Registers; and,
- advise and assist the DoE.

We operate openly and aim to balance the interests of all who benefit from and make use of the Environment.

1.2 Anglian Region

Anglian Region faces growth and development. This requires an effort on Planning Applications, Consents and Abstractions which is large compared with the rest of England & Wales.

This pressure occurs in the context of the impacts of intensive agriculture and the special vulnerability of groundwater. We see increasing competition for scarce water resources and the vital need to protect waters of high quality.

1.3 Looking Back

Much of our most important work is low-key. We aim to sustain water quality against a risk of attrition caused by the demand both for water and for the use of land.

To sustain success we must audit compliance with water quality standards, assess priorities and take action. The output is commerce, recreation and development that does no damage to the leisure and livelihoods currently enjoyed, and which preserves opportunities in the future.

During 1995, we met our recurring responsibilities for monitoring, reporting and regulation. We also:

- demonstrated an improvement of 37% since 1990 in the chemical quality of our rivers
- assessed the biological quality of our rivers and showed a 39% improvement since 1990
- assessed the quality of discharges and demonstrated a 40% reduction since 1990 in the load discharged to rivers by sewage treatment works operated by Anglian Water
- assessed for OFWAT and the DoE, the results of investment by Anglian Water
- updated our River Quality Objectives and our plans on the action needed to meet them
- planned and justified the improvements needed in discharges; and set up new mathematical models for this
- completed case studies on Cost Benefit Analysis
- proposed Statutory Water Quality Objectives for the Cam
- assessed whether removing nutrients from effluents will improve waters designated as Eutrophic Sensitive Areas under the Urban Waste Water Treatment Directive
- developed ways of deciding the need for Eutrophic Sensitive Areas
- resolved the majority of appeals by dischargers to the DoE on their Consents
- set up items of policy on Consenting and provided training
- completed our part of Authorisations of industrial processes for Integrated Pollution Control
- under of charging scheme for dischargers, generated bills for £5.5M, and dealt with queries
- handled record numbers of enquiries to the Public Register

- set up a database on pesticides and highlighted issues of pollution by pesticides
- introduced new procedures for the recovery from polluters of the costs of incidents
- improved the reporting of pollution incidents
- managed the publication of literature on the prevention of pollution, including joint productions with others
- aimed to reduce the impact of incidents through 1500 visits to sites identified under the Groundwater Protection Policy, and sites flagged in Local Environment Agency Plans
- introduced Phase 3 of the programme for Groundwater Protection Zones and promoted the Protection Areas defined under Phase 2
- helped plan measures to mitigate cases of groundwater pollution (for example: Helpston and Sawston)
- developed the system of charges for Waste Management Licensing Regulations
- managed the National Centre on Toxic and Persistent Substances
- managed the agreement with the National Laboratory Service and improved the efficiency of the Laboratory; managed the contract for microbiological analysis
- continued to develop our systems for the management of sampling programmes and data, the validation of information, and the audit of water quality. And so improved efficiency and decision-taking
- achieved all our monitoring programmes, met our deadlines for reports and our commitments to International Agreements
- operated our Coastal Survey Vessel to assess the state of our coastal waters; assisted with national projects
- we took part in reviews of the efficiency of sampling and of Coastal Survey Vessels
- completed the monitoring for the 1995 River Quality Survey
- completed the review of non-statutory monitoring, and the monitoring of Groundwaters and Marine Waters
- prepared for the Agency

- met increased commitments for Directives; continued our input into policy for new and revised Directives
- dealt with queries referred by the Government's panel on the Vulnerable Zones introduced for the Nitrate Directive
- continued to support Research & Development

1.4 Outputs Planned for 1996

- establish and promote the Environment Agency
- policies on Water Quality integrated for the duties formerly carried out by Her Majesty's Inspectorate of Pollution and Waste Regulation
- policies taking account of new duties Sustainable Development
- policies taking account of new duties for Cost Benefit
- policies on new powers for Enforcement
- pressure of persuasion and enforcement to build on recent improvements in water quality
- reports on change in the quality of rivers and discharges, on the likely impacts of such changes, and on recommendations for action
- the results of the 1995 GQA for rivers, and the press launch
- reports for OFWAT and the DoE on the achievement of investment by Anglian Water; certification that the costs are correct
- assessments of the studies carried out by Anglian Water on coastal waters that may be High Natural Dispersion Areas under the Urban Waste Water Treatment Directive
- updates of the action needed to meet River Quality Objectives; planned and justified improvements to discharges
- priorities for investment by Anglian Water
- Cost Benefit Analyses; proposals for Statutory Water Quality Objectives
- a set of Local Environment Agency Plans harmonised with the investment plans sanctioned for Anglian Water and Directives

- sound plans for projects of special complexity (for example, the potential to use treated sewage effluent to augment water supplies, plans to control eutrophication)
- information on the implications for future statutory obligations, of recent schemes to remove phosphorus from discharges
- various items of policy and the training
- Authorised Industrial Processes; the start of the review of previously Authorisations
- Consents for discharges issued promptly and in line with national policy
- Bills for discharges for £5.5M; satisfied queries from customers
- satisfied inquiries of the Public Register
- recovery from polluters of the costs of pollution incidents
- reduction of the impact of incidents by a planned programme of site visits
- protection of groundwaters by Groundwater Protection Areas
- liaison with Local Authorities on contaminated land and plans for remediation
- encouragement of sustainable practices for the disposal of solid waste
- management of our agreement with the National Laboratory Service and others
- improved efficiency through improved systems for data management, the validation of data, and the audit of monitoring programmes
- new ways of applying our data to the issues for Local Environment Agency Plans, especially for Water Resources and Conservation
- sampling programmes that include the requirements of Integrated Pollution Control and Waste Regulation
- achievement of monitoring programmes to the required standards; completed commitments for national projects, Directives and International Agreements;
- implementation of national moves on a computer system for the management of sampling programmes

- sound cases for the designation in 1997 of Eutrophic Sensitive Areas under the Urban Waste Water Treatment Directive
- national and Regional data from our Coastal Survey Vessel
- operation of new networks for the monitoring of groundwaters and the new programme for marine waters
- meeting of increased commitments for Directives; new national policy
- preparations for the 1997 review of Nitrate Vulnerable Zones
- progress with R&D projects
- as in past years, the completion of unexpected projects required at short notice by the DoE etc
- Annual Reports; Business Plans; reports and presentations to Committees, National Groups, and Management Teams and external organisations like the CBI, English Nature and the NFU

1.5 **Input to National Policy**

Anglian makes a strong input to:

Policy and Training for Statutory Water Quality Objectives;
Negotiations with the Water Industry on investment;
Implementation of the Directive on Urban Waste Water Treatment;
High Natural Dispersion Areas (HNDAs);
Policy and Training on Consents and Compliance;
Implementation of the Nitrate Directive;
The National Strategy for Monitoring;
National Surveys of Water Quality in Rivers, Lakes and Estuaries;
Charges for Discharges;
Strategy for the Protection of Groundwater;
Policy on Land-use in Rural Areas;
Waste Disposal and Contaminated Land;
Pollution Prevention;
The North Sea and the Paris Commission;
Toxic and Persistent Substances; and,
R&D on Toxic Algae, Pesticides and Groundwater Pollution

1.6 Efficiency

Our data management systems help the Agency to realise the savings in manpower brought about by setting up the National Laboratory Service.

We shall make any changes in monitoring required by national policy whilst preserving our effectiveness though the use of Information Systems to make even better use of our data.

We shall save costs by implementing Regional Contracts. We shall recover more of the costs of Pollution Incidents. We shall save costs on our marine work by taking on external contracts for our Coastal Survey Vessel.

We shall enable savings in other Regions by providing national services for the North Sea, Blue-green Algae, Pesticides, National Surveys of River Quality, Setting Consents; and Mathematical Modelling.

Our computer systems will continue to focus our monitoring and eliminate wasted effort. Our computer based compliance systems will target Black-spots for action. The administrative resources freed by all this will be fed back to manage growth in work elsewhere.

We shall continue to use procedures which compare the performance of our Catchments and Areas. Recent comparisons of Regions show that we are efficient in the determination of Discharge Consents; in Charging for Discharges; and in dealing with enquiries on the Public Register.

1.7 Beyond 1996

Much of our work will continue to aim to protect water quality from the accumulating risks of impacts from growth, developments, abstractions, changes in land-use, accidents and pollution from past neglect. Details are in our Local Environment Agency Plans.

Special improvements will accrue downstream of the discharges that will benefit from the extra spend by Anglian Water negotiated under Asset Management Plan. We also expect improvements in water quality at 10 Bathing Waters following improvements by Anglian Water to sewerage and sewage treatment.

We shall also see improvements in 180 intermittent discharges over the next 5 years.

PART 2: RIVERS AND GROUNDWATERS

2.1 Chemical Monitoring

Much of our work depends on good data on river chemistry.

2.1.1 Routine Sampling of Surface Waters

Our 1995 programme for chemical monitoring is shown in Table 2.1:

TABLE 2.1

Numbers of Routine Sites and the Frequency of Sampling

Samples per year	Reservoirs	Rivers	Canals	Lakes	Totals
< 5	1	286	1	16	304
5 - 12	4	831	12	3	848
13 - 24	9	65	0	2	76
25 - 48	12	68	0	18	98
> 48	2	28	0	0	30
Totals	26	1278	13	39	**1356**

Most river sites are sampled 12 times per year. This monitoring allows us to characterise 4800 km of rivers. Over 16000 routine samples were used.

Samples of river sediments were collected at 139 sites, mainly for the Dangerous Substances Directive. The frequencies ranged from one to four per year.

Our routine programme for groundwater included 709 sites and 2613 samples. Sampling frequencies ranged from fortnightly to one per year, depending on the type of survey and the variability of water quality (see Part 2.9).

Table 9.1 in Section 9 gives additional detail.

2.1.2 Continuous Monitoring

We maintain a network of Automatic Monitoring Stations. These provide continuous measurements of water quality. Most stations are placed directly above the abstractions made by Water Companies, below major discharges of effluent, or at places where water is pumped from one river to another.

Results are sent by telemetry to operational staff. If any of the measurements exceed pre-set limits, the stations notify our Regional Communication Centre. Staff here will then instigate an investigation.

2.2 River Quality Classification

For 1995 the regular annual survey was part of the special quinquennial survey of England and Wales. A General Quality Assessment (GQA), or equivalent, has been carried out every five years since 1970. The survey leads to a report on the state of our rivers.

2.2.1 General Quality Assessment

The chemical assessment is based on 3 years' results of analyses stored on the Public Register, and standard, published methods of calculation. No subjective judgements are involved.

The Grade for a particular stretch is determined exclusively by Biochemical Oxygen Demand (BOD), Ammonia and Dissolved Oxygen. Table 2.2 gives details.

TABLE 2.2

Water Quality	Grade	Dissolved Oxygen (% Saturation) 10-percentile	Biochemical Oxygen Demand (mg/l) 90-percentile	Ammonia (mgN/l) 90-percentile
Good	A	80	2.5	0.25
	B	70	4	0.6
Fair	C	60	6	1.3
	D	50	8	2.5
Poor	E	20	15	9.0
Bad	F	-	-	-

The Classification of rivers for 1993-5 is shown in a map enclosed with this report. Overall, 87% of rivers fall into the Grades defined as Good to Fair Quality.

There has been a net improvement of 37% (1697km) since 1990, although the quality in the single year 1995 was slightly worse (8.6%) than in 1994. Of the upgrades, 11% (488 km) are statistically significant, whilst only 0.07% (3 km) of downgrades are significant. Figure 2.1 and Table 2.3 illustrate the overall picture.

Figure 2.1: 1995 GQA Grade - Up and Downgrades

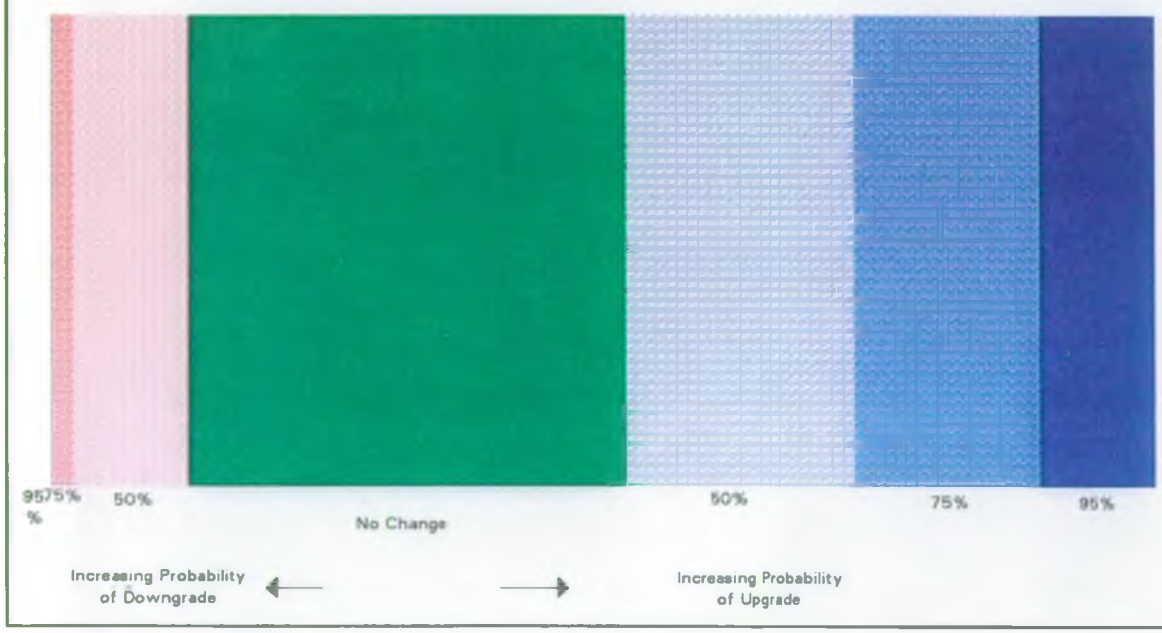


TABLE 2.3

Percent Length in each Grade

Grade	1990	1995
A	0.8	5.6
B	16.6	33.6
C	37.1	30.6
D	26.1	17.5
E	17.2	12.1
F	2.2	0.6

Investment in effluent treatment by dischargers has improved the quality of effluent from many sewage treatment works (see Parts 4.2.4 and 4.3.5). Specific examples of improvements in quality which are due to investment in sewage treatment are:

- Tighter effluent discharge standards, and capital investment by Anglian Water at Marston STW which serves Grantham, have resulted in 38 km of the River Witham being upgraded from moderate or fair to good.

- Improvements at Dunstable STW have lead to significant chemical and biological improvements to Ouzel Brook, part of the Bedford Ouse system.

- The River Wang in Suffolk has benefitted from better discharge quality from the Bernard Matthews factory at Holton.

Another factor is that overall. river flows were greater in the three years ending 1995 than in the three years ending 1990. Increased flows are a cause of some of the improvement seen since 1990. Figure 2.2 shows river flows for a number of sites.

Examples where flows have affected river quality are:

- Increased summer flows through the Gwash to Glen river transfer scheme were the main cause of chemical and biological upgrades in the River Glen, near Bourne, Lincolnshire.

- Also in Lincolnshire, biological and chemical qualities of 14km of the naturally slow-flowing and nutrient-rich River Ancholme improved, largely due to increased flows.

Pollution prevention initiatives over the last five years have also helped to reduce the pressure on our rivers.

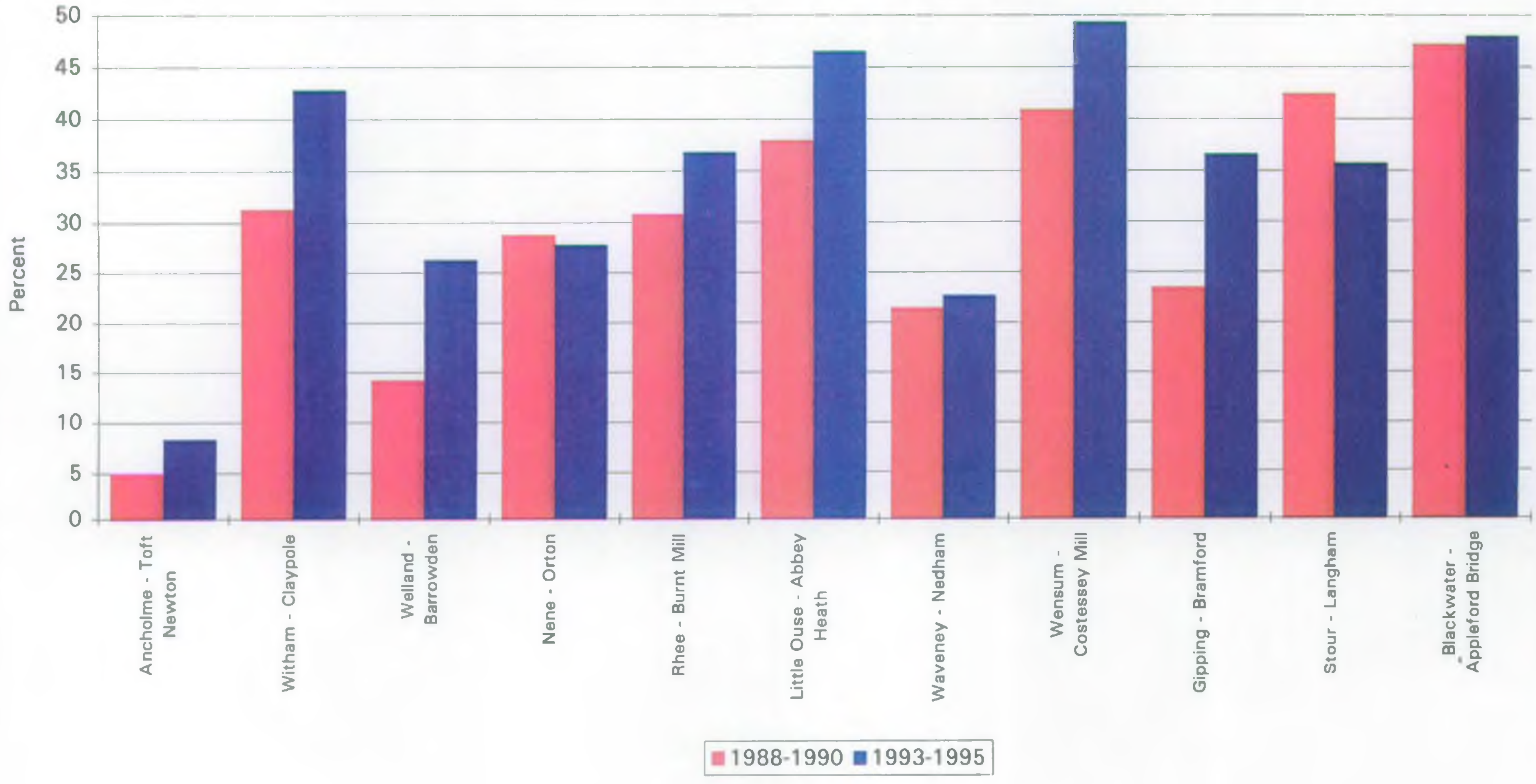
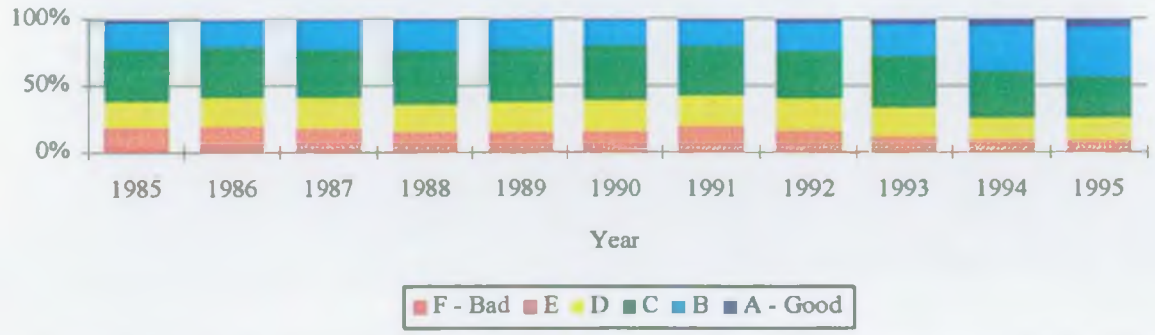


Figure 2.2:Percent of Long Term Average Flow

Looking further back, river quality showed a 4% deterioration from 1983/5 to 1988/90, and a 31% improvement between 1983/5 and 1993/5. The pattern given in Figure 2.3 shows that quality for 1995 was the best since at least the early 1980s.

Figure 2.3: GQA Grades 1985-1995
(for the 3328.4 km graded in each year)



This, when coupled with the net changes recorded for 1975 and 1980, under the old classification systems, suggest that in terms of pollution measured by the GQA, river quality in 1995 is better than it has been for at least 20 years.

The GQA is a national scheme which caters for the different types of river across England & Wales. A natural consequence of the nature of our rivers is that background levels of water quality appear worse than in fast flowing streams. In our Region, the growth of algae is encouraged by the nutrient-rich, slow-moving flow. This leads to algal activity in the laboratory test for BOD (algal-BOD), and to spurious, elevated results. Consequently, the Grades are pessimistic.

2.3 River Quality Objectives

The GQA provides an absolute measure of quality and is designed to show trend. A river in a good Grade will generally be a good fishery and suitable as raw material for a supply of drinking water. However, this cannot be guaranteed because a use can be affected by pollutants which are not in the GQA.

We use River Quality Objectives (RQOs), to plan actual improvements to river quality. RQOs ensure that river quality is checked against all the quality standards needed to support Uses.

Since 1979, we have had RQOs for 1350 stretches of river, totalling nearly 7900 km. Each river stretch has a group of Uses, and the amalgamation of the standards for all these Uses gives a set of water quality standards for that part of the river.

RQOs can now be underwritten by the Secretary of State for the Environment. When issued in this way the targets are Statutory Water Quality Objectives (SWQOs). These will be trialled for "pilot" catchments. The Cam is included in the first batch, and a three month period of public consultation on our proposals began in March, 1996.

The Agency uses Local Environment Agency Plans (LEAPS) to consult on RQOs and to prepare plans for meeting the RQOs. We shall also use these plans to prepare proposals to transform RQOs into Statutory Objectives.

At present RQOs in this Region cover the following Uses:

- River Ecosystem;
- Abstraction for Public Water Supply;
- Abstraction for Industrial Water Supply;
- Spray Irrigation of Field Crops; and,
- Livestock Watering.

Only River Ecosystem is a national system - though these standards are applied to all rivers. For other uses, plans will continue to be based on our Regional objectives for the present.

2.3.1 Compliance with RQOs

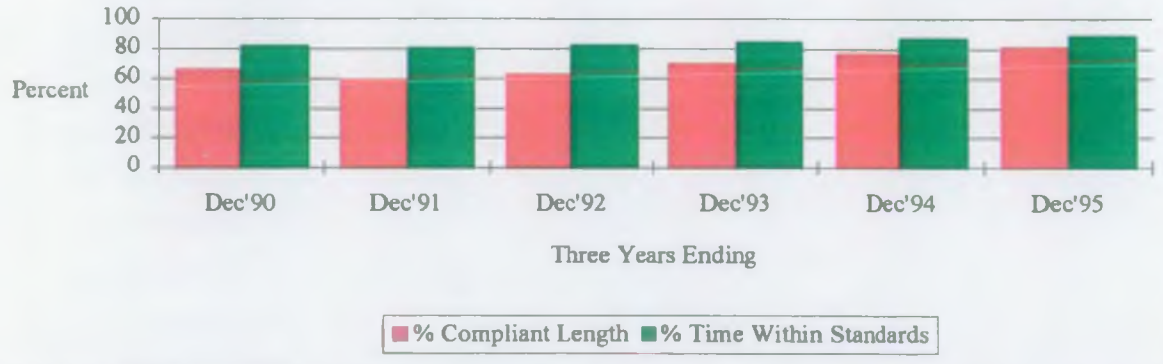
The determinands most often involved in decision-making are Dissolved Oxygen, Biochemical Oxygen Demand, and Ammonia. The impact of other substances, for example, pH, metals and pesticides, is also assessed against the standards set down in the River Quality Objectives.

River quality is variable and our use of sampling means that there is always a risk that we report wrongly that water quality has changed, that a river has failed to meet a standard, or that a river has passed a standard. We control this risk by using statistically-sound methods of assessing compliance and change.

Every three months, we audit and report the chemical quality of all rivers that are routinely monitored. (Much of the remaining river length is monitored biologically (see Part 2.6)).

The trends in compliance for the determinands for River Ecosystem (Dissolved Oxygen, Biochemical Oxygen Demand, Ammonia, Un-ionised Ammonia, pH, Copper and Zinc) are given in Figure 2.4. It shows results for the average percent of time for which rivers complied with standards, and the percent of total river length which met standards. These statistics, particularly the former, are stable measures of performance and small changes are significant.

Figure 2.4: Performance of Rivers against River Ecosystem Standards



For the three years ending in 1995, the percent of time spent within the limits was 89.2%, an improvement compared with 87.2% for the previous three years. Over the same period, 80.9% of river lengths were of the required quality. This compares with 76.6% for the three years ending in 1994. This improvement mirrors that reported above for the GQA.

2.3.2 The Impact of Effluents and the Drought

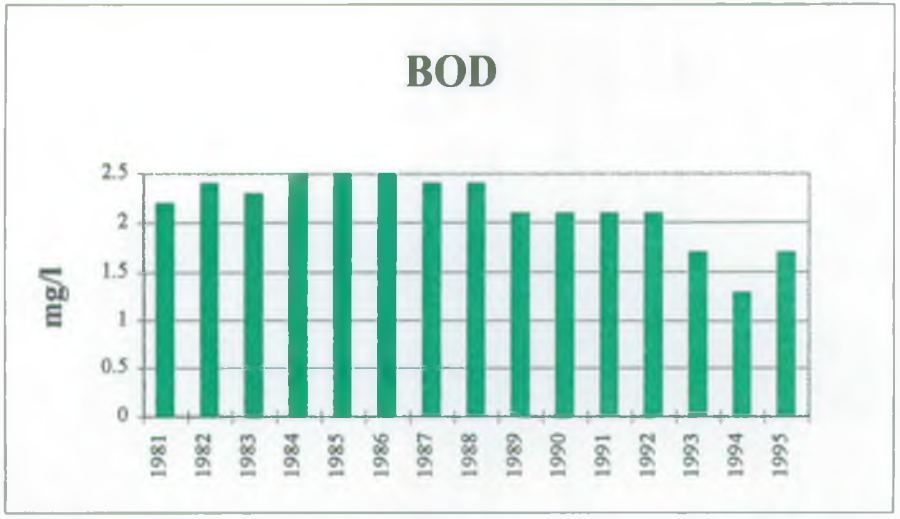
We investigate the causes of improved river quality by looking at median values of chemical quality. Median values are those which fall exactly in the middle of the range of values. They are reliable indicators of change because they are insensitive to extreme results or to changes in sampling rates.

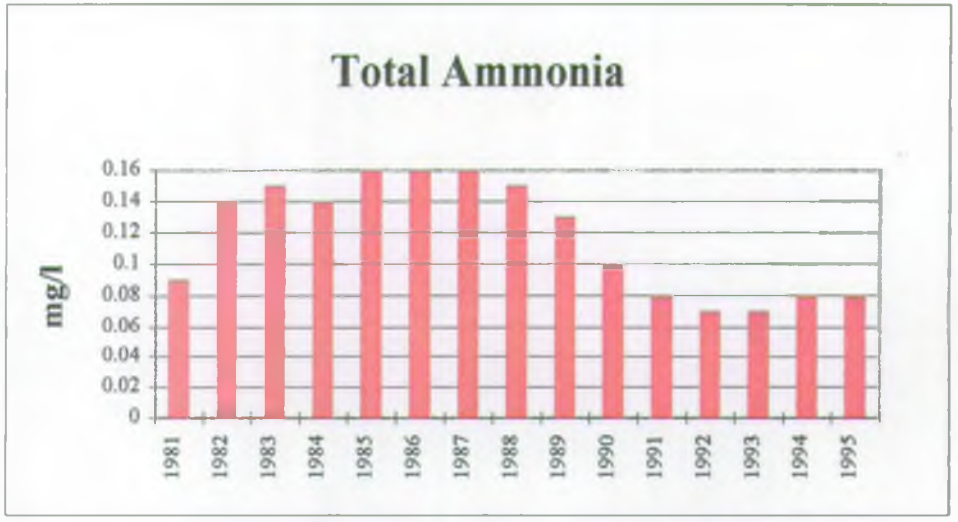
Results from median values for all the Region's samples taken each year are in Figure 2.5. This figure brings together the 182000 samples taken over 15 years.

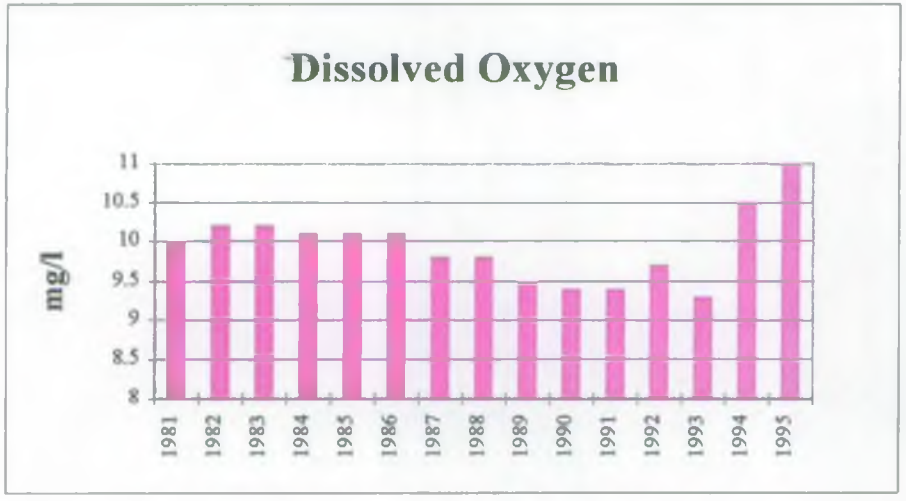
Since the mid-1980's, the values for BOD and Ammonia have improved. Conversely, values for Dissolved Oxygen deteriorated in the late 1980's and early 1990's - although they improved in 1994 and 1995. Dissolved Oxygen had been depressed by the low flows of the drought which ended in 1992.

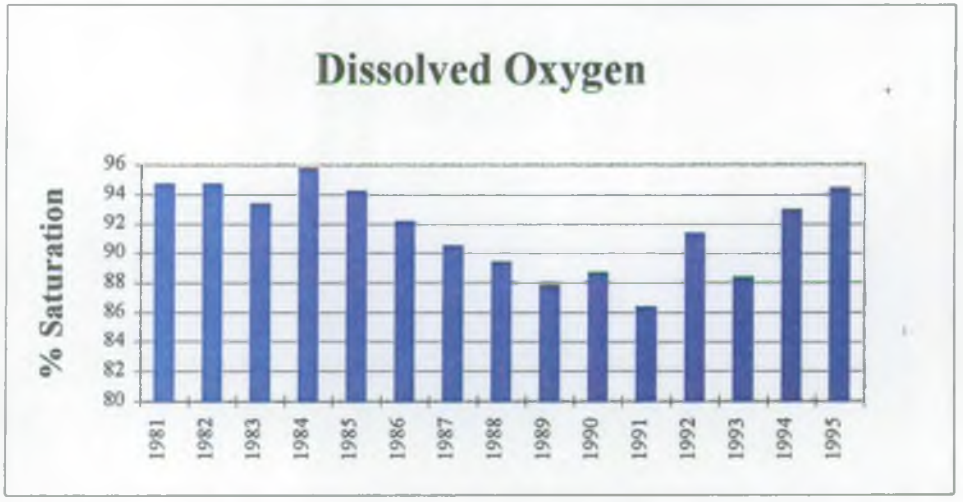
The improved concentrations of Dissolved Oxygen since 1994, are at least partly attributable to higher flows and lower temperatures following the drought. The continued lower concentrations of BOD and Ammonia indicates that another reason is the improvements in the quality of discharges.

Figure 2.5: River Median Values









2.4 River Quality Indices

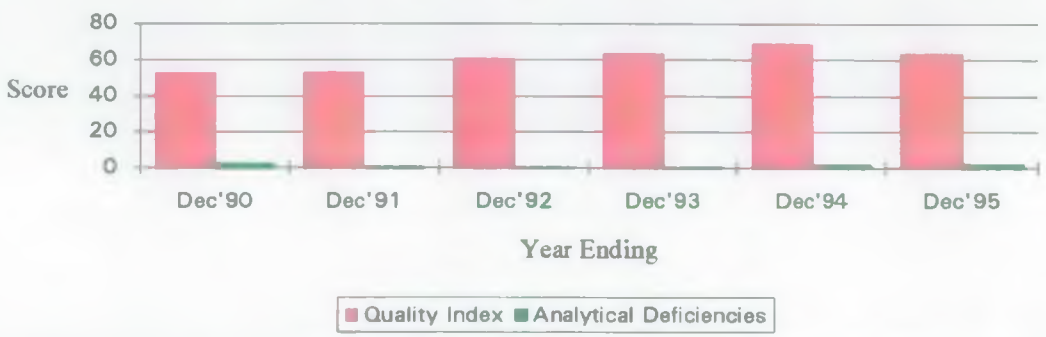
Much of the above discussion has concentrated on a few important determinands like Dissolved Oxygen and Ammonia. At many sites we need to assess compliance with the standards for over 90 different determinands (see Part 9). The management of this workload is aided by a system of River Quality Indices (RQIs).

Indices summarise water quality and measure performance in the management of monitoring. Data are compressed into a simple number which discriminates between good and bad quality.

They allow us to summarise information at a site, within a Catchment or an Area, or over the whole Region. They are used to direct resources to areas of concern and to ensure that our sampling programme covers all our obligations.

Figure 2.6 shows changes in the RQI since 1990. The target is to see Indices rise progressively towards 100. No derogation has been made for algal-BOD in these values. The picture confirms that chemical quality in 1995 was worse than in 1994 (see Part 2.2.1). In the improvements shown since 1990, it also demonstrates our ability to manage our sampling programme (in the reduction of scores for Analytical Deficiency).

Figure 2.6: Regional River Quality Index



2.5 Biology

Biological assessments are based mainly upon the monitoring of aquatic macroinvertebrates (small animals).

These animals live in river water and so provide information on the quality of the water which passes over them. If the water is polluted, even for only a few minutes, then some or all of them may die. Recovery of the community may take several months. This means that biology provides evidence of pollution which may have been missed by the routine spot-checks which form the basis of most chemical monitoring.

As some macroinvertebrates respond differently to different chemicals the data can give an indication of the type of pollution which has occurred.

Biological samples are collected as part of an annual survey (see Part 2.6.2). They are also collected to investigate pollution incidents and as part of special investigations. A variety of other work is carried out and a list is in Appendix I.

2.5.1 Presentation of the Data

Various systems are used to judge quality. The basis for these is the scoring scheme devised by the Biological Monitoring Working Party (BMWP). A family (taxon) of macroinvertebrates which is sensitive to organic pollution scores more highly (10 points) than one which tolerates pollution (1 point). The total BMWP score for a sample can range from 0 to over 150.

In addition, the Average Score Per Taxon (ASPT) is calculated by dividing the BMWP score by the number of scoring families present. This measure is often preferred to the BMWP Score because it is influenced less by errors in sampling.

The ASPT scores of samples have been given a rating as in Table 2.4.

TABLE 2.4

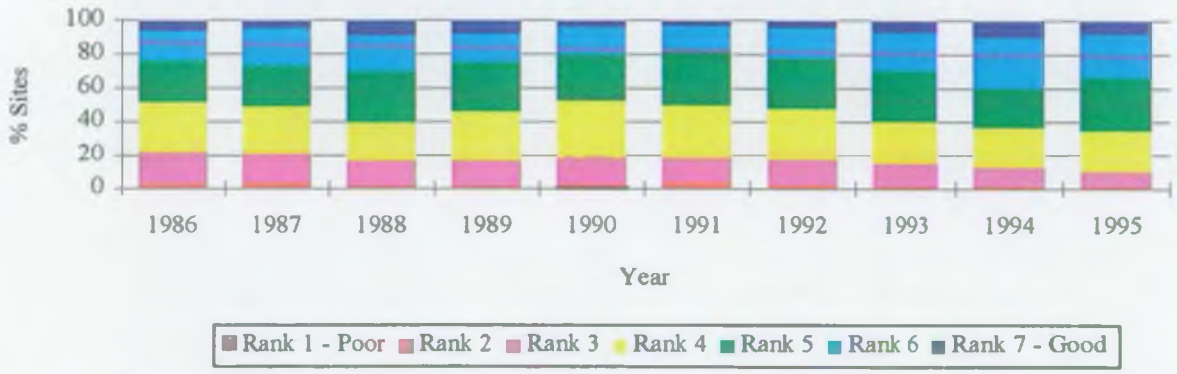
ASPT Ratings for Rivers

Habitat-Rich Riffles		Habitat-Poor Riffles and Pools	
ASPT	Rating	ASPT	Rating
6.0+	7	5.0 +	7
5.5 - 5.9	6	4.5 - 4.9	6
5.1 - 5.4	5	4.1 - 4.4	5
4.6 - 5.0	4	3.6 - 4.0	4
3.6 - 4.5	3	3.1 - 3.5	3
2.6 - 3.5	2	2.1 - 3.0	2
0.0 - 2.5	1	0.0 - 2.0	1

The percentage of sites in each ASPT rating is shown in Figure 2.7. In the years 1990 to 1992, the drought caused a shift to lower ratings. The break of the drought at the end of 1992, coupled with better water quality, can be seen in the results for 1993 and 1994. The 1995 data has fewer sites in the top categories, but also less in the bottom categories. Some of the decline in top quality sites may be due to low flows as a result of the dry summer.

Figure 2.7: ASPT Ranks

(156 sites common to each



Classification

Rivers vary in size, flow and in the background geology and topography. This means that the biology varies even when pollution is absent. Therefore, it is useful to describe the biota by comparing the actual biology with the biology predicted for natural conditions of water quality.

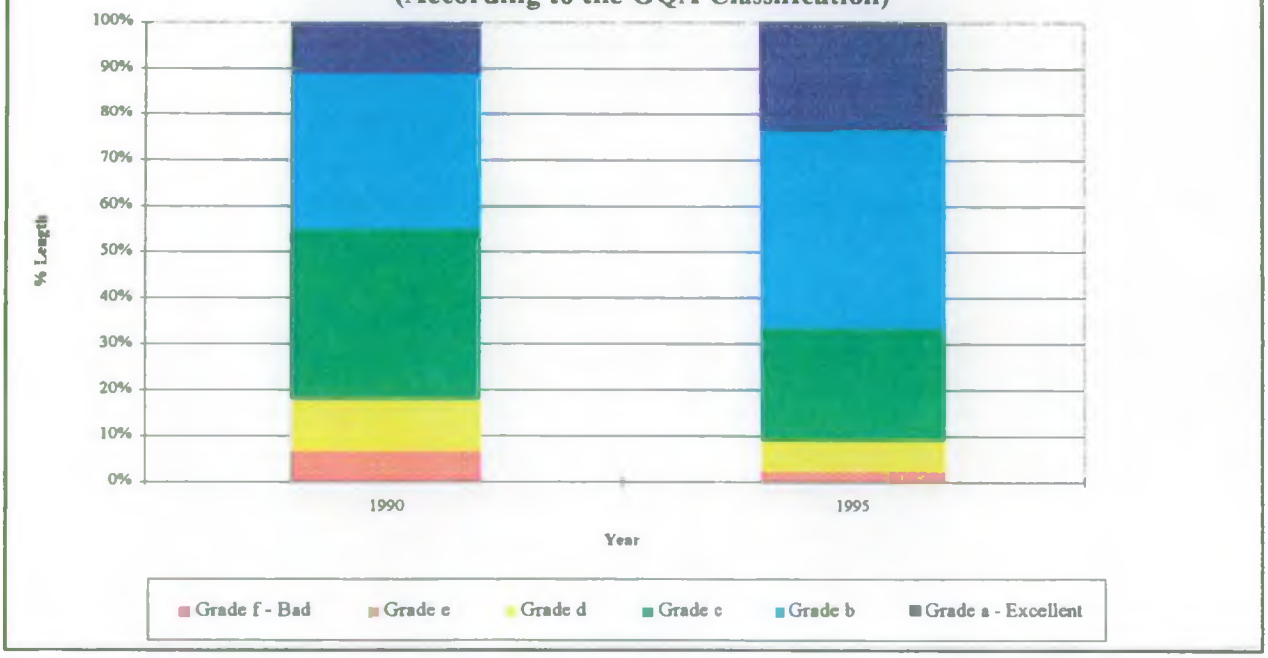
The DoE funded the Institute of Freshwater Ecology to develop a mathematical model that predicts the macroinvertebrates which should be found in natural conditions. The model is called RIVPACS, an acronym for River InVertebrate Prediction And Classification System.

If RIVPACS predicts a higher score than is observed, the results suggest that some form of pollution has occurred. RIVPACS has been used to develop a biological GQA scheme, based on the ratios of predicted and observed values for ASPT and Number of Taxa (see Table 2.5).

2.5.2 Biological Survey

The system of classification developed for the GQA survey divides the biological data into one of six classes, a-f. Details are in Table 2.5 and Figure 2.8. The results for 1995 are shown on a map included with this report.

Figure 2.8: Biological River Quality 1990-1995
(According to the GQA Classification)



Quality Assurance procedures were put in place to ensure that the data were accurate. This involved training staff and having 10% of samples checked by another biologist. A number of samples were sent to the Institute of Freshwater Ecology for further re-checking. The audits showed that we achieved the targets for the quality of our results.

TABLE 2.5

Class Limits for the Biological Classification

Biological Class	RIVPACS Ratio for ASPT	RIVPACS Ratio for Taxa
a	1.0	>0.85
b	0.90	0.7
c	0.77	0.55
d	0.65	0.45
e	0.50	0.30
f	-	-

We also used the grading scheme on 1990 data. The comparison shown in Table 2.6 draws on information from the 797 river stretches representing 4170 km of river which was surveyed in both 1990 and 1995. Over 66% of lengths is now in Grades

a and b.

Table 2.6
Biological Classification of Rivers in 1990 and 1995

Biological Class	% length in 1990	% length 1995
a	11.1	23.5
b	34.0	43.0
c	36.6	24.3
d	11.6	7.1
e	5.0	1.8
f	1.7	0.3

There has been a net improvement of 39% (1642 km) since 1990. This is made up from an upgrade of 49% and a downgrade of 10%. Of the upgrades 11% of the total length (453 km) are statistically significant, whilst only 0.6% (27 km) of the downgrades are statistically significant.

The improvement is reflected in fish stocks, with substantial shifts of river length from poor and moderate fish biomass grades, towards good and excellent.

What caused these changes?

In the last five years, improvements have been achieved by combinations of pollution prevention initiatives, substantial investment in effluent treatment, and increased river flows since mid-1992. (see Part 2.2.1)

2.5.3 Macrophyte Surveys

We can use river macrophytes to help identify and monitor areas affected by nutrients. High concentrations of nutrients may increase the abundance of tolerant plants, with a consequent decrease of diversity.

During 1995, 179 surveys were carried out for the Urban Waste Water Treatment Directive (see 2.6.5). For each survey, we compiled a list of the species and estimates of their abundance and cover.

2.6 Directives

The management of water quality is affected by the Directives issued by the European Union. They impose requirements to monitor, report compliance, and pursue improvements.

Some Directives have been in force for many years; the most important being:

- Dangerous Substances in Surface Waters;
- Surface Water Abstracted for Drinking Water;
- Freshwater Fisheries; and,
- Dangerous Substances in Groundwater.

During the last few years, new Directives have been adopted:

- Urban Waste Water Treatment;
- Pollution of Waters by Nitrates from Agriculture;
- Freedom of Access to Environmental Information; and,
- Standardised Reporting Directive.

Several Directives apply both to fresh and to saline waters. The detail on all of these Directives is described in this section. Directives which apply only to saline waters are in Part 3.

Most of the Directives prescribe methods of assessing compliance with standards. Hardly any takes account of the Laws of Chance in using samples to assess compliance. This means that the assessment can produce volatile results, and, in borderline cases, give incorrect statements of compliance. This must be borne in mind when considering action.

2.6.1 Dangerous Substances in Surface Waters

This has two lists of pollutants. List I covers those which are particularly toxic, persistent, and which accumulate in the environment. List II covers pollutants with less serious effects.

2.6.1.1 List I Substances

This applies to discharges to fresh and saline surface waters. We have to list the important discharges, and monitor the receiving waters and their sediments.

We have also to control all major discharges of Listed Substances, either through Consents, or by Authorisations (see Part 4.8).

In addition to monitoring at sites which may be affected by specific discharges (known as Discharge-related Sites), the DoE requires that we monitor background levels at a set of National Network Sites. These sites are mainly at the tidal limits of large rivers.

At the Discharge-related Sites in 1995:

[a] There were no failures at any of the 21 freshwater sites designated for Mercury, nor at the 42 sites designated for Cadmium.

[b] A failure occurred at one of the three freshwater sites monitored for Lindane. The site is downstream of the premises of Calders and Grandidge, near Boston. The site suffers from historic contamination by timber treatment chemicals. No problems have been detected downstream, in the Witham Haven.

A treatment plant was commissioned in 1994. A Consent was issued and the discharge had to comply with conditions designed to prevent further failures in the river. However, the company has appealed to the DoE about some of the conditions. The appeal has not been resolved.

There is contamination of the sediments in the river because of the former contamination of the site. It is likely that the sediments are contributing to the Lindane detected in water. There may be more failures in the future. We are investigating the extent of the contamination.

[c] The site designated for Carbon Tetrachloride passed.

[d] The two freshwater sites monitored for discharges of PCP passed.

[e] We have no freshwater sites for DDT.

[f] Under the "Drins" Directive, four freshwater sites were monitored. One of these failed for Dieldrin and Total "Drins". The site is downstream of Calders and Grandidge and the issue is being addressed as described in [b] above. There were no problems further downstream.

[g] The remaining substances in the "Drins" Directive are Hexachlorobenzene (HCB), Hexachlorobutadiene (HCBD) and Chloroform. We have no discharges for which we need to monitor freshwaters for HCB and Chloroform. We have one freshwater site at which we monitor for HCBD. The site passed in 1995.

[h] The one freshwater site monitored for tetrachloroethylene passed the standard. There is one freshwater site which was monitored for Trichloroethylene, Trichlorobenzene, and 1,2-Dichloroethane. There were no failures.

We have continued monitoring discharges which have previously had low concentrations of solvents. We shall assess whether the discharges need to be controlled for these substances.

A single National Network (background) site on the Blackwater Estuary, at Stansgate Abbey, failed for total DDT, Isodrin, Endrin, and Total "Drins". This exceedence was not statistically significant, and was caused entirely by difficulties in chemical analysis. We have corrected the problem.

2.6.1.2 List II Substances

We monitored the impact of 112 discharges to freshwaters. The following sites

exceeded the standards:

[a] Mintlyn Stream and Middleton Stop Drain, near Kings Lynn, both failed the standard for Iron. Both waters have high natural levels of Iron which originate from the Sandringham Sands. The failures are not open to control through Consent to discharge.

[b] Pix Brook at Church End, Arlesey near Letchworth, failed the standard for copper. This site is downstream of Letchworth STW which is known to receive copper from a trade discharge to the sewerage system. The amount of copper from this discharge has increased over the past couple of years. We have continued to liaise with Anglian Water and have proposed a copper limit for the Consent for Letchworth STW consent.

[c] The Dove at Manor Farm Bridge, near Stowmarket, failed for iron. The site is downstream of a water treatment works, whose discharge is know to contain iron. However, the effluent soaks away before reaching the main river for most of the year. We will investigate operational procedures at the works. In addition, this area has a high natural occurrence of iron its geology. This is the most likely cause of the failure.

Two sites which failed for List II in 1994, now pass: the Louth Canal at Alvingham Lock, near Grimsby, failed for iron, and Noblesgreen Ditch, Cherry Orchard Lane, near Southend, failed for copper.

2.6.1.3 Revisions to the Directive.

A proposed Directive on Integrated Pollution Prevention and Control (see Section 2.6.9) is aimed at controlling point source discharges, while a revised Dangerous Substances Directive will probably concentrate on diffuse sources. However, the timing and format of any revision to the Directive are unclear (see section 2.6.10).

2.6.2 Discharges of Dangerous Substances to Groundwater

This prohibits the discharge to groundwaters, of List I Substances, and limits the discharge of List II Substances. The substances differ to some extent from those for surface waters. No reports have yet been requested by the DoE (but see Part 2.6.7).

During 1992, we received a Direction from the DoE requiring that we classify substances as List I or List II. This work continued during 1995, and the results will be made available for public examination.

The Council of Ministers has asked the Commission to progress an amendment of the Directive which would incorporate it within a general policy for the protection of freshwaters. A group (including Agency representation) is drawing up proposals. The Council had asked to receive the proposals by March 1995. This did not occur due to the more fundamental review of legislation (see section 2.6.10).

2.6.3 Surface Water Abstraction

Surface water abstracted for public water supply has to comply with standards which depend upon the classification of the waters abstracted, and the type of treatment provided.

As in previous years, several sites failed for nitrate. These reflect the impact of agriculture. Action on these failures is one of the provisions of the Nitrate Directive (see Part 2.6.6).

Two other standards were failed for hydrocarbon compounds (PAHs and Dissolved or Emulsified hydrocarbons). None of these are believed to be caused by discharges. Dredging activities or boating are possible reasons. Should such failures recur, we will initiate the further investigations.

2.6.4 Freshwater Fisheries

400 km of salmonid (trout) fishery and 950 km of cyprinid (coarse fish) fishery have been designated.

The results of monitoring will be reported to the DoE under the Standardised Reporting Directive (see Part 2.6.7). 380.2 km (95%) of salmonid fishery complied. This is a 2% improvement on 1994. For cyprinid fisheries, 835 km (88%) complied. This is a 11% decrease on 1994.

Most of these failures were for Dissolved Oxygen and pH, and were due to the hot summer of 1995. This resulted in reduced river flows, and encouraged the growth of algal blooms, which in turn reduced DO and increased pH. These effects on DO and pH, when caused in this way, are less critical than similar effects caused, say, by discharges.

This Directive is one of those which is susceptible to the production of misleading results because of the Laws of Chance in sampling.

Sites which fail the Directive are at a greater risk of causing damage to fisheries than those which comply. However, we are not aware that any of the failures in 1995 have caused damage to fish.

2.6.5 Urban Waste Water Treatment

This imposes requirements on sewerage systems and sewage treatment. It requires that specified standards are achieved for the effluents. The stringency of the requirements depends on the population served by the discharge, and on the type of receiving waters.

Nutrient removal may be required for discharges are considered to contribute either to eutrophication, or to elevated concentrations of nitrate in waters abstracted for drinking (see 2.6.3).

When the Directive is fully implemented, Consents will be varied to incorporate its provisions. Dischargers will monitor their own effluents for the purposes of the Directive (see Part 4).

2.6.5.1 Eutrophic Sensitive Areas

Waters that are eutrophic, or at risk from becoming eutrophic, can be designated as Eutrophic Sensitive Areas. Sewage treatment works that discharge to these Areas may require nutrient removal if they serve more than the equivalent of a population of 10,000.

Using criteria set out by the DoE we proposed candidates for designation by the Government. In 1994, the DoE designated the first set. 33 were designated in England and Wales, 13 in our Region. Table 2.7 lists these and the discharges that are required to have phosphorus removal by the end of 1998.

At four year intervals, designations will be reviewed, and further designations will be considered. We are monitoring the 13 designated Areas, and a further 27 freshwaters, and 15 estuarine stretches, which we consider to be candidates for future designation.

We continued our surveys of aquatic plants (see Part 2.5.3).

TABLE 2.7	
Eutrophic Sensitive Area	STW's Requiring Phosphorus Removal
Hanningfield Reservoir	Bocking, Braintree, Shenfield
Ardleigh Reservoir	Halstead
Alton Water	Needham Market, Stowmarket
River Bure	Stalham
River Ant	Stalham
Cut Off and Relief Channel	See [1]
Grafham Water	Cotton Valley, Bedford, Chalton
Foxcote Reservoir & Hyde Lane Pit	Brackley
Pitsford Reservoir	Whilton
River Nene	Great Billing, Broadholme, Whilton, Corby
Rutland Water	Oakham, Great Billing, Broadholme, Corby
Louth Canal	Louth
Covenham Reservoir	Louth

[1] - see below

When the Cut-Off Channel was designated, the DoE asked us to determine the inputs of phosphorus, and whether nutrient removal would have any effect. During 1995 we completed this study, using our SIMCAT model (see Part 2.14), and made recommendations that nutrient removal could be worthwhile only for discharges made direct to the Cut-off-Channel.

2.6.5.2 Sensitive Areas for Nitrate

This applies to surface waters used for water supply which have abstraction points with high concentrations of nitrate. Sewage treatment works that serve more than the equivalent of 10,000 people and which discharge directly into the Sensitive Area may be required to have treatment which is *more stringent* than secondary.

This part of the Directive is being implemented in tandem with the Nitrate Directive (see Part 2.6.6). We have already reported on the contribution of nitrate from large sewage discharges. This information will be used by the DoE to decide the form of *more stringent* treatment. In 1995, the DoE continued to carry out work on what form the *more stringent* treatment should take, in consultation with ourselves and Anglian Water. It is likely that DoE will announce the designations during 1996.

2.6.6 Pollution of Waters by Nitrates from Agriculture

This aims to protect surface and groundwaters from pollution from agriculture. The requirements come into force over the next few years.

Member States must identify *Polluted Waters*. These can be surface waters with elevated nitrate concentrations which are abstracted for drinking water, groundwaters with high nitrate, or waters which are eutrophic because of nitrate.

During 1992, we undertook the monitoring required for the identification of Polluted Waters. Further monitoring will be required for a review of every four years. The first review will be during 1997.

Following the identification of Polluted Waters, Nitrate Vulnerable Zones (NVZ's) are designated. These are areas of land draining to the affected waters.

During 1993 we identified Polluted Waters and the boundaries of the catchments draining to them. This information was used by MAFF and the DoE to define the Zones.

In addition, we identified groundwaters which have high nitrate concentrations and the catchments (NVZ's) draining to them. We used data from Water Companies for some of this work.

Groundwater NVZ's will be based around boreholes that are used for Public Water Supply. Work on this is being linked to our Groundwater Protection Policy (see Part 2.9.2).

Anglian has nearly two thirds of the total area proposed for NVZ's.

In 1994, the proposed surface and groundwater NVZ's were the subject of public consultation. Hundreds of representations were made to MAFF and to us. During 1995, MAFF and DoE published revised proposals.

At this stage farmers affected by the proposals were given an opportunity to make representations to an Independent Review Panel. We provided a great deal of information to the Panel. The Panel reported in 1995. It made recommendations about the extent of proposed NVZs, and commented on how they were defined. The Panel made favourable comments about our role in the process.

In 1996, the Government announced the designation of 68 NVZs in England and

Wales, of which 20 were all, or partly, in Anglian Region.

Action Programmes must be established and implemented within six years of designating the Zones. The Programmes will detail the mandatory restrictions on agriculture. The draft Programmes were published by MAFF during 1995, and were the subject of public consultation.

A Code of Good Agricultural Practice is also required. This must aim at achieving a general level of protection from nitrate pollution. This Code will be compulsory within Zones, but voluntary elsewhere. It is likely to be similar to the Code of Good Agricultural Practice that has existed for several years.

More details on nitrates are given in Part 2.10.

2.6.7 Standardised Reporting

The Commission will receive data, for every year, for all environmental Directives, from all Member States. This will provide information on the state of the environment, and the degree to which legislation is being complied with.

We report annually to the DoE. The DoE collates these reports and passes them to the Commission at the end of each three year reporting period.

2.6.8 Freedom of Access to Environmental Information

The aim is to ensure access to the information held by public bodies. The Directive sets out conditions by which information is made available.

This right of access has been much used by the Public, Pressure Groups and businesses. In effect, the Directive codifies the practice of the Agency (which has always sought to make information available). (The information given out through our Public Register goes beyond what is required by the Directive, see Part 5).

During 1995, 266 enquiries were made under this Directive, as opposed to via the Public Register..

2.6.9 New Directives

The following new Directives are proposed (but see Section 2.6.10):

- Ecological Quality of Surface Water:

  Proposals were published by the Commission in 1994. These would allow Member States to set up systems to assess waters. Member States would then define targets, and implement action to achieve them.

Our Local Environmental Action Plans and our Statutory Water Quality Objectives (see Section 2.4) could be the way to implement some of the Directive. Once the Directive is adopted (which is likely to take several years) some other Directives will be annulled.

- Integrated Pollution Prevention and Control.

  This is similar to Integrated Pollution Control (IPC) (see Part 4.8). It seeks to control emissions from the industrial processes using the principle of Best Available Techniques. The proposals include more industries than currently controlled by IPC.

  During 1995 the final version of the Directive was adopted by the Council of Ministers. The text must now be approved by the European Parliament.

2.6.10 Review of EU Water Legislation

Much of the water legislation is nearly 20 years old. During the past few years there have been proposals to revise Directives, or for completely new Directives. The proposals have to be approved by the European Parliament and the Council of Ministers before they are adopted.

Whilst considering the proposals on the Bathing Water Directive, the European Parliament suggested a more fundamental review of water legislation. This approach was endorsed by the Council of Ministers, and the Commission was asked to carry out the review. Negotiations on new or revised Directives has been halted, whilst this review is carried out.

2.6.11 European Environment Agency

This was set up by the European Union in 1993. It is based in Copenhagen. Its purpose is to produce assessments of the environment.

During 1995 the European Agency produced a report, *Environment in the European Union (also known as the "Dobris Assessment")*. The main conclusions are that the European Union is making progress in reducing certain pressures on the environment, but not enough for sustainability. On the water environment, contamination of groundwater by nitrates and pesticides are cited as particular problems.

2.7 Pollution Prevention

Following the success of setting targets for site inspections in 1994, targets were set again for 1995. These were assigned according to local priorities, such as farms, groundwater protection and known problems. The latter includes visits to schools, hospitals or sites implicated in a pollution incident.

A target for 1995 of 1340 inspections was set and 1767 were achieved, representing an increase of nearly 19% on 1994. Targets have been increased in 1996 and extra emphasis is being placed on ensuring that the quality of the work is maintained.

Successful measures to pollution prevention requires liaison with many organisations: industry, agriculture and the general public. During 1995 work has been carried out both externally and internally with the Public Relations Department and other Regions. A list of *Pollution Prevention Guidance Notes* is at Appendix II.

In response to the increasing number of pollution incidents attributed to oil, a National Oil Care Campaign was launched in 1995. The campaign, aimed at those who store or use oil and produce waste oil, was given wide coverage by the media. Thousands of leaflets and other information has been distributed in the Region. An 0800 Freephone number giving location of the nearest oil recycling bank proved very useful.

As well as dealing with National campaigns, local campaigns included a joint venture with Cambridge Water Company where all their business customers were mailed with advice on Pollution Prevention.

Many industrial estates were targeted for site inspections. Pollution incident statistics were used to help determine priorities for press campaigns. Campaigns for the pig and poultry farming were started in 1995 as well as several long term initiatives on educational information for schools.

We have been working with the Fertiliser Manufacturers Association in 1995 on the publication of a *Code of Practice for the Prevention of Water Pollution from Fluid Fertilisers*. Anglian Region has half the national pollution incidents attributed to fertilisers, and several serious incidents involving the loss of fluid fertilisers prompted this liaison. Fertiliser incidents will be kept under review to see if further guidance is needed.

Liaison with the Health and Safety Executive (HSE) continued in 1995 on a range of issues and culminated in a joint seminar with Buckinghamshire Waste Regulation Authority, Anglian Water, HSE and ourselves. This looked at the storage of chemicals and the control of the risk of spills. The seminar was attended by over 60 representatives from companies in Buckinghamshire, Bedfordshire and Hertfordshire. It highlighted the value in holding joint initiatives with the business and industrial sector.

2.8 Pollution Incidents

Formal records of pollution incidents began in 1974 and, since 1991, they have been held on a computer system called POLLEASE. This enables field staff to enter details on to computers as they carry out their investigations.

Incidents are categorised into 4 groups according to their severity. These are: Category 1 (major), Category 2 (significant), Category 3 (minor) and Category 4 (unsubstantiated or no pollution). Within each category a proportion of incidents will be caused by natural effects such as low oxygen resulting from accelerated algal growth. In previous years this sort of incident has been recorded as 'no pollution', but since the effects of such conditions can kill fish, or affect the water quality at supply intakes, this practice has been changed.

2.8.1 1995 Incidents

In 1995, we dealt with 3416 reported incidents. This is a decrease of 7.5% over 1994. Anglian had 9.5% of the National total. The number of substantiated incidents (that is, confirmed on inspection) was 2156 (63%).

Category 1 incidents were 12 in 1994 and 15 in 1995. The causes are shown in Table 2.8.

TABLE 2.8

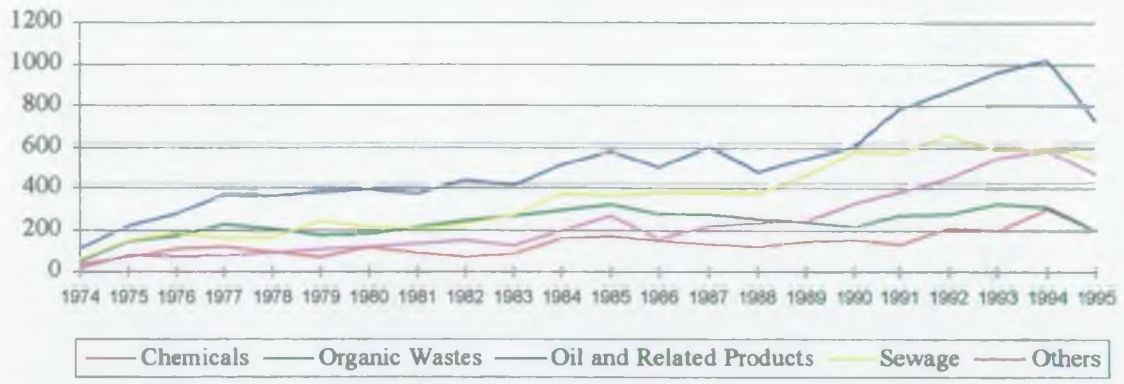
Category 1 Pollution Incidents

Oil	3
Sewage	3
Chemicals	4
Organic Wastes	1
Others	3
Total	15

Category 2 makes up 9.4% of the total, Category 3 is 53.3%, and the remaining 36.9% were Category 4.

The nature of the pollutant is classified into five basic types: oil, sewage, chemical, organic wastes and 'other'. Figure 2.9 shows the number of incidents reported annually since 1974.

Figure 2.9: Number of Pollution Incidents by Type of Pollutant



Oil accounts for most incidents (734), with incidents caused by sewage next. Examples of incidents during the year include:

- Pig slurry, applied to saturated fields entered Wilstead Brook, near Houghton Conquest in Bedfordshire, through land drains. J D Wilson of Chapel End Farm was fined £10,000 with £200 costs.

- Diesel oil entered a tributary of the Bourn Brook, near Bourn in Cambridgeshire. Pre-start were found guilty and fined £3,000 with £1,300 costs.

- Fertiliser entered Green End Brook at Great Barford killing 200 fish. Davison & Co (Barford) Ltd were found guilty and fined £1,000 with £631 costs.

- Food material entered the Middle Level Main Drain at Upwell. Greenbanks Drinks Co. Ltd were found guilty of a breach of their consent and fined £3,000 with £850 costs.

- In July, 700 fish died in the Nene at Earls Barton, as a result of poor quality effluent being discharged from Billing STW following mechanical failure. Use of aeration equipment prevented further fish from dying.

- Food waste entered the Rase at Market Rasen in August, leading to the death of 390 fish. The source was identified through liaison with Anglian Water.

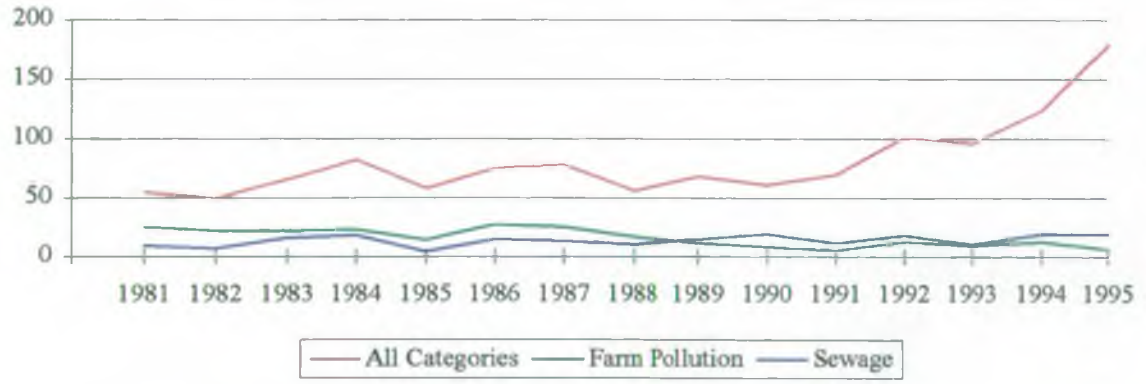
- 150 fish died in a pond in Burrough Green in October. This was the result of an algal bloom, which induced low oxygen concentrations.

Further details of prosecutions are given in Part 2.11 and Appendix III.

Figure 2.10 gives a breakdown of incidents resulting in fish mortalities. The total number has increased since 1993 and many are due to 'natural causes' such as low

dissolved oxygen concentrations.

Figure 2.10: Number of Pollution Incidents Resulting in Fish Mortalities



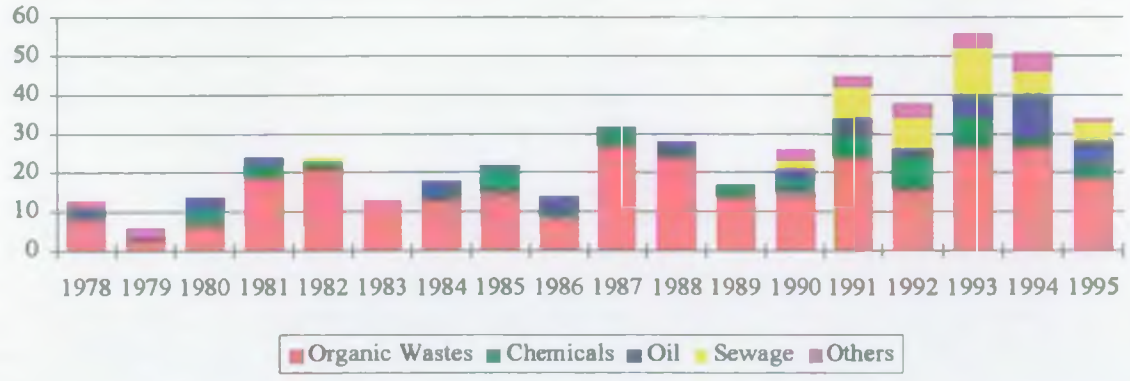
Better use of powers and our growing effectiveness at pollution prevention can further reduce the number and impact of incidents. However, any decrease in the number of incidents continues to be offset by increased public awareness resulting in the reporting of incidents.

2.8.2 Prosecutions for Pollution Incidents

It is an offence to *cause or knowingly permit any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters*. Prosecutions for incidents are normally brought only where serious pollution has occurred, or some negligence or deliberate act was involved, and where sufficient evidence can be accumulated to mount a successful case.

This means that the number of prosecutions is a small fraction of the total number of incidents, and some prosecutions are not bought to court until the following year. The cases brought to court in 1995 are listed in Appendix III, and trends in the prosecutions over the last 17 years are shown in Figure 2.11. In 1995, 34 prosecutions for pollution were undertaken, including two for breach of discharge consent.

Figure 2.11 Number of Prosecutions for Pollution Incidents by Type of Pollution



In 1994, Anglian Region prosecuted under the Control of Pollution (Silage Slurry and Agricultural Fuel Oil) Regulations 1991. This was for two offences of pollution and an offence of storing slurry contrary to the Regulations. The total of the fines imposed was £22,000 plus costs.

In November, two further charges were brought under Section 85 (3) of the Water Resources Act (1991). The defendant had refused to pay fines for the earlier convictions. The magistrates indicated that because of his lack of care and refusal to pay earlier fines they were considering a custodial sentence (a maximum of 3 months). The defendant was finally ordered to undertake 200 hours community service and to pay costs of £950. This is the closest anyone has come to receiving a custodial sentence for a pollution offence.

In addition to prosecuting, we can issue Formal Cautions. These are issued for pollution incidents where it is inappropriate to prosecute but it is clear that an offence has been committed. Such a caution, whilst not leading to court action, does require the offender to acknowledge guilt. In 1995 there were 15 formal cautions (See Appendix IV).

2.8.3 Pollution Incident Cost Recovery

In 1994, the National Audit Office highlighted as a cause for concern, our performance in recovering the costs of pollution incidents. New policy introduced during 1995, laid down procedures for the recovery of all costs for all pollution incidents. These are followed for Category 1 and 2 incidents, and with discretion for Category 3 incidents, and for Category 4 incidents where we have incurred costs in preventing pollution. Increasing efforts are being made to recover all costs associated with pollution incidents.

The need to update POLLEASE meant that full recording of cost recovery did not begin until October 1995.

2.9 Groundwater

Half of the public supply of drinking water in the Region is taken from groundwaters. In most cases these supplies require treatment only by disinfection before distribution to customers. In addition to the large boreholes used for Public Water Supply, there are thousands of abstractions for supplies for agriculture and industry and many wells are used for private supplies of drinking water.

2.9.1 Monitoring

Based on new national guidelines, a monitoring strategy has been developed. The network contains 724 sites. The analyses range from simple tests, to measurements for metals, pesticides and microbes (see Part 9). Most of the big boreholes are owned by Water Companies, and we regularly obtain their data, to supplement our own.

2.9.2 Protection

Protecting the quality of groundwaters is important because the resource is so valuable and because pollution is very difficult to remedy once it has occurred. Our Groundwater Protection Policy gives a framework. It is used to achieve our own duties and to influence others, for example, in responses in the planning processes of Local Authorities.

We have started a review to answer to two questions: *Who has used the policy?* and *How has it been used?* The results will be reported in 1996.

Our Policy is based on two strategies:

i) **Resource Protection**. This protects potential or future abstractions. It uses Vulnerability Maps which classify strata into Major, Minor, and Non-Aquifer. Major and Minor Aquifers are further classified as High, Intermediate, or Low Vulnerability. These classifications are based on the rate at which pollutants might travel downwards through the ground to reach the water table - the greater the rate, the greater the vulnerability. In turn the rate of travel is related to the nature and thickness of the soil and solid strata overlying the aquifer.

A proposed development in a high vulnerability area presents a greater risk to than the same development in an area of low vulnerability.

Maps at 1:100,000 scale of the Humber Estuary (No. 13), Nottinghamshire (No. 18); Lincolnshire (No. 19), North Northamptonshire (No. 24), West Norfolk (No. 25), Bedfordshire (No. 31, North Essex (No. 32), East Suffolk (No. 33), West London (No. 39), Thames Estuary (No. 40) are available from HMSO at a cost of £9.95;

ii) **Source Protection**. This applies to boreholes, wells and springs that are used for potable water supply, including supplies to food and drink industries. Three Protection Zones are placed around each source. Zone 1, the inner zone closest to the source, is based on a 50 day travel time in groundwater to the source. Zone 2 is further away from the source, and is based on a 400 day travel time. Zone 3, the total catchment of the source, is the whole area from which the source obtains its water. The Zones are shown on maps are non-statutory, and their size and shape may change with time. The Zones represent areas where groundwater abstractions are at greatest risk of impact by man's activities, the risk being greatest in Zone 1 and Zone 2 areas.
By the end of 1995, we had defined zones around 140 sources. Fifty of these were given priority for completion so that we could define Nitrate Sensitive Areas (see Part 2.6.5.2 and Part 2.10.2) and Nitrate Vulnerable Zones (see Part 2.6.6).

There are 218 large sources to be zoned. "Large" is an abstraction greater than 90 thousand cubic metres per annum (tcma). We have started the next phase of work for these sources. Maps will be compiled in 1996.

Sources with abstractions less than 90 thousand cubic metres per year are classed as "small". We have developed a method for deriving protection zones around these sources. There are several thousand small sources in the Region.

Activities which pose a threat to groundwaters are grouped together as:

A. Abstractions;
B. Physical disturbance;
C. Waste disposal;
D. Contaminated land;
E. Disposal of liquid wastes;
F. Discharges to underground strata;
G. Diffuse pollution; and,
H. Other activities.

Our view on the acceptability of these activities, and the controls we should like to see exercised, is governed by whether or not it is located in any Source Protection Zone, or on the vulnerability of the groundwater resources.

As part of our work to prevent pollution, inspections have been carried out in the inner and outer Source Protection Zones, and will continue during 1996 (see Section 2.7).

We have continued to press operators of Waste Disposal Sites to prevent leachate causing damage to Controlled Waters. For new and proposed Landfill Sites, we stipulate systems for the containment and extraction of leachates, according to the Agency's guidelines.

The landspreading of wastes, such as sewage sludge, is an activity that could affect the quality of groundwaters and surface waters if it were not adequately controlled. We have been part of the national group with the National Association of Waste Regulation Officers, which produced a guidance, *Controlling the Landspreading of Wastes*, for use by all concerned with these activities.

2.9.3 Remediation

We work closely with private bodies and local authorities to investigate and improve the conditions around a number of contaminated Public Water Supply sources. These include the areas in catchments of boreholes at Beck Row, Letchworth, Birchmoor, Quidenham, Cambridge, Sculthorpe, and Etton.

The Agency is involved with the Defence Estate Organisation (DEO) at RAF Mildenhall over the development of a remediation scheme for the groundwater beneath the airfield.

We continued to liaise with Glanford Borough Council on a scheme to reclaim contaminated land on a site at Barton-upon-Humber. On completion of the clean-up, we anticipate that the potential for pollution of the chalk aquifer and the River Humber will be reduced.

An interim management plan for the area of contaminated groundwater around Helpston has been finalised. Over the next few years we shall continue to monitor the groundwater by a series of specially constructed boreholes. Also, the discharges from "wild" boreholes will be monitored, and our predictive modelling will be further developed.

Our monitoring will allow us to assess the risks. If necessary, we shall then control of the situation by preventing discharges to surface waters and by controlling the underground plume of pollution. This will protect the environment and the public supply well at Etton. In due course, the best longer term solution will be identified.

At Eastern Counties Leather, Sawston near Cambridge, we are continuing to monitor the movement of perchlorethylene pollution in the aquifer and the effectiveness of the limited groundwater pumping which the company is carrying out. This site has been used as a case study in a project to develop strategies for investigating and treating such polluted groundwaters. Detailed proposals for this site are included in the report of the project, and their feasibility will be assessed in the near future.

2.10 Nitrate

2.10.1 Nitrate in Rivers

Figure 2.12 illustrates the variability of nitrate concentrations at points where water is abstracted for public supply. It suggests that since 1976, an upward trend has levelled off.

2.10.2 Nitrate Sensitive Areas

The Water Resources Act (1991) allows for the designation of Nitrate Sensitive Areas (NSA's). These are areas of land where nitrate concentrations in sources of public drinking water exceed, or are at risk of exceeding, the limit laid down in the Drinking Water Directive.

In 1990, following notification of Candidate Areas, and after consultations with farmers, MAFF established 10 Pilot NSA's. Two are in Anglian Region, one at Sleaford and the other at Branston Booths, near Lincoln.

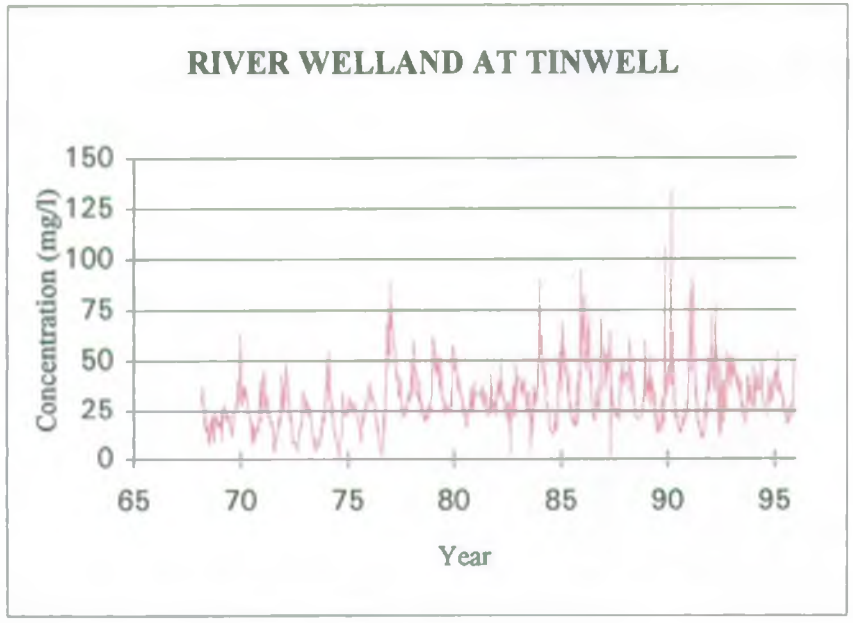
In 1994, MAFF introduced a new scheme (using EC funding) involving the catchment areas of a further 22 groundwater sources. Of these, 5 are in Anglian. The Pilot NSA's were incorporated into the new scheme. The net result for Anglian Region is 7 NSA's, namely Sleaford and Branston Booths together with Aswarby (adjacent to Sleaford), North Lincolnshire Wolds, Sedgeford (north west Norfolk), Slip End (near Royston) and Birchmoor (Woburn).

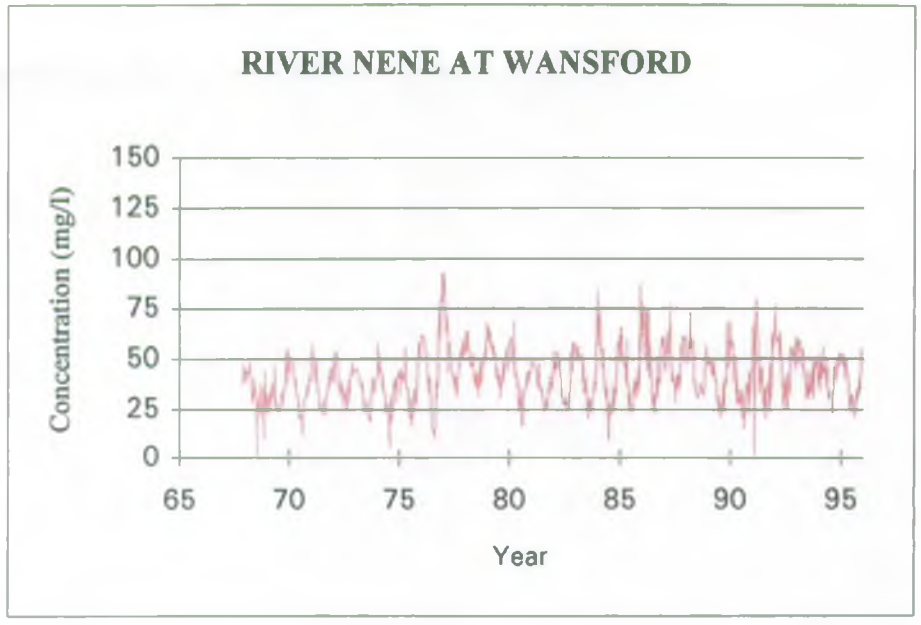
There are three voluntary options within the NSA scheme - Premium Arable, Premium Grass, and Basic. These have different rates of compensation for farmers depending on the scale of changes made to the management of their land.

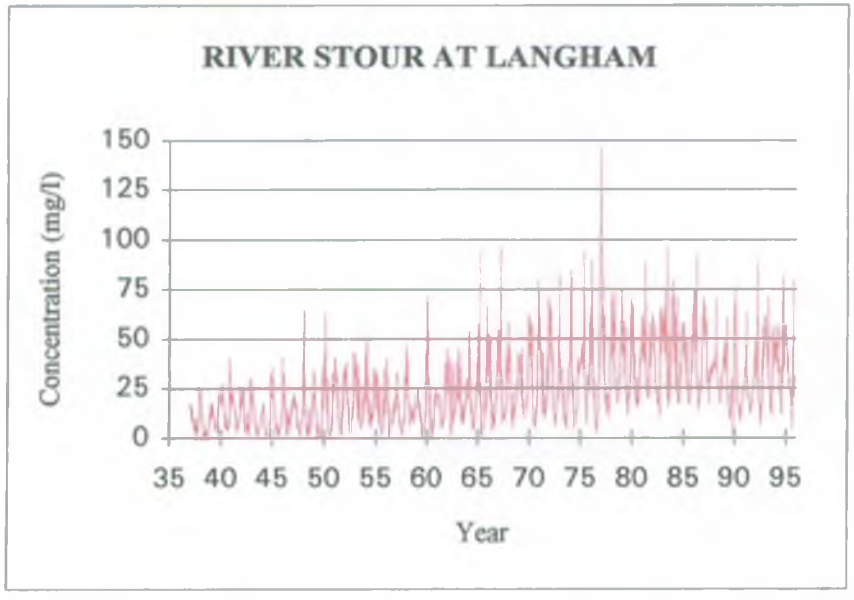
Premium Arable involves the conversion of arable land to extensive grass; the Premium Grass involves extensification of existing intensively managed grassland; the Basic Scheme allows for continuation of arable cropping but requires farmers to follow agricultural practices designed to reduce nitrate leaching.

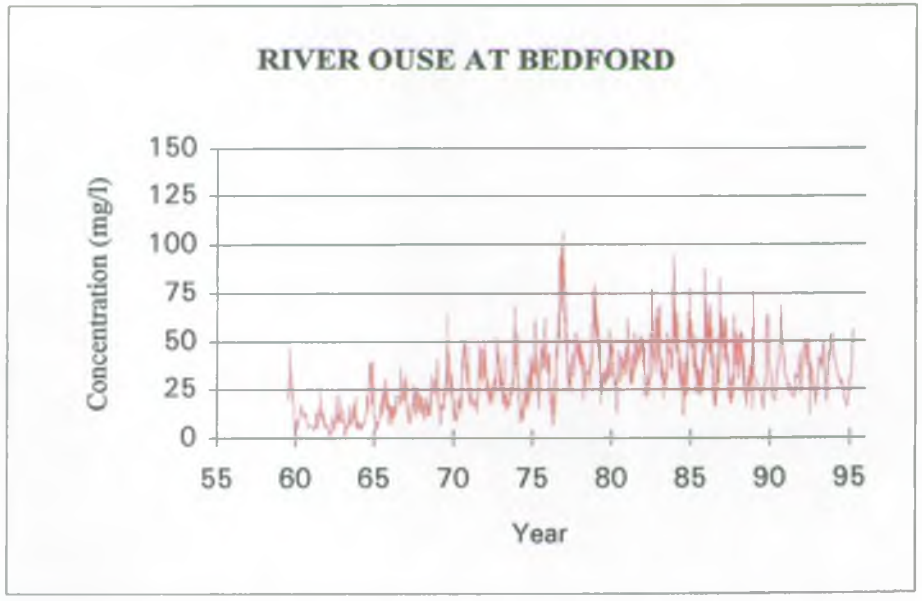
All options include requirements to retain certain environmental features on, or bordering, any land in the scheme.

Figure 2.12: Observed Nitrates





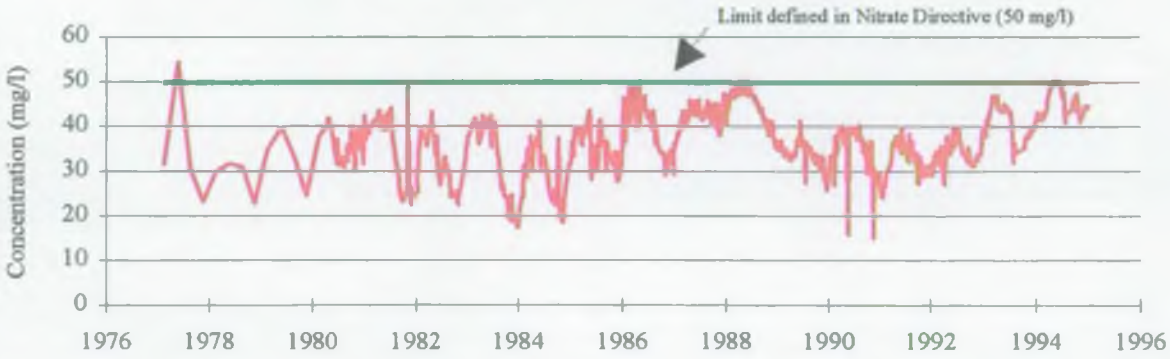




Virtually all the land in the Pilot NSA's was entered into some part of the initial scheme. The uptake of the new schemes is not yet known.

In conjunction with the Water Companies (whose boreholes are being protected by the NSA's), we monitor nitrate within the NSA's and at the boreholes themselves. The results are sent, through MAFF, to the farmers involved, and are available on the Public Register. A plot is given in Figure 2.13.

Figure 2.13 Branston Booths Nitrate Concentrations



The apparent reduction in nitrate starting in 1989 is due to the effects of drought. The dry winters from 1988 to 1991 meant that less nitrate was leached from the soil. Heavy rain in the autumn of 1992 and 1993 resulted in rapid leaching and many boreholes showed high concentrations of nitrate in 1994. Figure 2.13 indicates that concentrations are now similar to those observed before the NSA's were set up. It is still too early to say if the changes in the use of land caused by the NSA will have an effect on nitrate.

2.11 Blue-Green Algae and Eutrophication

Since the problems at Rutland Water in 1989, blue-green algae have continued to be an issue. A special Task Group was set up in 1989. In 1994 the Group recommended continuation of the so-called Reactive Monitoring Programme, whereby monitoring is carried out in response to enquiries from the public or owners.

The Reactive Monitoring Programme reflects the fact that fluctuations in algal populations depend on the weather, and that problems are likely to recur each year. We have advised the owners of waters monitored in the past to take precautions to prevent people coming into contact with blooms and scums.

In 1995, 47 waters were sampled for the first time. Of these, 24 (51%) contained potentially toxic species at densities sufficiently high for us to warn owners. In

addition, 20 waters which were sampled in previous years were also sampled in 1995. 14 of these exceeded the warning level and contained blooms or scums.

We are working on Action Plans. The first stage is to identify the waters which have a problem. The second is to decide priorities. A computer package called PACGAP (Prediction of Algal Community Growth and Production) is used to identify the options. These options are assessed and the best can then be selected and, following consultation, implemented.

During 1995 we had an blue-green algal bloom on the Great Ouse. Such blooms in rivers are unusual and this may have been started by a discharge of water from a lake. Blue-green algae were first detected in the Great Ouse upstream of Bedford on 2 August. By the 9th a bloom had developed. The bloom affected 15 miles of the river, disrupting navigation and recreation, and persisted until 12 September.

2.11.1 Ferric Dosing

This procedure controls algae by removing phosphate from water, precipitating it as a floc which settles to the bottom. The floc also reduces the release of phosphate from sediments.

We are monitoring the effects of dosing at Rutland Water. Results indicate that dosing has damaged the invertebrate communities near the discharge point. We cannot tell whether this was caused by toxicity or blanketing by floc.

Covenham Reservoir was last dosed in 1994 and dosing at Pitsford Reservoir ceased in 1993. Grafham Water has not been dosed since 1992. Monitoring carried out at this reservoir suggested that the benthic communities recovered quickly.

Ferric dosing has been initiated at sewage treatment works discharging to rivers used to fill Rutland Water and Grafham Water. We are monitoring the effects on the receiving waters.

The use of ferric sulphate in reservoirs is not a long term option. A Working Group has been formed by the Agency, Anglian Water and English Nature to develop longer term options for Rutland Water, Grafham Water and Pitsford Reservoir.

2.12 The Norfolk Broads

In conjunction with the Broads Authority and Anglian Water, work continued on the restoration of the broads suffering from the effects of nutrient enrichment.

Phosphorus inputs from the larger sewage treatment works within the catchments of the Bure and Ant have continued to be monitored, enabling an assessment of the impact of phosphorus removal to be made. Plans for phosphorus removal at 7 key sewage works have been agreed with Anglian Water. Work started in 1995, with

completion by the end of 1997.

Once point sources of phosphorus have been controlled, diffuse inputs become significant. Sources in the upper Bure are being monitored as part of a project by Reading University. These results will be used to calibrate a model for use in this and other similar catchments.

Investigations have continued on the release of phosphorus from sediments. Work has demonstrated that in shallow lakes, rich in organic matter, ferric dosing does little to in control the release of phosphorus from sediments.

Mud pumping removes phosphorus from the lake. However at Alderfen Broad, release rates remained high following the removal of the mud. This was due to the decomposition of newly exposed material. It was concluded that mud removal may be worthwhile only where there was a need to increase the depth of the water.

Another line of research has been part funded by the EU LIFE Programme. This has shown that, by reducing fish populations and increasing the number of the zooplankton which graze on the algae, we can return the broads to a clear water state dominated by aquatic plants. An improvement has been maintained in both the diversity and cover of aquatic plants at a number of the experimental broads including Cromes and Cockshoot. Further investigations have been carried out into the importance aquatic plants in preventing a return to algae dominated water. This work has focused on the role of aquatic plants in acting as a refuge for zooplankton from predation by fish.

The use of this technique has been tried at Ormesby Broad, with full co-operation from the owners, Essex and Suffolk Water, and support from the local community. Clear water was maintained throughout the summer with increased numbers of zooplankton. The macrophytes flourished. It is hoped that blooms of blue-green algae can now be prevented.

2.13 **Pesticides**

2.13.1 Pesticide Monitoring

Pesticides are used to control micro-organisms, weeds, animals and insects. Many pesticides find their way into surface and groundwaters. With increasingly accurate analytical techniques, pesticides are being detected at low concentrations. Although such quantities are not known to be harmful to humans or aquatic life, it is prudent to make every effort to prevent contamination.

There are 450 Approved Pesticides in the UK and it is not possible to monitor for all of them. In the past, monitoring concentrated on the older organochlorine and organophosphorus insecticides. More recently we have monitored the most commonly used modern products, mainly herbicides.

During 1995, we analysed for 117 pesticides (and obtained 37,200 results). This list is reviewed to ensure that we look for pesticides that are most likely to be present in water, as well as new pesticides.

In the absence of specific Environmental Quality Standards (EQS's), we use the Drinking Water Directive's standard of $0.1\mu gl^{-1}$ as a reference. This is the limit that drinking water has to meet after treatment.

The introduction of pesticides is controlled by Ministers in six government departments. They are advised by the independent Advisory Committee on Pesticides (ACP). The government can withdraw approval for use or seek reassessment of any pesticide at any time.

In 1995, the ACP reviewed isoproturon (IPU) to establish means to reduce the compound's potential to contaminate water supplies. IPU is a widely used herbicide. It leaches easily and so, when applied before rainfall, frequently reaches watercourses. IPU may not now be applied pre-emergence on wheat and barley, and aerial application was revoked. A maximum total dose of 2.5 kg per hectare was imposed, with a target rate of 1.5 kg per hectare to be considered. In 1995 over 52% of results for isoproturon exceeded $0.1\mu gl^{-1}$. A set of EQS's has been established for isoproturon. In 1995, the annual average standard of $2\mu gl^{-1}$, was exceeded at 3 sites, and the maximum concentration of $20\mu gl^{-1}$, at one site.

Mathematical models can predict concentrations in surface and groundwaters. FARMSTAT is a commercial service which, for example, identified bentazone as a pesticide likely to be found in surface water despite its relative low usage. Consequently bentazone was added to the list of analyses in 1993. In 1995 over 5% of the results for bentazone exceeded the $0.1\mu gl^{-1}$ standard .

2.13.2 Regional Pesticide Database

Our Pesticide Database (RPD) holds data for all samples of fresh and saline surface waters, and groundwaters. It holds more than 250,000 results, from 1184 sites monitored by the Agency, Anglian Water, Cambridge Water Company, Three Valleys Water Company, and Essex and Sufolk Water Company. Data since 1991, for 154 pesticides are held, for all of these sources.

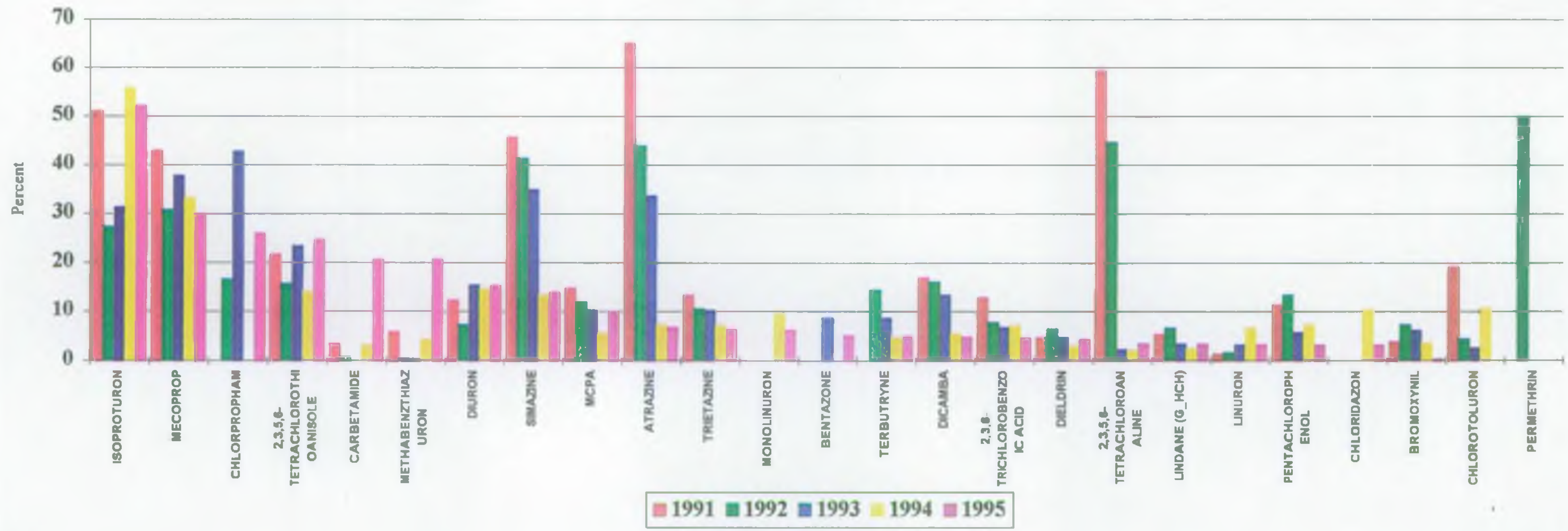
Data are being collected from District and Borough Councils, who are responsible for monitoring private boreholes.

The RPD is used to provide details of pesticides occurring at sites or catchments. It provides information to the general public through the Public Register (see Part 5). A report is in preparation, summarising the position since 1991.

2.13.3 Pesticide Monitoring Results

Figure 2.14 shows the percentage of the Agency's routine samples exceeding $0.1\mu gl^{-1}$ for a number of pesticides. Some of the exceedences, for example dieldrin, are due

Figure 2.14 Results Exceeding 0.1µg/l



to known point sources while others, such as Isoproturon, come from diffuse sources.

Pesticides cause failures of water quality standards near Boston. (see Part 2.6.1.1)

Of the diffuse inputs, exceedences for atrazine have fallen since 1991 probably because of a ban in 1993 on its use outside agriculture. Simazine also has shown a drop in exceedences for similar reasons. Conversely, deraign appears to have increased slightly, possibly reflecting its use as an alternative to simazine and atrazine.

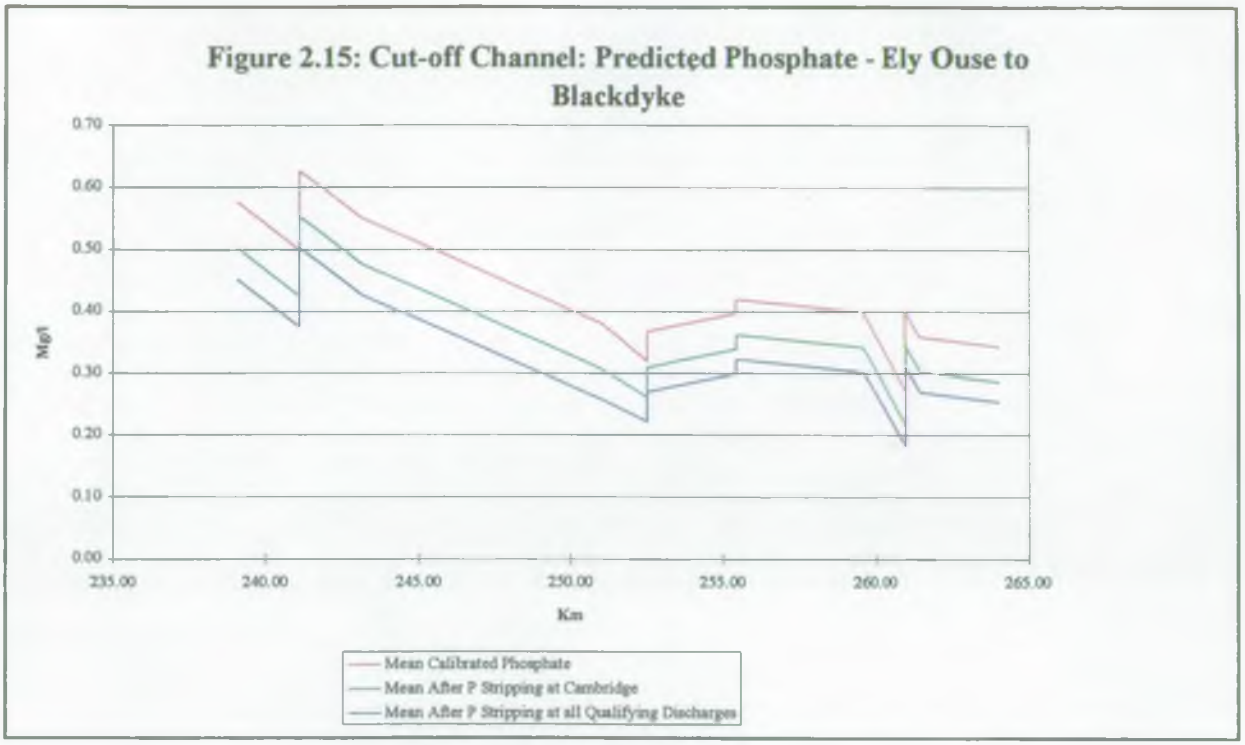
There were no major pollution incidents involving pesticides during 1995. This outcome was promoted through the training of users, the provision of guidance and the implementation of strict measures to prevent pollution.

2.14 Mathematical Modelling

SIMCAT, our river water quality model, describes the quality of river water throughout a catchment. It has been used for all our main rivers

The model is used to assist us in setting conditions for Consents to Discharge (see Part 4.1). In addition, we have applied it to examine the effect on the rivers Great Ouse, Cut-off Channel, Nene, Stour, Blackwater, Chelmer and Wid, of removing phosphorus from the effluent from sewage treatment works.

In 1995 we extended our biggest SIMCAT datafile which covers the whole Great Ouse catchment, to include the Cut-off Channel. This is because water from the Great Ouse system can be diverted into the Cut-off Channel at times of flood, or when the Ely-Ouse to Essex water transfer scheme is operating. We used the model to investigate the possible effects of phosphate removal at sewage treatment works in the upstream catchments on the concentration of phosphate in the Cut-off Channel (see Part 2.6.5.1). Figure 2.15 shows an example of the model predictions.



Several projects were done to develop models to establish source protection zones for the Groundwater Protection Policy. Most of these have been set up using a model called FLOWPATH.

We helped develop LANDSIM. This will assess the risk to water resources from proposals for landfill. The software will be available to the public at a cost. The project was commissioned by DoE, and is expected to be completed in 1996.

PART 3: ESTUARIES AND COASTAL WATERS

3.1 Monitoring

During 1995, we worked on 22 estuaries and most of our coastal waters. Routine sampling was performed at 432 sites, including the 34 Bathing Waters. Additionally, 31 sites were sampled for special surveys. Frequencies ranged from annual to weekly. The total number of samples was 4900.

We obtained further information on nutrients, chlorophyll and algal populations in our estuaries. The results were used as background information for the Directives on Urban Waste Water Treatment and Nitrate.

Sediments were collected at over 240 sites. These were for investigations of discharges containing Dangerous Substances, and as part of the monitoring programme for the Humber. Frequencies ranged from one to four per year.

Samples of shellfish were collected from the Wash to assess any bacteriological impact of sewage effluents and to gather information for the Shellfish Hygiene Directive.

Biological monitoring was performed on all of our main estuaries and at several sites on the coastline. The numbers of samples are given in Appendix I.

3.2 Classification

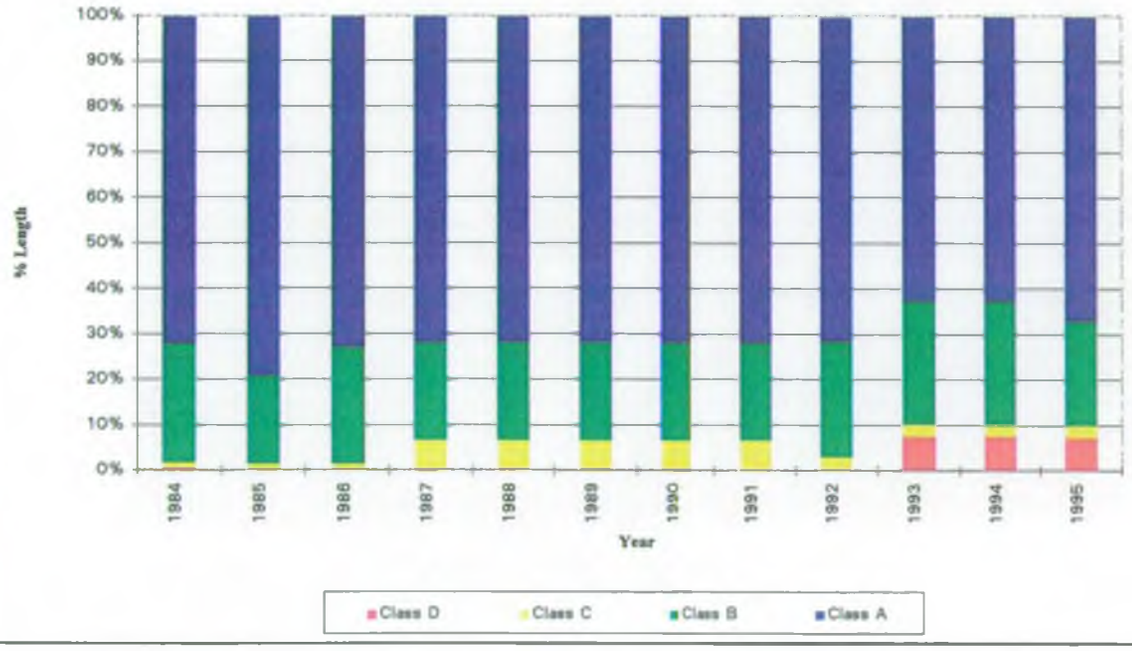
We use the Classification of Estuaries Working Party (CEWP) System to assess the quality of 580 km of our estuaries, including the whole 65 km of the Humber.

There has been little change in quality since 1994. Most lengths of estuary are of good quality although there are localised areas of pollution around some outfalls.

A summary of the results for 1995 is given in Figure 3.1 with data for previous years for comparison. Most of our estuaries (68%), are in Class A, with 22% in Class B, 3% in Class C, and 7% in Class D. This is the shown on one of the maps included with this report.

Our coastal waters have some of the strongest tides in the whole of the North Sea. In some areas the range can be as much as 7 metres. These tides ensure that effluents and riverine discharges are rapidly diluted and dispersed.

Figure 3.1: Estuarine Water Quality



3.3 Marine Biology

A total of 3810 marine biological samples were analysed in 1995 compared with 2574 in 1994 (Appendix I). The increase was due to samples collected for the 1995 GQA survey. For example, in the Humber Estuary over 75 sites were sampled, compared with the standard 14 stations. This information is used to build up a picture of the status of the estuary.

Samples were also collected for routine monitoring and as a part of our contribution to the National Monitoring Programme (NMP).

Surveys were carried out to assess the impact of discharges affected by the Titanium Dioxide Directives (see 3.4.3). These examined the effect of discharges on the life of the seabed, such as invertebrates and flatfish.

Another large project, concerned with the Urban Waste Water Treatment Directive, examined nutrients and phytoplankton in the Wash..

In 1994 concerns were raised by the Shellfish Association of Great Britain over periodic high levels of microbiological contamination of the Simpool shellfishery at Blakeney. As a result, a low water monitoring programme was initiated to identify the sources of contamination. This work has ruled out a number of candidates and investigations are now focused on the area of Blakeney Quay and the Glaven.

3.3.1 Marine Algae

The enrichment of waters with nutrients can prompt changes in the populations of algae and cause them to form growths and blooms. Material can be blown inshore where it accumulates on beaches and decays into a brown slime which looks like sewage.

We have a monitoring programme for algae at sites sampled for the Bathing Water Directive. Algal material is collected for analysis whenever algal blooms are visible. The programme was repeated in 1995. In addition we also monitored in response to inquiries about particular waters.

Substantial blooms were detected off the Norfolk coast between Lowestoft and Wells and also in the Wash. The area around Mablethorpe was affected in June and August. The information provided by this sampling was used to notify the public and Local Authorities.

3.4 Directives

The principal, long-standing Directives affecting saline waters are those for:

- Dangerous Substances in Surface Waters;
- Bathing Waters;
- Shellfish Waters; and,
- Titanium Dioxide.

During the last few years, the following new Directives have been adopted and their requirements will come into force progressively:

- Urban Waste Water Treatment;
- Shellfish Hygiene;
- Pollution of Waters by Nitrates from Agriculture;
- Freedom of Access to Environmental Information (see Part 2.6.8).

Directives also affecting Freshwaters are described in Part 2.

3.4.1 Dangerous Substances

The scope and objectives of this Directive are outlined in Part 2.6.1. All our sites passed the List I Standards for metals, pesticides and chlorinated solvents.

We monitored waters downstream of 40 discharges that contain List II Substances. Two sites exceeded the quality standards:

- Fenn Creek (Crouch estuary) south of Eyotts Farm for Copper;

- the Crouch at Battlesbridge for Copper.

No single cause has been identified for the failures in Fenn Creek, and the River Crouch. The monitoring points are in waters used extensively by yachts, and one contribution could be from anti-fouling paints.

Another factor could be discharges from sewage treatment works, although most of the works are small. We are monitoring the discharges for copper and we shall use this information to decide whether we need to amend Consents.

Two sites which failed List II standards in 1994, now pass: Hamford Water at The Twizzle, off Titchmarsh for Copper, the Orwell at Woolverstone Marina for Copper, and the Orwell at Landguard Point, Felixstowe for Copper.

3.4.2 Shellfish Waters

In contrast with the Shellfish Health Directive (see Part 3.4.6), this is not a direct public health measure. It lays down quality standards for waters designated as shellfisheries, and aims to ensure a suitable environment for shellfish growth. There are six designated Shellfish Waters in our Region.

Under the Standardised Reporting Directive (see Part 2.6.7) we must report the results of monitoring carried out in 1995 to the European Commission (via the DoE). There were two exceedences of the Mandatory Standards.

There was a copper failure at one site:

- Hamford Water, The Twizzle off Titchmarsh.

A possible cause is the increasing use on boats of copper based anti-fouling paints, or the failure may have been due to an industrial discharge. This discharge now has an Authorisation, which includes a limit on copper.

There was a failure for Dissolved Oxygen at one site:

- Pyefleet Channel, at North Farm Hard.

There are no known sources of pollution that could be responsible for the failure. The failure is not believed to have caused any damage to the shellfishery.

3.4.3 Titanium Dioxide

Waste from the Titanium Dioxide industry can harm the environment, mainly because of it contains iron and high acidity.

The Directives on Titanium Dioxide require that factories reduce the pollution caused by their discharges, within a specified timescale. There are three factories in the UK. The two largest, Tioxide Europe and SCM, are on the south bank of the

Humber and their effluent is discharged to the estuary.

In 1988, the outfalls from both factories were relocated to deeper water where dilution and dispersion are much greater. A survey in 1989 confirmed that the new outfalls had produced a big reduction in the area affected by pollution.

In 1995 monitoring of the estuary was carried out as required by the Directives and the results were reported to the DoE. Lower iron concentrations in the receiving waters, evident since the relocation of the two outfalls, have been maintained.

Although the results of biological monitoring in 1993 had indicated an improvement around Tioxide's outfall, monitoring from 1994 and 1995 suggests an impact on the fauna compared with assessments done before the discharge was made. Data from around the SCM outfall show no evidence of an impact at this site.

The Harmonisation Directive states timescales for the reduction and elimination of pollution from the discharges. The DoE is drafting Directions to the Agency, which will place the new Directive within UK Law.

Both companies have constructed treatment plants. These should result in improvements over the next few years. Discharges from both companies sites are now regulated by Authorisations.

3.4.4 Bathing Waters

The purpose of the Directive is to reduce pollution of Bathing Waters, to prevent further deterioration, and thereby protect Public Health and the Environment.

During 1995, we continued to analyse all Bathing Water samples for Faecal Streptococci, secondary indicators of sewage pollution. This is because the Directive's Guideline Standard for Faecal Streptococci is one of the requirements of the European Blue Flag Scheme, and the 'Premier' Seaside Award scheme set up by the Tidy Britain Group.

Our results are sent, weekly, to Local Authorities, and are displayed on posters on the beaches.

Of our 34 Identified Bathing Waters (Clacton Groyne 41 was newly identified for 1995), 30 passed the standards as assessed by the DoE criteria during 1995. This compares with 27 out of 33 in 1994 (See Table 3.1).

The six sites which failed were Cleethorpes, Heacham, Great Yarmouth South, and Great Yarmouth Pier. Cleethorpes, and Great Yarmouth South also failed in 1991, 1992 and 1993, and 1994. Great Yarmouth Pier also failed in 1993 and 1994. Heacham had not failed since 1988.

Capital schemes planned by Anglian Water will improve water quality at all of the these sites over the next few years:

[a] A new sewage treatment works has been built to serve the Cleethorpes area. This has secondary treatment and disinfection. Anglian Water is also carrying out work to reduce the operation of intermittent discharges in the area. In addition the Agency and Anglian Water are investigating other possible sources of pollution.

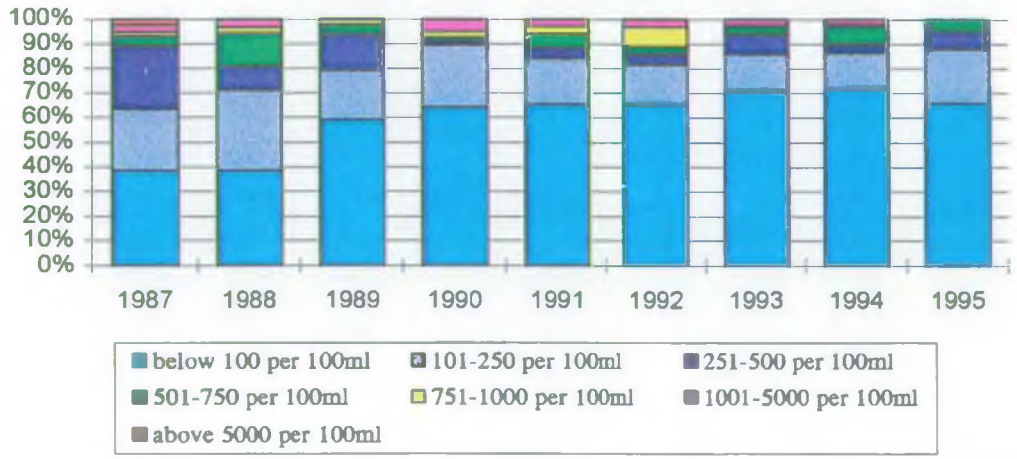
[b] Improvements are being made by Anglian Water to Heacham Sewage Treatment Works, including the installation of disinfection. Improvements are also being made to intermittent discharges in the Hunstanton area.

[c] At Great Yarmouth, Anglian Water is improving the sewerage system by transferring flows to Caister from outfalls which currently discharge untreated to the harbour and the Yare. These will eventually be discharged via a long sea outfall.

The method of assessing compliance with the Directive is volatile and can lead to results whereby, in statistical terms, some Waters may be classified wrongly as a pass or fail. It is therefore useful to look at the trend from a different viewpoint, using the median values of water quality (see also Part 2.3.2).

By ranking the median values of all Waters over several years, we get a better estimate of the true trend. Figure 3.2 shows median quality over the past nine years. The histogram shows the range of median coliform concentrations observed, and the percentage of Waters falling into various concentration bands.

Figure 3.2: Bathing Water Quality Expressed in Terms of Median Faecal Coliform Concentrations



There has been a steady improvement since 1987. Although the percentage of Waters with a median concentration of less than 100 per 100ml has dropped slightly in 1995, compared with 1994, for 1995 there are no longer any Waters with medians above 1,000.

TABLE 3.1
BATHING WATER DIRECTIVE
Compliance with Standards for Total and Faecal Coliforms

Bathing Water	1987	1988	1989	1990	1991	1992	1993	1994	1995
Cleethorpes	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
Mablethorpe	Fail	Pass*	Fail	Pass*	Pass	Pass*	Pass	Pass	Pass
Sutton on Sea	Fail	Fail	Pass	Pass*	Pass	Pass*	Pass	Pass	Pass
Moggs Eye	Pass	Pass	Pass*	Pass	Pass	Pass	Pass	Pass	Pass
Anderby	Pass*	Pass	Pass*	Pass	Pass	Pass	Pass	Pass	Pass
Chapel St. Leonards	Fail	Pass	Pass	Pass*	Pass	Pass	Pass	Pass	Pass
Ingoldmells	Fail	Pass*	Pass*	Pass*	Pass	Pass	Pass	Pass	Pass
Skegness	Pass	Pass	Pass*	Pass*	Pass	Pass*	Pass	Pass	Pass
Heacham	Pass	Fail	Pass	Pass*	Pass*	Pass	Pass	Pass*	Fail
Hunstanton	Pass	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Wells	Fail	Pass*	Pass*	Pass*	Pass	Pass	Pass	Pass*	Pass
Sheringham	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass*
Cromer	Fail	Fail	Fail	Pass	Pass*	Pass*	Pass*	Fail	Pass*
Mundesley	Pass	Pass*	Pass	Pass	Pass	Pass	Pass*	Pass	Pass
Hemsby	–	–	–	–	Pass	Pass*	Pass	Pass*	Pass
Gorleston Beach	–	–	–	–	Fail	Pass*	Fail	Fail	Pass
G.Yarmouth North	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass*	Pass*
G.Yarmouth Pier	Fail	Fail	Pass*	Pass*	Pass*	Pass	Fail	Fail	Fail
G.Yarmouth South	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
Caister Point	–	–	–	–	Pass	Pass	Pass	Pass	Pass
Lowestoft North	Pass	Pass	Pass	Pass*	Pass*	Pass	Pass	Pass	Pass
Lowestoft South	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass*
Southwold The Denes	–	–	–	Pass	Pass	Pass	Pass	Pass	Pass
Felixstowe North	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Felixstowe South	Pass	Pass	Pass	Pass	Pass*	Pass	Pass	Pass	Pass
Dovercourt	Fail	Fail	Pass*	Pass*	Pass	Pass	Pass	Pass	Pass
Walton	Fail	Pass	Pass*	Pass	Pass	Pass*	Pass*	Pass*	Pass
Frinton	Pass	Pass*	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Holland	Fail	Pass	Pass	Pass	Pass	Pass	Pass*	Pass	Pass
Clacton	Fail	Pass*	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Clacton (Groyne 41)	–	–	–	–	–	–	–	–	Pass*
Jaywick	Pass	Pass	Pass	Pass*	Pass*	Pass*	Pass	Pass	Pass
Brightlingsea	Fail	Pass*	Pass*	Pass*	Pass	Pass	Pass	Pass	Pass*
West Mersea	–	–	–	–	Fail	Pass*	Fail	Fail	Pass

* These sites have had at least one failing sample.

This improvement since 1987 has been attributed to a combination of investment by Anglian Water, together with dry, sunny summers from 1989 to 1991, and in 1995. The latter caused increased die-off of bacteria and less discharge of storm-water.

Although the bathing water seasons of 1992, 1993 and 1994 were wetter and cooler than the previous three, the improvement in quality was sustained and advanced. This strongly suggests that the investment, and not the weather, is the main cause of the improvement.

3.4.4.1 Revision of the Directive

As part of the European Commission's review of Directives, proposals for the revision of the Bathing Water Directive were published during 1994. Amongst the main proposals are a new, mandatory, standard for Faecal Streptococci, and monthly monitoring for enteroviruses. The current standards for Total Coliforms and Salmonella do not appear in the new proposals. In addition, it is proposed that Waters which significantly fail the Mandatory Standards are closed to the public.

We have been involved in a DoE-funded study, aimed at assessing the cost of the revision. This work has included assessing whether Bathing Waters will comply with the new standards, and liaising with Anglian Water over the costs of schemes to ensure compliance. In addition, we have considered the implications for monitoring.

If the proposals were adopted there would be a drop in compliance.

Progress towards the revision was halted during 1995. This is because the European Parliament suggested a fundamental review of all water legislation. This approach was endorsed by the Council of Ministers, and is currently being progressed by the European Commission (see 2.6.10) Implementation of any changes is therefore probably at least three or four years off.

3.4.5 Urban Waste Water Treatment

Discharges of sewage effluent to saline waters will be particularly affected by this Directive (see Part 2.6.5). It requires secondary treatment at many locations, unless the discharge is to a High Natural Dispersion Area (HNDA). This differs from the past practice of limited treatment but with discharge via a long outfall.

In many instances, the standards required by the Directive, are tighter than those which we would have required to meet the needs of the receiving waters.

3.4.5.1 High Natural Dispersion Areas

Member States can apply treatment less stringent than secondary to discharges to estuarine or coastal waters, where the waters have the status of HNDA.

To confirm this status, the discharger must demonstrate that the discharge of primary

treated effluent does not adversely affect the environment. The discharger does this by undertaking what is called a Comprehensive Study. We have to certify to the DoE that we agree with the conclusions from these studies. They can then be passed to the European Commission for verification.

During 1993, we commented on proposals that certain effluents be deemed to discharge to HNDAs. We were also involved in the development of the methodology for the Comprehensive Studies. The final version of this was published in 1994, and forms the basis of all Comprehensive Studies carried out in the UK.

In May 1994, the DoE designated the first set of 58 HNDAs in England and Wales, of which 12 are within Anglian Region. Table 3.2 lists these.

TABLE 3.2

Designated HNDAs	Coastal or Estuarine
Clacton	Coastal
Jaywick	Coastal
Shotley	Estuarine
Lowestoft	Coastal
Caister (Great Yarmouth)	Coastal
Cromer (North Norfolk)	Coastal
Mundesley & North Walsham	Coastal
Ingoldmells	Coastal
Pyewipe (Falls within Humber HNDA)	Coastal [1]
Immingham (Falls within Humber HNDA)	Coastal [1]
Barton-on-Humber (Falls within Humber HNDA)	Coastal [1]
Winteringham (Falls within Humber HNDA)	Estuarine

[1] - For the purposes of the Directive the DoE defined the estuarine boundary for the Humber to be the Humber Bridge. This decision was challenged by Hull City Council, and was the subject of a Judicial Review which was heard in January 1996. The Judge declared the DoE decision illegal, and required that the position of the boundary be reconsidered. The DoE is in the process of redefining the boundary, and has asked the Agency for advice. Depending on where the boundary is redrawn these discharges may no longer be eligible for only primary treatment.

During 1995 we maintained close contact with dischargers on their Comprehensive Studies. We discussed the scope of the dischargers' fieldwork and model

development. We contributed to a project to develop a model which will predict the impact of a sewage discharge on benthic organisms. The studies and Designations will be reviewed in 1997.

3.4.6 Shellfish Hygiene Directive

This Directive was adopted in 1991. Three sets of Regulations under the Food Safety Act 1990 have been issued. The Regulations lay down conditions for the production and marketing of live bivalve molluscs intended for immediate human consumption, or for further processing before consumption.

The key points for the Water Industry are the requirements for the Harvesting Areas and for the monitoring of those areas. Harvesting Areas are placed in one of three categories, principally on the basis of the bacterial content of the shellfish flesh. Shellfish may be marketed only if they are taken from classified waters and, for two of the categories, only after relaying or purification. A fourth category exists, from which harvesting is prohibited.

This Directive applies to all the main commercial shellfisheries and not just to those designated under the Shellfish Waters Directive (see 3.4.2).

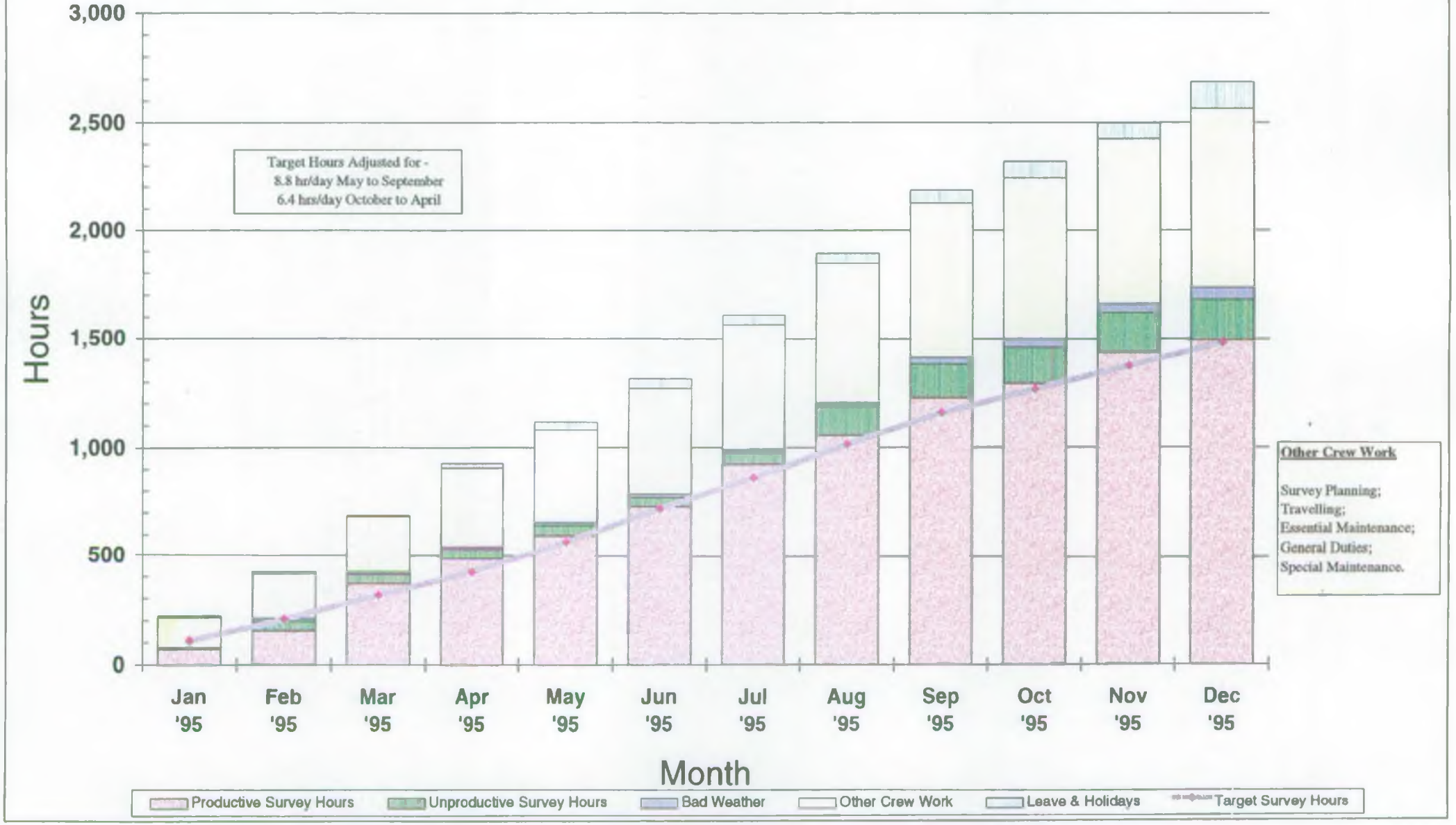
The classification of Harvesting Areas was based upon sampling undertaken by Local Authorities and Port Health Authorities, with our help. 76 Harvesting Areas have been identified nationally, with 17 in our Region.

The Agency monitors waters designated under the Shellfish Waters Directive; Local Authorities monitor shellfish quality, for the Shellfish Hygiene Directive.

Many commercial shellfisheries have fallen into categories which will require the relaying or purification of the molluscs. As a result there may be pressure for further designations of waters under the Shellfish Waters Directive and to bring about improvements in the water quality (and thus the classification) of shellfisheries. However, the DoE has indicated that it intends to make no further designations in the immediate future, and that higher classifications will come about only through water quality improvements under other Directives.

There is likely to be pressure on the Agency to determine the impact of discharges on shellfish quality. In anticipation of this, for each Harvesting Area, we have identified those discharges which may be affecting water quality. In addition, we contributed to work carried out by MAFF to map Harvesting Areas, and the discharges located near them.

Figure 3.3: Cumulative Utilisation of *Sea Vigil* - 1995.



3.4.7 Pollution of Waters by Nitrates from Agriculture

The scope of this Directive is outlined in Part 2.6.6. It applies to fresh and saline waters. Under the Directive, Vulnerable Zones had to be designated by the end of 1993.

The actual designations were made in 1996 (see section 2.6.6).] None of the designated Zones are for tidal waters. We are monitoring 18 waters, with a view to assessing whether they should considered at the first review of designations in 1997.

3.5 The North Sea

The UK participates in the international North Sea Conferences. Nutrients, and toxic and persistent pollutants are topics of concern, especially in the southern part of the North Sea. To address this concern we have increased our monitoring and we participate in a number of national and international studies. During 1995, we produced a Marine Monitoring Strategy.

3.5.1 Coastal Survey Vessel

This was the fourth year in which *Sea Vigil*, was fully operational. During 1995, *Sea Vigil* comfortably exceeded its targets for working hours. Details are in Figure 3.3.

Sea Vigil had a central role in the sampling programmes designed to test the proposed classification of estuaries for nutrients.

Much of the boat's time is spent collecting nutrient data. During the year, the data were processed and collated into reports on the Humber, the Wash, the Lincolnshire Coast and the East Anglian Coast.

Some of the characteristics identified from the surveys are:

- the Humber is a very turbid estuary making it unlikely that algal blooms would occur.

- the Wash itself is not usually well mixed and the influence of the tributary estuaries can be identified beyond their geographical boundaries. The effect of the Nene is traceable to the middle of the Wash: that of the Great Ouse can sometimes be seen beyond the Wash and into the North Sea.

- nutrient concentrations along the East Coast in the summer months are lower at sites north of Lowestoft than at sites to the south. This is illustrated in Figure 3.4.

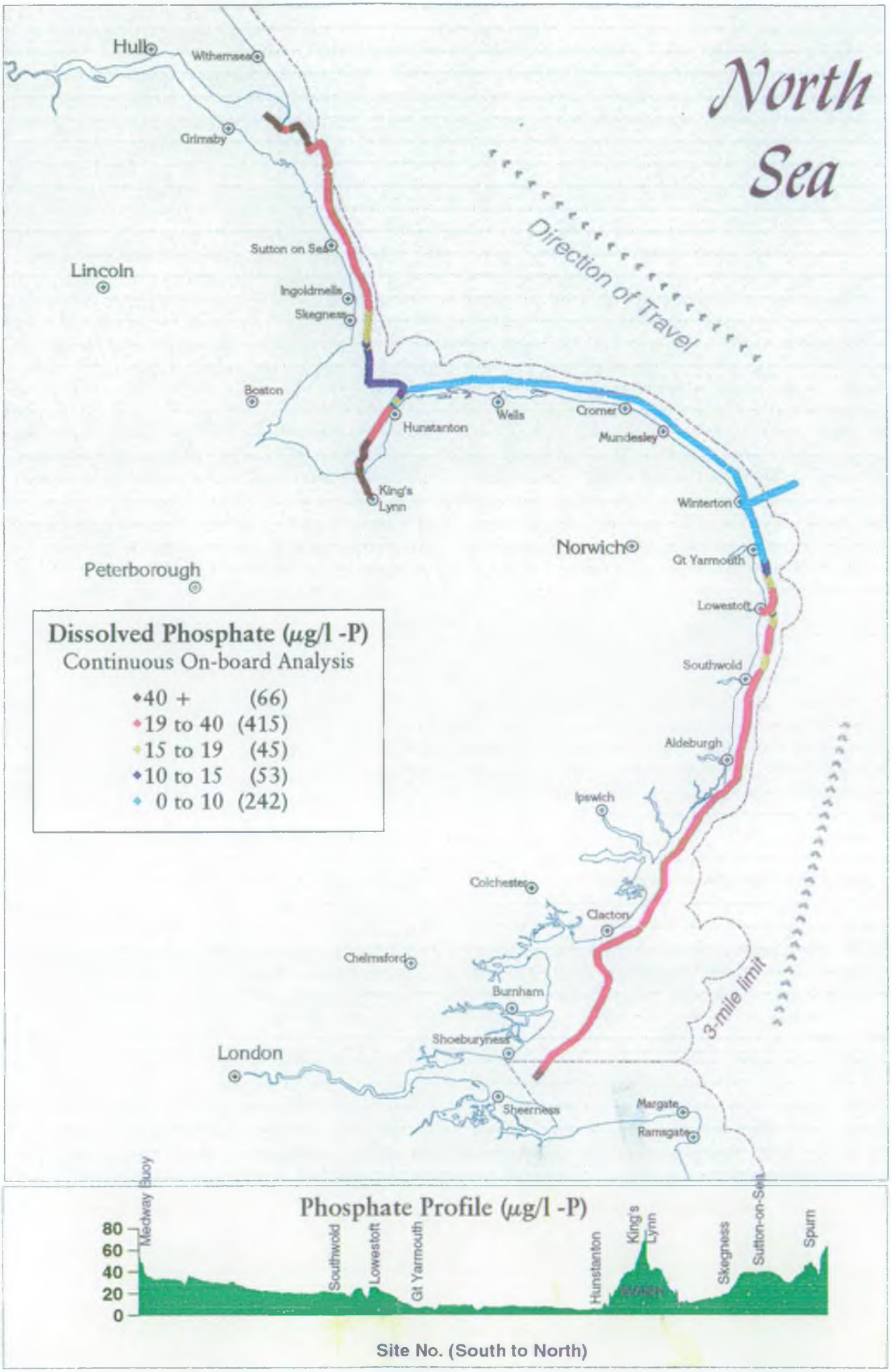


Figure 3.4 : 'Sea Vigil' Coastal Survey - 13 -15th September, 1995

Sea Vigil provided the platform for the biological monitoring carried out for the Humber Estuary Committee, as well as the Quinquennial survey. Further assistance on benthic surveys was provided for the programme of the industries that make up the Humber Industrial Consortium. Benthic sampling was also carried out in a number of smaller estuaries.

Our Engineers, investigating coastal processes for the purposes of Flood Defense, used *Sea Vigil* to measure currents in a number of estuaries, using advanced equipment borrowed from North West Region.

3.5.2 National Coastal Monitoring Study

We contribute to the Agency's National Coastal Monitoring Study in which data are recorded at 186 sites around the whole coast of England and Wales.

Survey vessels collect information along a line 1 to 3 km offshore while, at the same time, an aircraft flies overhead using a Remote-sensing scanner. Images collected by the scanner are mapped onto the data collected by the vessels. In this way, we can determine certain aspects of water quality anywhere within the area of sea surface covered. Four such surveys were carried out during 1995. The results are published by the National Centre for Instrumentation and Coastal Surveillance.

Sea Vigil usually covers the coast between the Humber and the Thames. From September 1995, it has extended its operation along the coast of Southern Region, as far as Poole Harbour.

3.5.3 The Joint Nutrient Study (JoNuS)

This study gathered information on the transport of nutrients through the Humber and Wash estuaries to the North Sea. We provided data for the estuaries and supported research at the University of East Anglia, on phosphate recycling in estuaries.

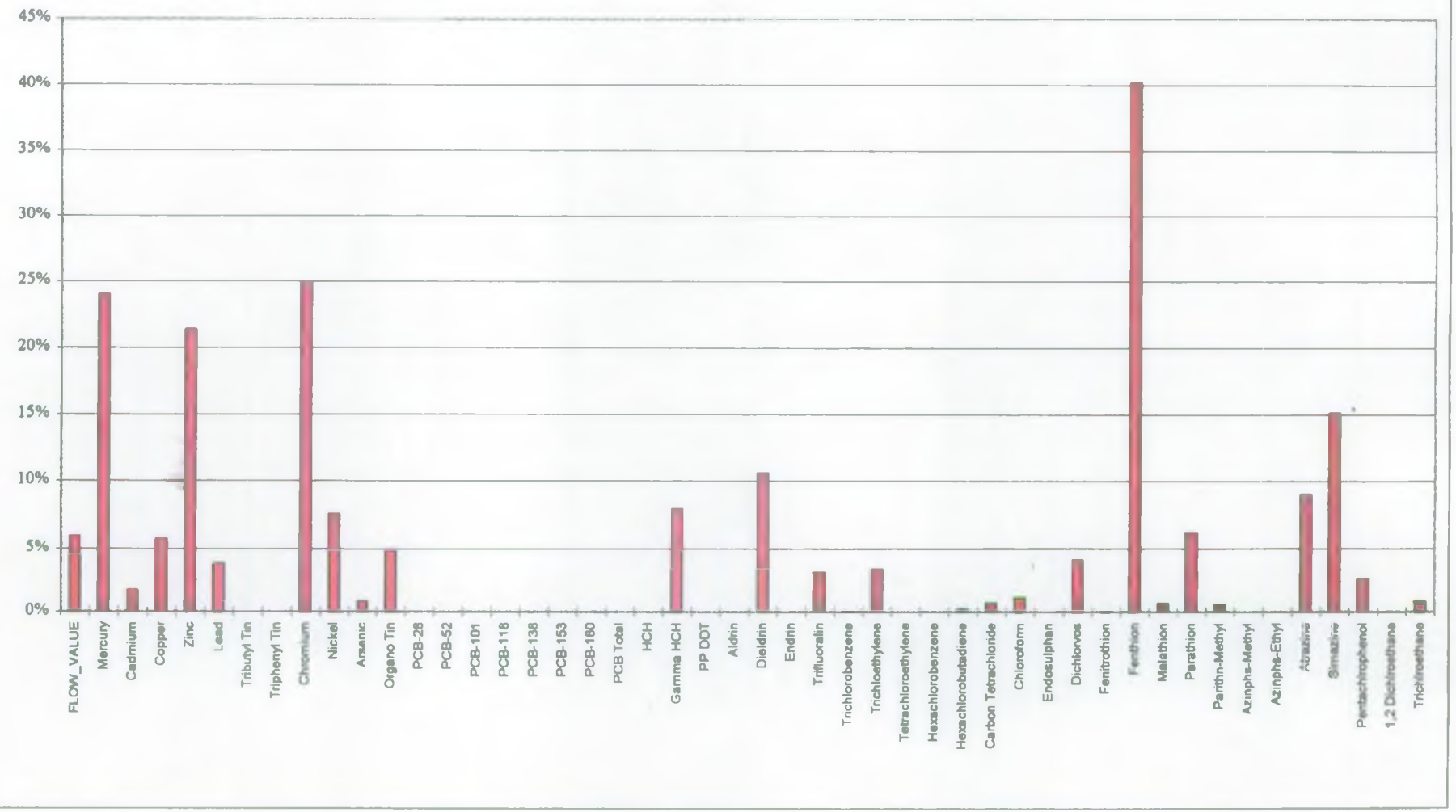
3.5.4 The Land Ocean Interaction (LOIS) Project

LOIS is a national project that aims to understand and predict environmental change in the coastal zone of the UK. Each month during 1995, *Sea Vigil* assisted the Plymouth Marine Laboratory with its sampling of the Humber Estuary.

3.6 Load Reductions - Paris Commission (PARCOM) and Annex 1A

In 1978, the Convention for Marine Pollution from Land-based Sources set up the Paris Commission. Since then, we have monitored pollutants entering the North Sea. In 1988, the Paris Commission (PARCOM), implemented an annual survey to identify the sources of 90% of the loads of selected pollutants found in the Convention's Waters.

Figure 3.5: Contribution to National Annex 1a Low loads, 1994



Additionally, the third North Sea Conference (1990) identified a list of Dangerous Substances, known as Annex 1A, requiring 50% load reductions from 1985 to 1995.

In England and Wales, the Agency has the responsibility for monitoring and ensuring that reductions are met. In Anglian Region, information for these commitments is gathered by monitoring discharges from 17 rivers, 14 sewage treatment works and 8 industrial sites.

The success of monitoring and load reduction, were reviewed at the fourth Conference on the Protection of the North Sea in Esbjerg, Denmark. The load reductions had been achieved for the majority of Annex 1A Substances.

Figures 3.5 and 3.6 show the proportion of the national loads discharged to the North Sea from our Region during 1994. Anglian contributes a small proportion of the total for most substances. This reflects the lack of heavy industry and our small rivers. Four substances stand out: chromium, zinc, mercury, and Fenthion.

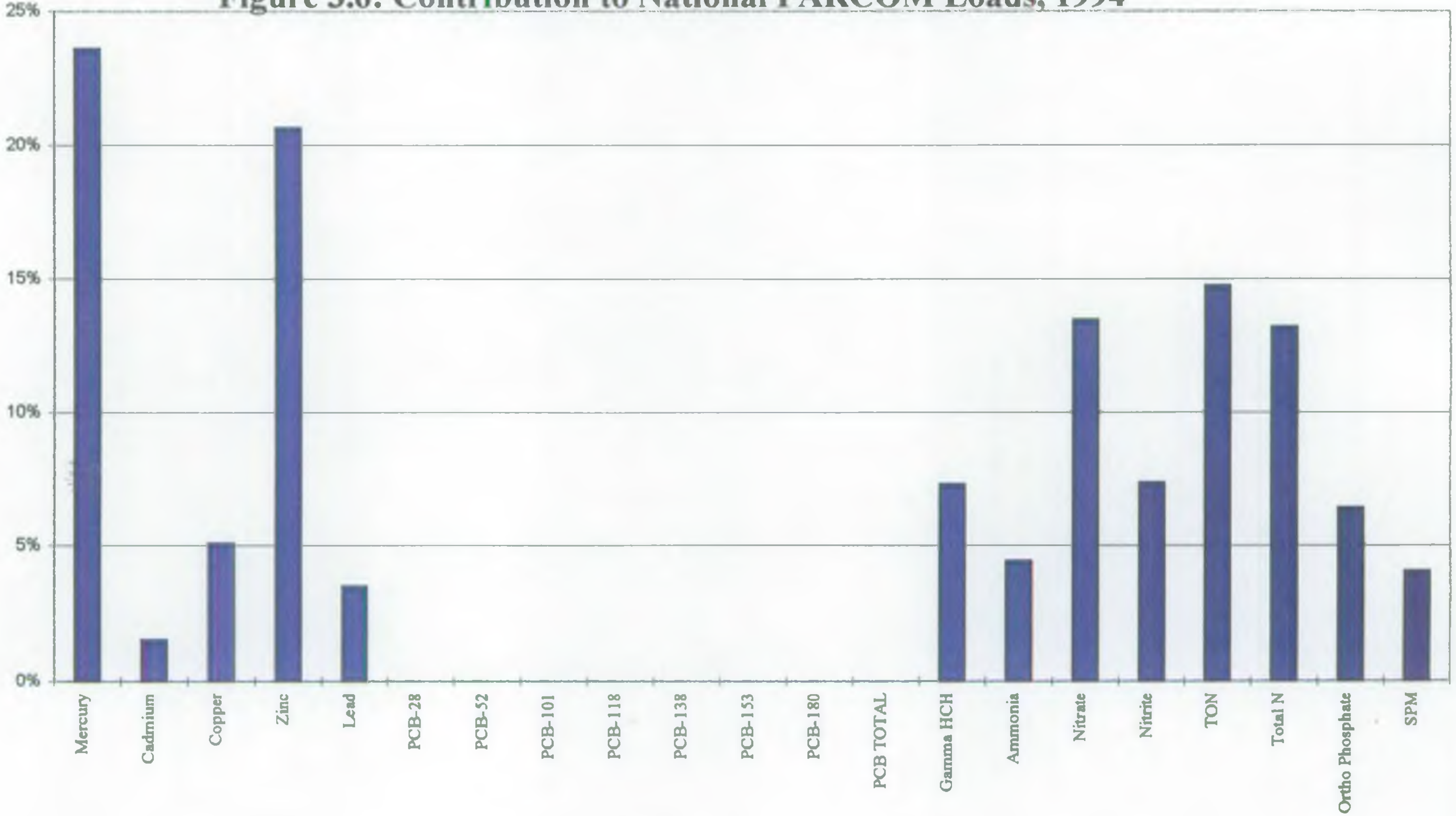
Chromium and zinc are associated with industries on the South Humber Bank. Discussions are in progress with the industrialists about ways of reducing their input and new treatment plants are being brought into use.

Mercury is often associated with industrial origin, (although historically it had been used as a seed dressing). The result for 1994 is due to one very high value not attributable to any specific cause. This coincided with a high flow event resulting in a high load calculation. We are continuing to monitor the situation.

Fenthion is an organophosphrous pesticide not used in this country. The result for 1994 appears to be from a solitary aberrant value.

The agricultural nature of the Region accounts for the relatively high contribution of nitrates

Figure 3.6: Contribution to Nationai PARCOM Loads, 1994



3.7 Mathematical Modelling

The aim is to provide a suite of consistent techniques for calculating the measures needed to achieve our objectives for water quality. A list is in Table 3.3.

TABLE 3.3

Saline Water Quality Models

Model	Type	Dim-ension	Determinands
Humber	Hydrodynamic & Water Quality	1D	Water Level Sanitary Nutrients Chlorophyll Metals User defined
Humber	Hydrodynamic & Water Quality	1D/2D	Water Level Sanitary Nutrients Chlorophyll Metals User defined
Humber Outfall Model (held by WRc)	Water Quality	2D	Titanium dioxide
Orwell	Hydrodynamic & Water Quality	1D	Water Level Sanitary Nutrients Chlorophyll Coliforms
Stour	Hydrodynamic & Water Quality	1D	Water Level Sanitary Nutrients Chlorophyll Coliforms
Stour/Orwell/Harwich Harbour	Hydrodynamic & Water Quality	1D/2D	Water Level Sanitary Nutrients Chlorophyll Coliforms

TABLE 3.3

Saline Water Quality Models

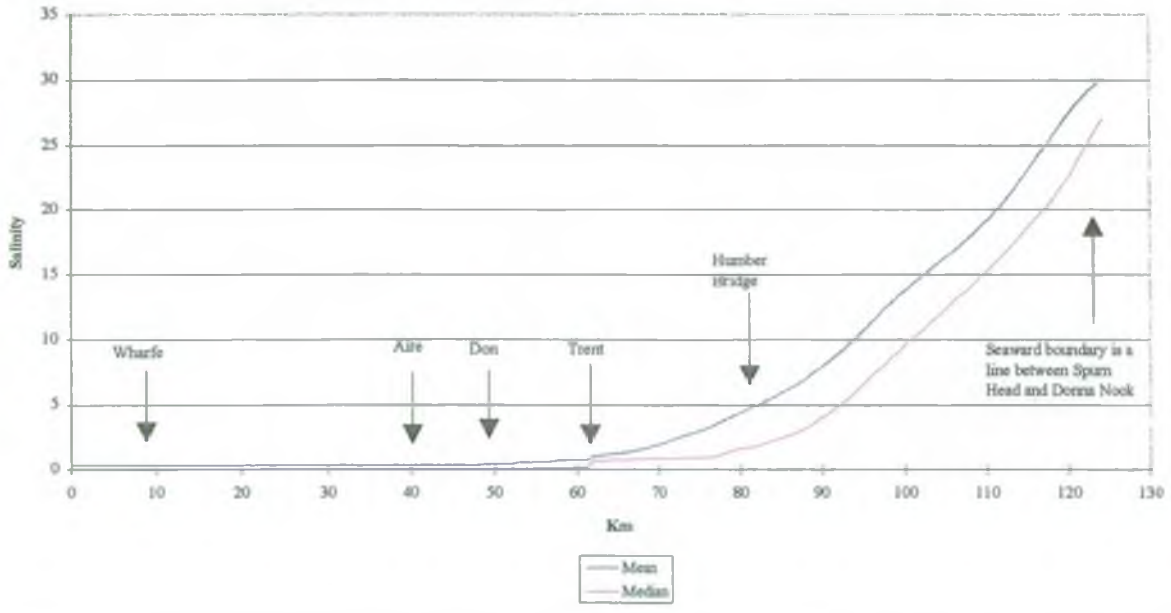
Welland & Witham	Hydrodynamic & Water Quality	1D	Water Level Sanitary Bacteria Nutrients Chlorophyll
Great Ouse	Hydrodynamic & Water Quality	1D	Water Level Sanitary Bacteria Nutrients Chlorophyll
Nene	Hydrodynamic & Water Quality	1D	Water Level Sanitary Bacteria Nutrients Chlorophyll
Wash	Hydrodynamic & Water Quality	1D/2D	Water Level Sanitary Bacteria Nutrients Chlorophyll
Blackwater	Hydrodynamic & Water Quality	1D	Water Level Non-conservative
Crouch & Roach	Hydrodynamic & Water Quality	1D	Water Level Sanitary Nutrients Chlorophyll Coliforms
Colne	Hydrodynamic & Water Quality	1D	Water Level Sanitary Nutrients Chlorophyll Coliforms
Bacterial Dispersion Coastal	Hydrodynamic & Bacterial Dispersion	2D	Water Motion Bacteria

3.7.1 Estuaries

In 1995, WRc began working on a model of the Deben Estuary, and updated our models for the Colne, Crouch and Roach, and Stour/Orwell/Harwich Harbour.

Figure 3.7 shows the results of a model run to investigate the salinity profile of the Humber Estuary.

Figure 3.7: Humber Estuary Model - Predicted Annual Salinity



3.7.2 Coastal Waters

With Anglian Water, we have joint access to a set of models covering our Bathing Waters. We use them to predict the dispersion of microbes from effluents from outfalls. The output is produced for different degrees of effluent treatment to build up a picture of how a discharge might affect, for example, Bathing Waters or shellfish beds. We also use the model to check the Consent Limits requested by dischargers.

In 1995 we undertook two special investigations to determine the cause of failure of the Bathing Water Directive Heacham in Norfolk and Cleethorpes in Humberside (see Part 3.4.4). In both cases these had failed despite investment by Anglian Water on better treatment,.

3.7.2.1 Heacham

At Heacham we suspected at first that effluent from King's Lynn Sewage Treatment Works was affecting water quality. Computer modelling suggested that this was unlikely, especially as quality at nearby Hunstanton and Snettisham was unaffected and the modelling indicated rapid dilution and die-off of bacteria.

Heacham STW discharges to Heacham River, which flows through a tidal flap and across the beach. Our monitoring showed a marked deterioration in effluent quality from the works in May 1995. Although the works did not fail its consent, the quality of the effluent may have contributed to poor bathing water quality. Effluent quality did not recover until September 1995.

A clear correlation was detected between local rainfall and poor effluent quality at Heacham. A good correlation was also detected between effluent quality and bathing water quality.

Anglian Water provided telemetry data from Hunstanton storm outfall which supports the theory that problems at Heacham STW were causing the failure.

Anglian Water has built additional treatment at Heacham to address the problems.

3.7.2.2 Cleethorpes

At Cleethorpes, Anglian Water had diverted an existing crude sewage outfall from the beach to a modern treatment plant a few kilometres away. The bathing water quality was significantly improved, but elevated bacterial concentrations still intermittently exceed the Bathing Directive standards.

Computer modelling of the Pyewipe discharge indications that, under certain conditions of tide and wind, the effluent plume could affect the Bathing Water.

Analysis of our bacteriological data together with information from Cleethorpes Borough Council and Anglian Water show that poor quality water is confined to the northern part of the beach, particularly in the vicinity of the pier. It is unlikely that a single source is wholly responsible for the intermittent high bacterial concentrations observed.

A number of surveys and remedial actions have been taken on the local inshore sources which were found. Further work is continuing.

It is planned that Pyewipe will receive secondary treatment under the Urban Wastewater Treatment Directive (see Part 3.4.5).

PART 4: DISCHARGES

4.1 Consents

The discharge of wastewaters is controlled by granting a Consent. This is the legal permission to discharge an effluent to a Controlled Water.

4.1.1 Policy

We revise standards for discharges for a number of reasons. These include increases in discharged loads, changes in environmental standards and altered locations.

The aim of the Agency is that Consents will maintain the present quality of Controlled Waters (No Deterioration) and, wherever possible, that they will ensure that Water Quality Objectives are met (see Part 2.3).

National Policy was consolidated into the Consents Manual. This has become the comprehensive text of policies, guidance, procedures and legal opinions.

Because they are covered by different types of Consent, we distinguish between discharges owned by the Utility (Anglian Water) and those owned by other bodies, private individuals and other traders. These are called Non-Utility discharges.

4.2 Utility Discharges

4.2.1 Types of Consent

The Legal Consent is the Consent now in force. It may be a Numeric Consent, containing limits on the quality and quantity of the effluent or, for a small works, the Legal Consent may be a statement of the type of treatment which must be provided. This is a Descriptive Consent.

The River Needs Consent (or RNC), is a working estimate of the Consent which may be needed in the future to achieve Water Quality Objectives (see Part 2.3). In itself, it has no legal force, but a number of Legal Consents (about 38%), are equivalent in all respects to the River Needs Consent, and 90% of discharges comply with their River Needs Consents (See 4.2.4).

At the end of 1995, 691 of Anglian Water's sewage treatment works had Legal Consents which included numeric limits on the quality of the effluent. Descriptive Consents applied to 345 small works and a few large coastal outfalls.

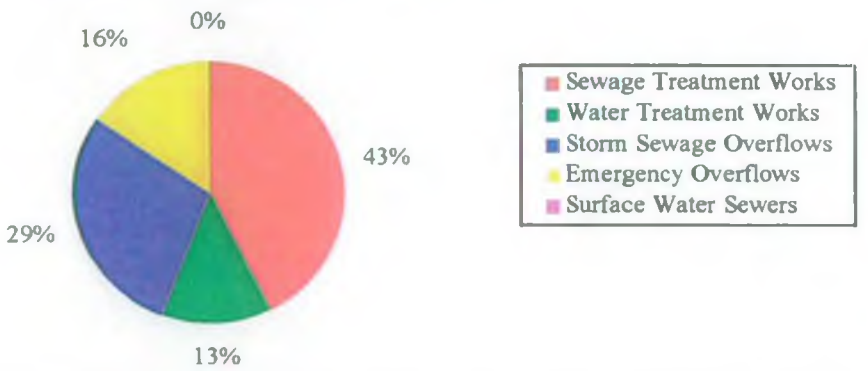
4.2.2 Processing of Application and Appeals

Under the Water Resources Act (1991), the person who applied for a Consent may appeal to the Secretary of State against the conditions imposed. Anglian Water started to appeal against some of the conditions early in 1991 and a backlog of about 480 appeals built up at the DoE by the end of 1995.

During 1995, the Secretary of State issued guidance but this still left several issues unresolved. Of the 480 outstanding appeals about 316 are now sorted out, 84 can be resolved by the Agency, leaving 80 awaiting determination by the Secretary of State.

The number of Applications in 1995 was 70. The proportion of Applications in different categories is shown in Figure 4.1. We issued 41 Consents, including 20 for sewage treatment works.

Figure 4.1: Utility Applications Received



4.2.3 Numbers of Discharges

At the end of 1995, Anglian Water was responsible for 4262 discharges:

Sewage Treatment Works	1083
Settled Storm Overflows	338
Storm Sewage Overflows	1285
Emergency Overflows	1024
Surface Water Sewers	376
Water Treatment Works	119
Miscellaneous	37

4.2.4 Compliance

Two summary statistics are used to measure the performance of discharges with their Consents. The first, the Percent of Compliant Works, states the number of discharges

which meet their Consent. This can be volatile and does not necessarily reflect the impact of effluents.

In managing the quality of receiving waters, large works are more important than small ones so we also report the percent of the total flow from all works which complies with the Consent Limits. This statistic, the Percent of Compliant Flow, is less volatile than the Percent of Compliant Works and gives a better measure of the damage which can be done by non-compliance.

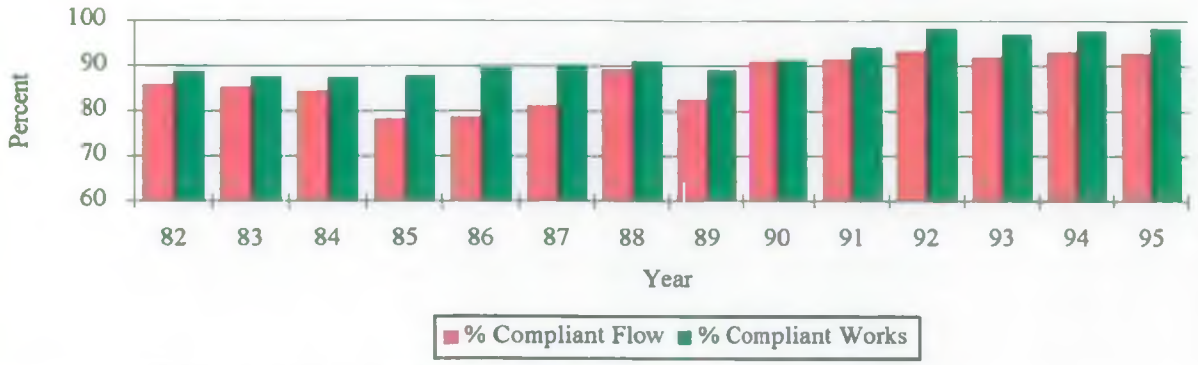
The pollutants commonly associated with sewage treatment are Suspended Solids, BOD and Ammonia. These are called Sanitary Determinands. The Consent Limits for the Sanitary Determinands are 95-percentile limits. The 95-percentile is a concentration which must be met for 95% of the time. Hence a summary target which covers all discharges is a Percent of Compliant Flow which exceeds 95%.

The definition of compliance allows a certain number of sample results to exceed the limit. If the number of exceedences is more than the permitted number, then we are 95% certain that the failure is not due to chance. We then report the discharge as having failed its Consent. The numbers of permitted failures is laid down in a Look-up Table, which is referred to in the Legal Consent.

4.2.5 Performance against Consents

Figure 4.2 shows the performance of works against the percentile limits in Legal Consents. Against this measure, performance again exceeds the target of 95%.

Figure 4.2: Compliance with Legal Numeric Consents



Performance against River Needs Consent gives an indication of the action needed to cater for growth and achieve Water Quality Objectives. Figure 4.3 shows that, since 1994, although the Percent of Compliant Flow judged against River Needs Consents has decreased from 77.7% to 76.7%, the Percentage of Compliant Works improved from 89.2% to 89.7% over the same period. The figure was only 54% in 1988.

Figure 4.3: Compliance with River Needs Consents

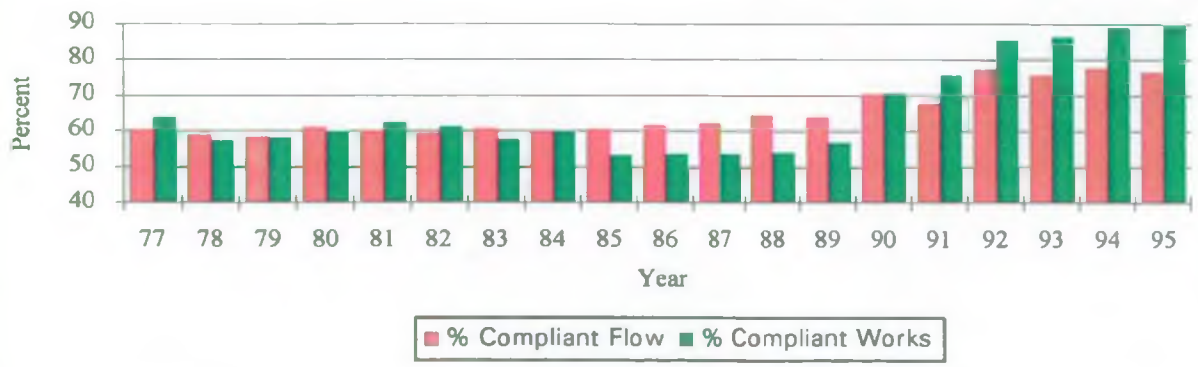


Table 4.1 gives the total load of ammonia discharged by effluents to all controlled waters and shows a reduction of 40% since 1988. Improvements in effluents are also indicated in the median values of ammonia in rivers (see Figure 2.5).

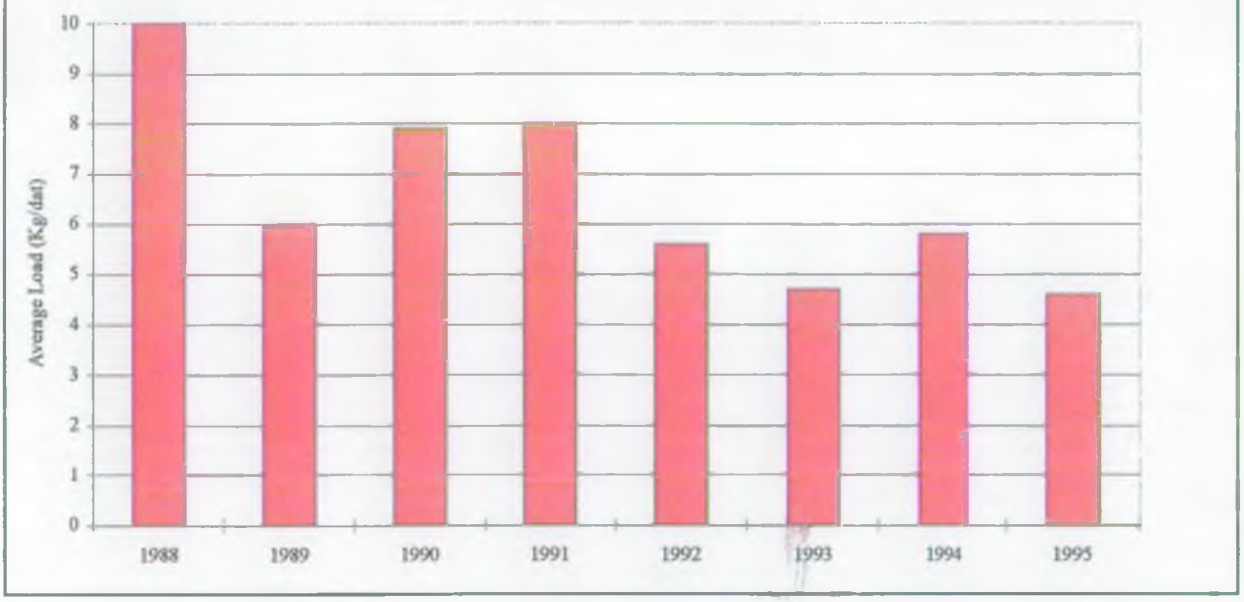
TABLE 4.1

Effluent Ammonia Loads

	YEAR (Number of discharges)		
	1988	1990	1995
Tonnes Ammonia per day (as nitrogen)	15.9 (671)	10.1 (672)	9.50 (709)

Figure 4.4 shows the annual average load of ammonia discharged to freshwater. We have also estimated loads in effluents of other substances. These show that there has been a decrease in loads of BOD, Suspended Solids and Phosphate, whilst loads of Nitrate and Chloride have not changed. Those substances expected to improve as a result of better sewage treatment, have improved.

Figure 4.5: Effluent Ammonia Load Discharges to Freshwater



4.2.6 Tidal and Non-Tidal Waters

Table 4.2 summarises the proportions of discharges to Non-Tidal and Tidal Waters. Although only 7% of discharges are to Tidal Waters, they account for around 20% of the flow, and more than three quarters of load of pollution (see Part 4.2.5). This is because discharges to Tidal Water serve larger populations and tend to require less treatment.

TABLE 4.2

Sanitary Criteria

Receiving Water	Number of Discharges	Percent Compliant			
		Discharges		Flow	
		1994	1995	1994	1995
Non-tidal	645	97.8	98.6	92.8	93.3
Tidal	46	97.8	95.7	99.3	89.2
Total	691	97.8	98.4	93.2	93.0

4.2.7 Upper-tier Standards

Some works also have standards for sanitary determinands which are absolute limits. These must not be exceeded at any time and are called Upper Tier Limits.

Three discharges failed the Upper Tier Limits in their Consents during 1995, compared with 2 discharges in 1994.

4.2.8 Non-standard Determinands

Non-standard determinands include nutrients and metals. In 1995, Legal Consents for 44 discharges included criteria for non-standard substances, almost all expressed as Absolute Limits.

Thetford Sewage Treatment Works had two failed results for Chloride. Horning failed to meet its limits for phosphate, with 4 failing results out of 12.

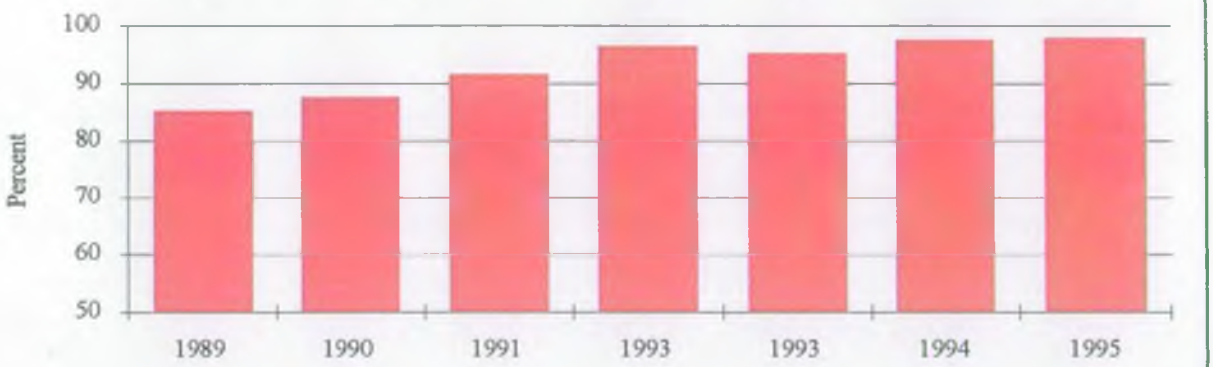
4.2.9 Descriptive Consents

At the end of 1995, 345 small discharges had Legal Descriptive Consents. 296 were inspected at least once during the year, compared with 310 in 1994.

Figure 4.5 shows how the compliance of these discharges has altered over the last

two years. The proportion which complied at the latest inspection is 98% (290 discharges).

Figure 4.5: Compliance with Legal Descriptive Consents



4.2.10 Asset Management Plans

Much of the improved effluent compliance, the reduction in loads discharged, and the resulting better water quality came about during Anglian Water's first Asset Management Plan (AMP1). Elsewhere in this report, we have described improvements associated with this investment. (see Figures 2.5, 3.2, 4.2, 4.3, and 4.4, Part 4.2.5, and Table 4.1).

During 1993 and 1994, we discussed, with Anglian Water, its Asset Management Plan for the years from 1995-2004 (AMP2). Part of the plan includes £42m investment in so-called Discretionary Schemes. This is expenditure not driven by statutory requirements.

Our mandate from OFWAT now extends to overseeing the implementation of schemes during the period of AMP2. Through the DoE and OFWAT, we requested the companies to provide us with targets and timetables for all schemes. These enable us to monitor progress .

In order achieve the greatest benefits within the limits of the settlement, we are examining some of the targets and assumptions made during the AMP2 process. This has resulted, for example, in 4 more works being accommodated within the Discretionary expenditure, bringing the total to 18. We are hopeful that more schemes will be affordable as details become clearer.

4.3 Non-Utility Discharges

4.3.1 Types of Consent

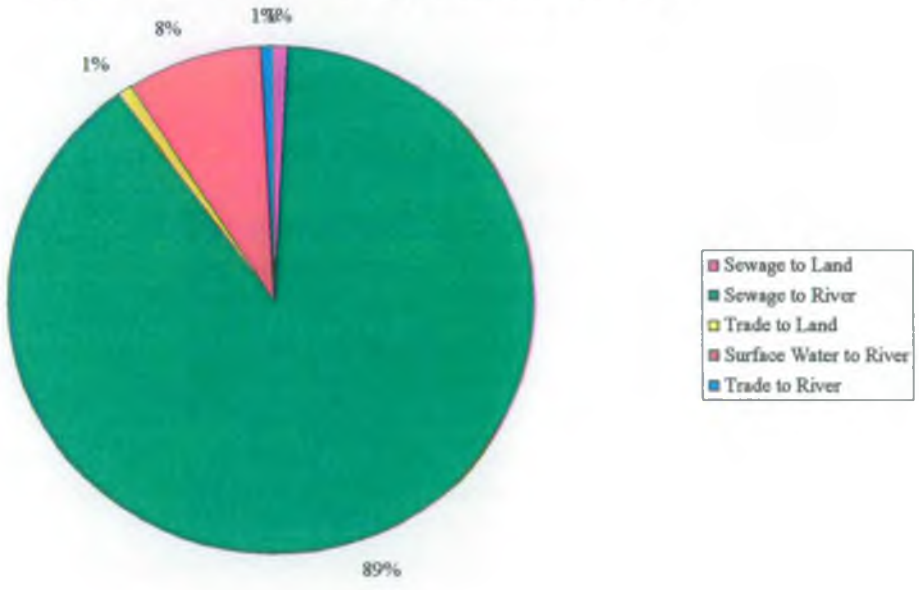
Consents for Non-Utility discharges are generally set to achieve the Water Quality Objectives for the receiving water. They equate to Legal River Needs Consents (see Part 4.2.1).

Discharges with the greatest potential to affect the environment have numeric limits. Legally, all numeric limits for Non-Utility discharges are absolute, even those for the Sanitary Determinands. Most Non-Utility discharges are made from small, "private" sewage works and small industrial premises. These have Descriptive Consents.

4.3.2 Applications for Consent

The number of Applications decreased from 550 in 1994, to 496 in 1995. Of those for 1995, 447 were for sewage effluents. The proportion of applications in different categories is shown in Figure 4.6. 508 Consents were issued.

Figure 4.6: Non-Utility Applications Received



4.3.3 Discharges

The total of 5870 Non-Utility discharges may be categorised:

Sewage Treatment Works	4457 *
Industrial Effluents	509
Surface Waters	662
Agriculture	50
Miscellaneous	192

* This figure excludes septic tanks of which there are 10473.

4.3.4 Monitoring

Most Non-Utility discharges are small and their potential effect on the environment is negligible. We monitor directly only those effluents judged to have a potential for impact. As a safeguard we rely on the biological monitoring of watercourses.

Sampling frequencies range from once per week for the larger discharges, for example, those made to the Humber, to a minimum of four per year for smaller discharges. Some others, not on the routine sampling programme, were sampled as part of occasional inspections.

Of the 397 "Private" sewage treatment works with numeric consent limits, 86% (343 discharges), were sampled in 1995. In addition, we sampled the 29 discharges made from Crown Property. These are the responsibility of the Property Services Agency.

Of the 48 Water Treatment Works with numeric consents, 96% (46 discharges) were sampled in 1995.

We have legal powers to control only those industrial discharges direct to Controlled Waters. Over 300 industrial effluents (84%) in this category were sampled in 1995. Most discharges of effluent from traders' premises are made to foul sewers. These discharges are managed by Anglian Water. Our control of these rests with setting consents for the Company's discharges from the treatment works which receive the waste (see Part 4.8).

4.3.5 Compliance

Legally, Non-Utility Consents are set as absolute values and not as 95-percentiles. On this basis, the proportion of monitored Private Sewage Treatment Works that were compliant was 50% (173 discharges), compared with 51% (180 discharges) in 1994. The proportion of monitored industrial discharges which were compliant is 68% (271 discharges), similar to last year.

The figure for compliant discharges owned by the Property Services Agency was 36% (10 discharges). For Water Treatment Works, 83% (38 discharges) were

compliant.

The figures indicate that the performance of Non-Utility discharges is worse than those of Anglian Water. However, when we compare the compliance of Non-Utility discharges with the compliance of discharges operated by the Water Company, we should take two factors into account. First we should judge the compliance of both types of discharges on the same basis, as 95-percentiles. Second we should compare performance using the Company's compliance with River Needs Consents.

TABLE 4.3

Non-Utility Discharge
(% Compliance with Percentiles)

	1994	1995
STW	79	76
Industrial	88	90
WTW	100	97
Crown Properties	96	79

Table 4.3 gives figures for the Non-Utility discharges for comparison with Anglian Water's. The comparable figure for Anglian Water was 90% in 1995. This indicates that the performance of discharges from industry and Water Treatment Works is similar to that of the Utility. The performance of Crown Properties and Private sewage treatment works is worse.

4.4 Toxicity Tests

These are used to assess the effect of complex effluents. In a number of cases, the chemical composition of effluents may not be known, or toxicity data for the constituents may be unavailable. An assessment of the overall toxicity is, therefore, a good method of monitoring quality.

We have 7 discharges with Toxicity Based Consents. The Consents stipulate the method of analysis, the test species, and the criteria for compliance. In most cases the species are the brown shrimp and trout, although freshwater plants, marine plants, and oysters are used.

Special surveys are also carried out on other discharges. All results are kept on the Public Register (See Part 5).

At a national level, the Agency and others are jointly developing a strategy and

procedures for the further use of Direct Toxicity Assessment. The aim is to use this to help consent complex effluents. Results of the project are being trialled this year.

4.5 The Index of Discharge Impact and Priority Lists

The Index of Discharge Impact (IDI) allows us to identify discharges which have the greatest potential impact on receiving waters. Indices are calculated from statistics for the compliance of discharges with their River Needs Consents, and from an assessment of compliance of receiving waters with their quality standards.

We use the IDI to produce ranked lists of discharges for which we would like to see improvements. These lists form the basis of discussions with the dischargers (see Part 4.2.10)

4.6 Targeting for Legal Action

We use our monitoring to assess change and to check compliance with standards. We audit the performance of all our discharges each month and rank them according to the statistical significance of any failure to meet Consents.

This type of list is used to set priorities for enforcement. As a rule this will trigger the collection of samples for legal action. Samples are taken until either a case for prosecution is made, or the quality of the discharge improves to the point where we conclude that it will comply with its Consent.

4.7 Charging for Discharges

This recovers part of our costs for pollution control. There are two kinds of charge, an Application Charge, and an Annual Charge.

4.7.1 Application Charge

The scheme covers processing Applications for Consent. For 1995/6, the charges (including VAT) were:

Sewage effluents of less than 5 m^3/day	-	£ 86.95
Cooling water of less than 10 m^3/day	-	£ 86.95
Uncontaminated surface water	-	£ 86.95
All other effluents	-	£609.82

4.7.2 Annual Charge

In 1991, an annual charge was introduced. Discharges of domestic sewage of less than 5 cubic metres per day are exempt.

The scheme was updated in 1994 to reflect more accurately the costs of dealing with various types of discharge. The new scheme will run until 31 March 1999. The Annual Charge is calculated taking into account a unit charge, of £401, and the size, nature and location of the discharge.

Here are some examples for a full year:

Emergency overflow from a pumping station to stream -	£	120.30
Drainage from Trade premises to a watercourse -	£	401.00
Cooling water of high temperature, pH or chlorinity -	£	401.00
STW serving 1,000 people, discharging to estuary -	£	3,609.00
Large trade effluent, toxic substances, to estuary -	£	42,105.00

In 1995, we levied charges on 6094 discharges, of which 4289 are owned by Anglian Water.

4.8 Integrated Pollution Control

The main objective of IPC is to control discharges of the most persistent pollutants entering air, land and water. IPC lists the specific pollutants as Prescribed Substances and the processes that produce them as Prescribed Processes.

Operation of a Prescribed Process requires an Authorisation. The existing Prescribed Processes have been split into groups, and are being dealt with on a rolling programme which finishes in 1996.

It used to be that all discharges to Controlled Waters required Consents (see Part 4.1). Now, where the significant bulk of the discharge is from a Prescribed Process, an Authorisation replaces the Consent. Both Authorisations and Consents are issued by the Agency.

PART 5: THE WATER QUALITY REGISTER

5.1 Information

The Register contains 37500 Consent records of which approximately 20000 are for current, active discharges. About 570 Applications were added in 1995. Details are retained on the Register for five years after Consents are revoked.

The Register also makes available the results of analysis of 477000 environmental and effluent samples taken since August 1985, giving public access to several million analytical results. Results from 50000 new samples are being added each year.

A computer-based mapping system is used to show the availability of information and to facilitate retrieval (see Part 8).

We are always happy to provide information not required to be held on the Register. The Environmental Information Regulations, introduced in 1992, gave statutory force to this. Data include results from biological, fisheries and sediment samples.

5.2 Enquiries

During 1995, 1500 enquiries were received, an increase of 17% since 1994. A large proportion of enquirers are students, but we saw a continued increase in the number of commercial enquiries, primarily from consultants requesting information as part of environmental audits. Trends and categories of enquiries are shown in Figure 5.1.

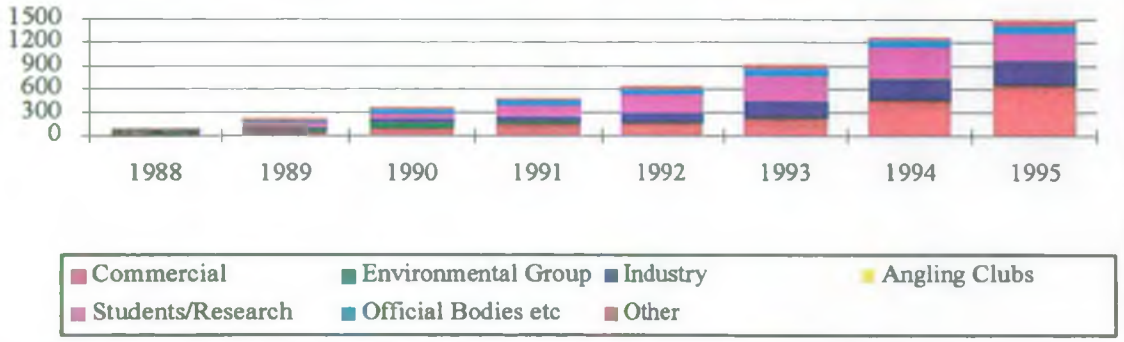
5.3 Registers

With the formation of the Environment Agency all Public Registers previously held by HMIP have moved to Peterborough in order to provide access at a single location.

5.4 Inspection of the Registers

The Register is at Peterborough and is open on weekdays (except Bank Holidays) from 9.30 to 16.30. Inspection of the Register is free, although a charge may be made for large or non-standard retrievals of information. Requests for copies of Register information may also be made in writing to the Peterborough Office. A leaflet, *A guide to information available to the public,* gives details.

Figure 5.1: Water Resources Act Register Enquiries



PART 6: CAPITAL PROGRAMME

The budget for 1995/6 was £340,000. 23 schemes were funded. The assets developed are shown in Table 6.1. Figures for 1994/95 are given in parentheses.

TABLE 6.1

Capital Programme

Type of Asset	Number	Cost (£ 000's)
Water Quality Monitoring Stations	5 (4)	117.5 (97)
Pollution Control	13 (10)	169.5 (180)
Marine Survey Facilities	1 (3)	10 (41)
Scientific Equipment	2 (2)	33.5 (35)
Laboratories	2 (1)	9.5 (18)
Totals	23 (20)	340 (371)

PART 7: RESEARCH AND DEVELOPMENT

We have a statutory duty for Research and Development. The benefits include improved knowledge, new policies and new procedures; increased efficiency and effectiveness; and collaborative links with other agencies.

We undertake research in two programmes: the National Programme, and a Regional Programme which addresses issues specific to our Region.

In 1995 we maintained our commitment to the National Programme, with 25 staff leading 38 projects. Our part of the national expenditure was £586,000 out of a total of £6,200,000.

A notable completion was a review of the occurrence and fate of blue-green algae in freshwaters. A project was initiated to develop a classification scheme for lakes.

Important regional work continued into eutrophication, in particular on the restoration of the Norfolk Broads in collaboration with the Broads Authority and RIZA, the Agency's equivalent in the Netherlands.

PART 8 : INFORMATION STRATEGY

We make extensive use of computers to help manage monitoring and interpret data.

8.1 Chemical Sampling Programme

We use AquaLIMS to schedule monitoring. AquaLIMS coordinates sampling and the delivery of samples to the National Laboratory Service, and receives analytical results electronically for storage in our archives.

In 1995 we made it even easier to use our data and provided more ways of getting data into other systems. We improved the assessment of the performance of the laboratory.

We use our Sampling Information Management System (SIMS) to help run monitoring, and to prepare data for use. We use our mapping and graphics software to display and interpret data. In 1995 all systems were enhanced in order to help staff save time in using data. This leads to better decisions and improved efficiency.

8.2 Modelling

We use models to predict impacts on water quality (see Parts 2.14 & 3.7). We also made it easier to operate our models, and continued to develop software for PROTECH2 (see Part 2.11).

8.3 The Future

In 1996 we plan to transfer to better computers, our chemical and biological data, and some of our models. This will improve access and reduce costs. We also intend to exchange data electronically with Water Companies on a regular basis.

PART 9 : CHEMICAL LABORATORY ANALYSIS

Analytical work is carried out by our National Laboratory Service (NLS). Samples are transported by overnight courier from catchment offices to the laboratory at Reading, where most of the analysis is carried out. Samples can be transfered to other sites if special analyses are required.

All laboratories are accredited with an internationally recognised quality assurance system (NAMAS) and undergo comprehensive audit procedures in order to maintain accreditation. They also participate in schemes of inter-laboratory quality control.

We have implemented procedures to provide the laboratory with extra options to flag unusual results. This gives an early warning system for suspect data, allowing repeat analysis before the sample is disposed of. This leads to fewer errors, saves time otherwise spent in tracking errors, and reduces the risk of drawing wrong conclusions from data.

During 1995, there was been a marked improvement in the quality of the service we received from the NLS, especially in the time taken to complete analysis.

We organise the analysis of ranges of determinands as sets or Suites. There are 335 of these and they cover determinands to be analysed for Uses (eg. the Surface Water Directive), as Groups (eg. List II metals) and for Site-Specific purposes (eg. of an effluent with a complex consent). The most comprehensive suite has 186 determinands.

We reviewed the routine sampling programme. We identify and keep track of the reasons why every samples is taken, and the reasons for every analysis. The review will result in more efficient use of sampling and analysis especially as the reasons for sampling and analysis are always changing.

The numbers of samples for routine monitoring are given in Table 9.1. The total in 1995 was 46332, (a decrease of 4.7% on 1994) and the total number of analyses was 552689 (an increase of 1.6% on 1994). A breakdown is shown in Figure 9.1.

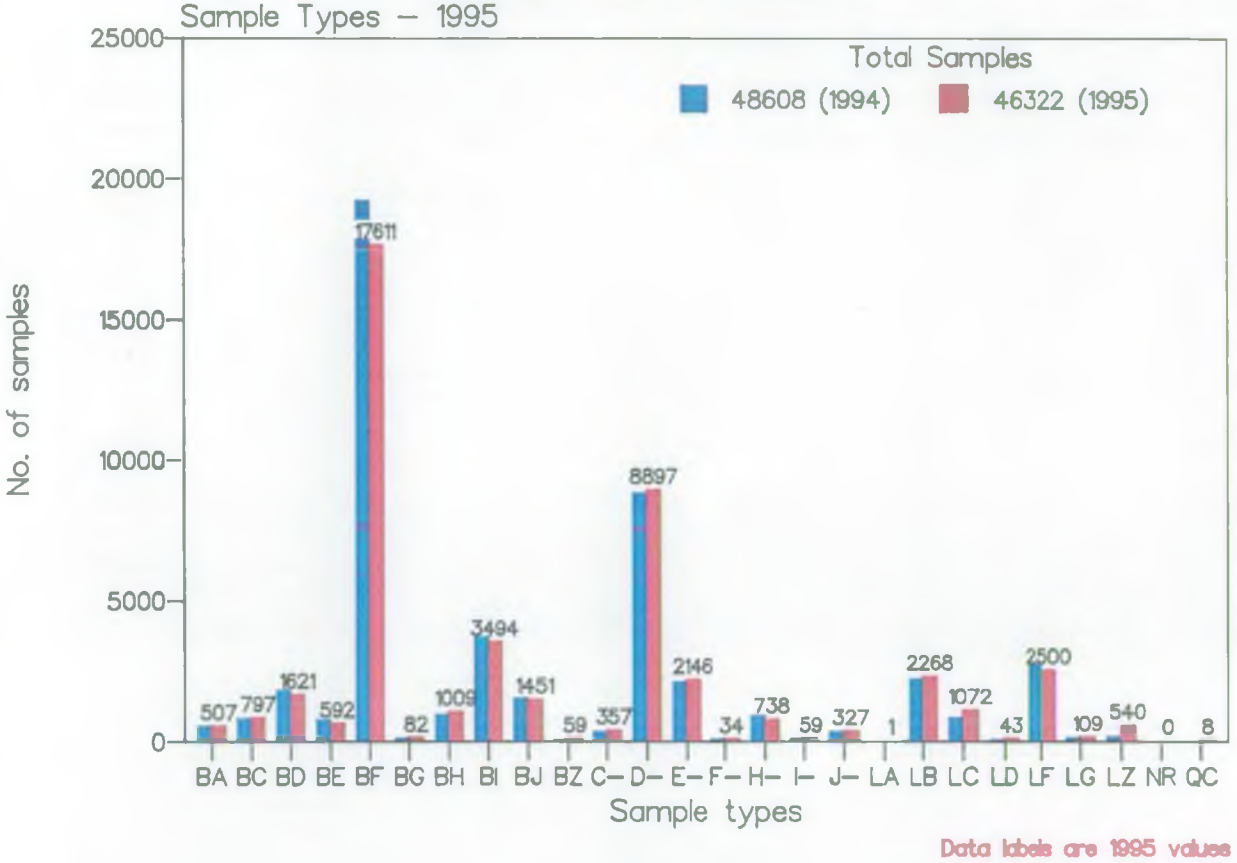
A number of samples are unplanned. These may be collected for a pollution incident or for an urgent survey. 7.4% of samples were pre-planned. This compares with 13.5% in 1994 and indicates further control of the sampling programme. The 1995 percentage is unlikely to change since this is the level for sampling that cannot be planned.

Table 9.1 Samples Taken: Programmed and Actual						
Type of Sample	Sites			Samples		
	Planned	Non Planned	Total	Planned	Non Planned	Total
Lakes & Reservoirs	76	69	124	1735	136	1871
Biota	25	17	42	37	22	59
Rivers	1197	426	1398	16277	1475	17752
Groundwaters	709	141	792	2613	399	3012
Freshwater Sediments	139	60	187	273	111	384
Estuaries	232	50	252	3315	179	3494
Coastal Waters	200	29	204	1333	118	1451
Saline Sediments	241	17	256	281	73	354
All Discharges	2283	511	2505	17041	904	17945
Total	5102	1320	5760	42905	3417	46322

Notes:

1) Non-programmed samples will include Pollutions Incidents, Special Surveys and samples missed from the programmed routes.

Fig. 9.1 – Sample Breakdown



Sample Types

BA	Reservoir Water
BC	Spring/Artesian Water
BD	Pumped Groundwater
BE	Static Groundwater
BF	River/Stream Water
BG	Canal Water
BH	Lake/Broad/Pond etc.
BI	Estuarine Water
BJ	Coastal Water
BZ	Miscellaneous Environmental Water
C-	Any Supply Water
D-	Any AWS 'D' Type Effluent
E-	Any AWS 'E' type Effluent
F-	Any Leachate
H-	Any Solid
I-	Any Biota
J-	Any WTW Effluent
LA	AWS STW Final Effluent
LB	Non-AWS STW Final Effluent
LC	Surface Water Drainage
LD	Any Other Sewage Discharge
LF	Industrial Effluent
LG	Agricultural Effluent
LZ	Miscellaneous Discharges
QC	Quality Control - Inter-Laboratory Calibration

APPENDIX I: BIOLOGICAL MONITORING

SAMPLE TYPE		NUMBER OF SAMPLES	
		1994	1995
Freshwater -Rivers			
Macroinvertebrates	Routine	2238	2096
	Pollution	385	226
	Special Investigation	707	748
Macrophytes		110	179
Microbes		427	541
Phytoplankton/Blue-green algae		530	353
Total		4397	4143
Freshwater - Lakes			
Macroinvertebrates		935	305
Macrophytes		829	38
Microbes		10	36
Phytoplankton/Blue-green algae		1048	963
Zooplankton		1543	1375
Total		4365	2717
Estuary & Coastal Waters			
Macroinvertebrates	Intertidal	378	237
	Subtidal	616	1334
Microbes		1348	1564
Phytoplankton		78	480
Zooplankton		44	66
Beam Trawl		38	66
Bioaccumulation		72	63
Total		2574	3810
Borehole			
Microbes		0	13

APPENDIX II: POLLUTION PREVENTION GUIDANCE NOTES

PPG 1 - General Guide to the Prevention of Pollution of Controlled Waters
PPG 2 - Above Ground Oil Storage Tanks
PPG 3 - The Use and Design of Oil Separators in Surface Water Drainage Systems
PPG 4 - Disposal of Sewage Where no Mains Drainage is Available
PPG 5 - Works in, Near or Liable to Affect Watercourses
PPG 6 - Working at Demolition & Construction Sites
PPG 7 - Fuelling Stations: Construction & Operation
PPG 8 - Safe Storage and Disposal of Used Oils
PPG 9 - Pesticides
PPG 10 - Highway Depots
PPG 11 - Industrial Sites
PPG 12 - Sheep Dip
PPG 13 - Guidance Note on the Use of High Pressure Water and Steam Cleaners
PPG 14 - Boats and Marinas
PPG 15 - Retail Premises
PPG 16 - Schools and Educational Establishments
PPG 17 - Dairies and Other Milk Handling Operations
PPG 18 Spillage and Fire Fighting Runoff
PPG 19 - Garages and Services Centres
PPG 20 - Dewatering of Underground Ducts and Chambers

APPENDIX III: PROSECUTIONS BROUGHT TO COURT

INCIDENT	HEARING	DEFENDANT	FINE £	COSTS £
Pig slurry to tributary of Tiffey	13/01/95	Mr P E Richardson	1,000.00	1,073.00
Sewage effluent into Great Ouse	27/02/95	Whitbread PLC *Fine later reduced	14,000.00 (1x 6,000 1x 8,000)	1,468.00
Fertiliser into Culford Stream	24/03/95	David Stennett Limited	7,500.00	669.00
Diesel into Pickers ditch	02/03/95	J Hodgson Limited	500.00	1,000.00
Trade effluent into Ship Burn	02/03/95	Blyth Carnegie, Irrigation Limited	750.00	1,117.00
Diesel into Toftwood Stream	09/09/95	Crane Freuhauf Limited	2,000.00	1,280.00
Trade waste into unnamed stream	19/04/95	Trafford Trading Company	500.00	500.00
Sewage effluent into Great Ouse	26/05/95	Whitbread PLC	6,000.00 (1x4,000 1x2,000) *(reduced)	NIL
Sewage effluent into Henlow Brook	05/06/95	G A Contracts Limited	10,000.00	629.00
Detergent into unnamed stream	12/06/95	Dalgety Agriculture Ltd	Conditonal Discharge (3 Years)	6,251.00
Sewage sludge into tributary of Great Ouse	26/07/95	A G White Environmental Services Limited	1,000.00	1,305.00
Sewage sludge into Stagsden Brook	26/07/95	A G White Environmental Services Limited	1,000.00	1,100.00
Pig slurry into Harrowden Brook	05/07/95	J D Wilson	10,000.00	200.00
Poultry waste into Little Ouse	07/07/95	Kerry Foods Limited	10,000.00	820.00
Oil into Toftwood Stream	13/07/95	Crane Fruehauf	1,250.00	979.00
Oil into Yare	20/07/95	British Railways Board	5,000.00	682.00

INCIDENT	HEARING	DEFENDANT	FINE £	COSTS £
Sewage effluent into Leaden Brook	24/07/95	Anglian Water Services Ltd	5,000.00	1,440.00
Pig slurry into Harwood Brook	18/08/95	PIC (UK) Limited	4,000.00	1,368.00
Sewage effluent into Bugbrook Brook	11/08/95	Anglian Water Services Ltd	1,000.00	1,072.00
Poultry waste into tributary of Lark	14/08/95	M W Buchanon	2,500.00	1,600.00
Pig slurry into Bourn Brook	16/08/95	J E Clarke	3,500.00	1,183.00
Pig slurry into Marsh dyke	16/08/95	R Green	2,000.00	938.00
Poultry waste into unnamed stream	08/09/95	N Appleyard	4,000.00 (2x 2,000)	1,351.00
Pig slurry into Booton Beck	29/08/95	D & G Pigs	250.00	NIL
Pig slurry into Harwood Brook	01/09/95	Hogshaw Farms Limited	4,000.00	1,200.00
Trade effluent into trib of Middle Level Drain	06/09/95	Greenbank Drinks Co Ltd	3,000.00	850.00
Sewage effluent into Alconbury Brook	06/09/95	Avondale Coachcraft Ltd	2,500.00	865.00
Poultry waste into unnamed stream	08/09/95	Sullivan Agriculture Ltd	2,000.00	1,351.00
Poultry waste into tributary of Grafham Water	08/09/95	Sullivan Agriculture Ltd	2,000.00	
Diesel into tributary of Bourn Brook	11/10/95	Pre-start Limited	3,000.00	1,300.00
Farm waste into unnamed stream	01/11/95	M Blake	200 hrs Community Service (2 x 100)	950.00
Fertiliser into Green End Brook	06/11/95	Davison and Company (Bradford) Limited	1,000.00	631.00
Food waste into Cemetery Drain	24/11/95	Geest Food Limited	10,000.00 (2 x 5,000)	1,976.00

APPENDIX IV: FORMAL CAUTIONS

INCIDENT	DEFENDANT	DATE ISSUED
Herbicide into Wold Grift Drain	F W Burkitt and Sons, Park Farm	15/02/95
Trichloroethylene to aquifer	Aim Aviation (HBA) Limited	13/03/95
Oil into unnamed watercourse	S J Barrick Limited	31/03/95
Sewage discharge to unnamed watercourse	Fettlebridge Company Limited	15/04/95
Piggery waste to tributary of Blackwater River (Norfolk)	Nigel Webster	20/05/95
Piggery waste to tributary. of Blackwater River (Norfolk)	Michael John Gore, Railway Farm	20/06/95
Septic tank overflow to Ketlam Drain	Staffing Solutions Limited	29/07/95
Leachate from manure heap into tributary of Wissey	P L Brown, Broom Hill Farm	07/08/95
Liquid fertiliser to tributary of Blackwater (Essex)	H J Fairs and Son, Warrens Farm	03/08/95
Trade waste to aquifer	Duramite Electroplaters Limited	24/08/95
Pig slurry into unnamed stream	S Fielding, Clay Hall Farm	11/11/95
Pig slurry into Whilton Branch of Nene	Bridge House Farm Ltd	15/11/95
Piggery liquor draining to watercourse via land drains	S J Roberts, Deal Farm	20/11/95
Poor quality sewage effluent	British Telecommunications	24/11/95
Poor quality trade effluent	Trinity Foot Public House	27/11/95

GLOSSARY

Aquifer	Layers of underground porous rock which contain water and allow water to flow through them.
Bentazone	A herbicide used to controlling weeds in Broad-leaved crops
Blue-Green Algae	Ubiquitous, usually microscopic plankton that can form dense, floating scums in still waters during calm weather. Strictly speaking, they are not algae, but Cyanobacteria.
BOD and BOD (ATU)	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed in water, usually by organic pollution. Oxygen is vital for life so the measurement of the BOD tests whether pollution could affect aquatic animal. The value can be misleading because much more oxygen is taken up by ammonia in the test than in the natural water. This effect is suppressed by adding a chemical (Allyl Thio-Urea) to the sample of water taken for testing. Hence BOD(ATU).
Cadmium	A very toxic heavy metal with a wide variety of uses.
Carbon tetrachloride	An organic solvent commonly used as a dry-cleaning agent.
Chloroform	An organic solvent commonly used throughout industry.
Coliforms	Bacteria found in the intestines and faeces of most animals. Their presence indicates faecal pollution by humans or animals.
Cyprinid Fish	Coarse fish like roach, dace and bream.
Dichlorvos	A soluble organophosphorus insecticide which is used as a fumigant in crop protection and for controlling louse in the salmon farming industry.
DDT	An acronym for Dichloro-diphenyl-tetrachloroethane. This is a persistent organochlorine pesticide no longer approved for use in the United Kingdom.
Determinand	A general name for a characteristic or aspect of water quality. Usually a feature which can be described numerically as a result of scientific measurement.
Drins	The abbreviated name for a group of persistent Organophosphorus insecticides, including Aldrin, Dieldrin and Isodrin.
Ecological Quality Index	This describes how close biological quality is to expectations. An index of 1.0 indicates that the animals are unaffected by adverse conditions.
Environmental Quality Standard (EQS)	A measure of the amount of a substance considered to be critical or useful in defining the needs of a Use (ibid) like water supply, a fishery, or just good practice in caring for the Environment. Usually a

	combination of concentration and a summary statistic like, for example, the mean, maximum or a percentile.
EQS	See Environmental Quality Standard
Eutrophication	The process of nutrient enrichment of surface waters; often the cause of unsightly growths of algae and higher plants.
Faecal Coliforms	Usually taken to be synonymous with *Escherichia coli* (*E. coli*). These are coliform (ibid) bacteria characteristic of faecal pollution of mammalian origin. These bacteria are relatively harmless but their presence indicates that harmful micro-organisms may also be found.
Groundwater	Underground water especially in or from aquifers (ibid).
Hexachlorobenzene	A fungicide commonly used for treating cereal crops.
Hexachlorobutadiene	An intermediary compound commonly used in the plastics industry, particularly in Europe.
Invertebrates	A general term for all animals without backbones,ie. all groups except the vertebrates.
Isoproturon	A widely used herbicide used to control weeds in cereal crops.
Lindane	An organochlorine insecticide (1,2,3,4,5,6-hexachlorocyclohexane, also known as Gamma-HCH).
LIMS	Laboratory Information Management System. This is based on micro-computers and generates schedules for sampling and analysis, captures data from instruments, and evaluates and archives the results.
Look-up Table	The numbers of permitted failures in a set of samples is laid down in a Look-up Table, which is referred to in the Legal Consent (ibid).
Mercury	A very toxic heavy metal with a wide variety of uses.
PCB	Polychlorinated Biphenyls. These substances were widely used in the manufacture of electrical insulators.
Pentachlorophenol	An organochlorine fungicide, used primarily for timber preservation.
Pesticides	Substances used to kill pests, weeds, insects, fungi, rodents, and so on. Typically, older pesticides are organochlorine or organophosphate compounds.
Property Services	The organisation that administers and maintains Crown Agency Property.
Remote-sensing Scanner	Formally called a Compact Airborne Spectral Imager, this instrument senses and records 288 bands of reflected water colour, for later comparison to results of water quality samples.

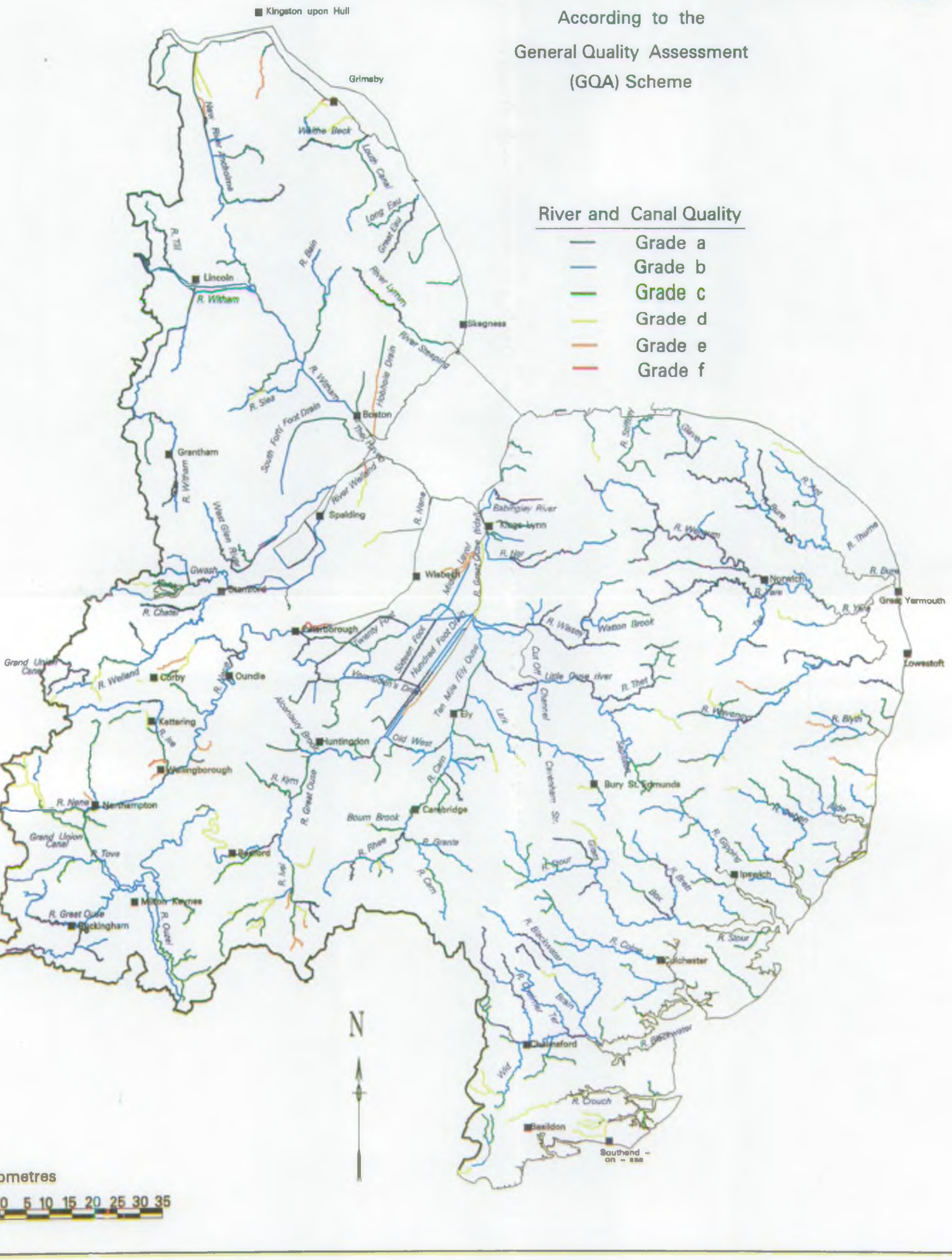
Sacrificial anode	A zinc block found on boats. It is designed to dissolve and prevent corrosion of other metal fittings on the boat.
Salmonid Fish	Game fish, e.g. trout and salmon.
Surface Water	Rivers, canals, lakes or impoundments.
Tetrachloroethylene	A chlorinated organic solvent commonly used as a dry-cleaning agent.
Trichlorobenzene	A chlorinated organic solvent.
Trichloroethylene	A chlorinated organic solvent used as a dry-cleaning agent.
1-2 dichloroethane	A chlorinated solvent used as a de-greasing agent.

INDEX

BIOLOGICAL RIVER QUALITY SURVEY 1995

ENVIRONMENT AGENCY

According to the
General Quality Assessment
(GQA) Scheme



River and Canal Quality

- Grade a
- Grade b
- Grade c
- Grade d
- Grade e
- Grade f

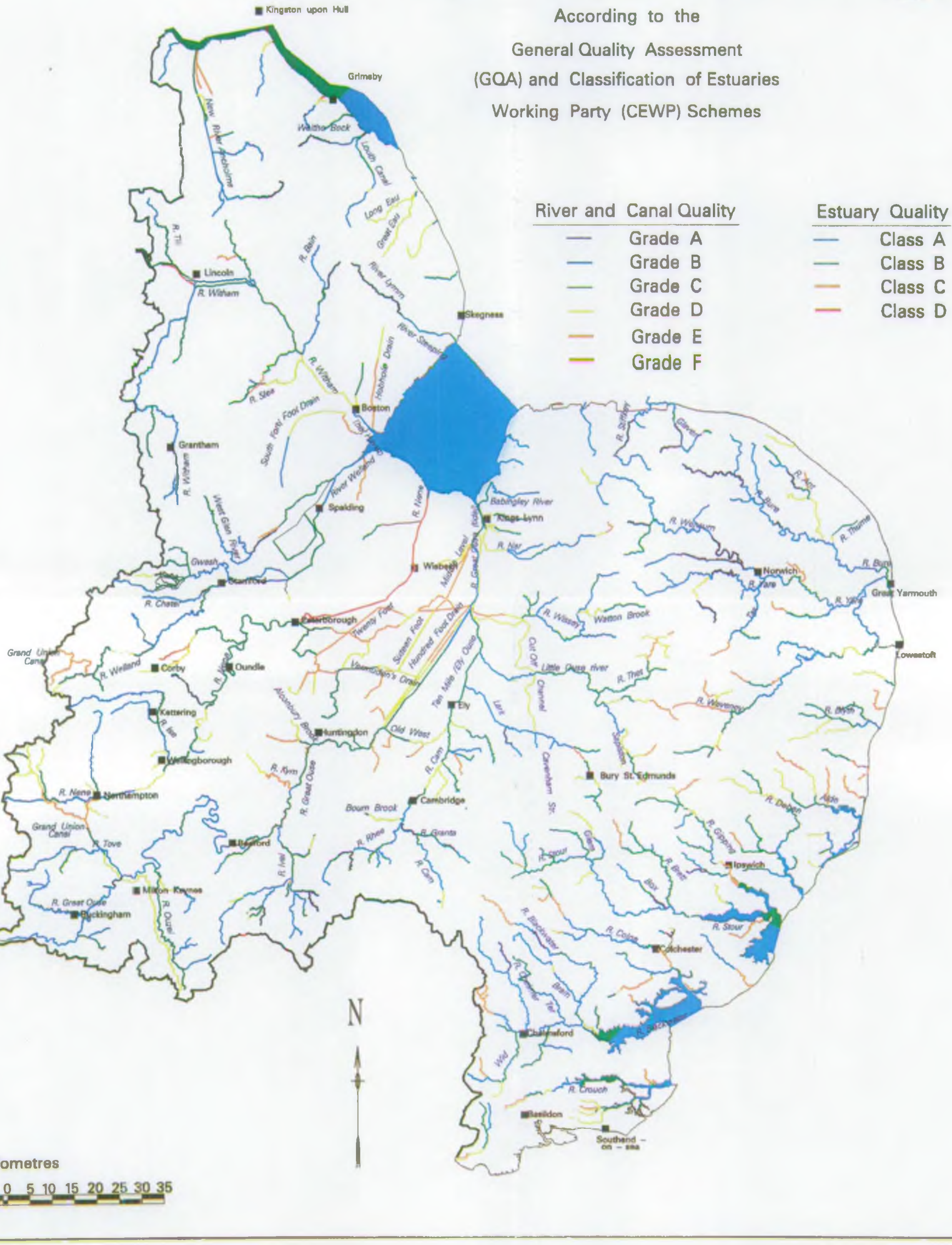
Kilometres

5 0 5 10 15 20 25 30 35

CHEMICAL RIVER QUALITY SURVEY 1995

ENVIRONMENT AGENCY

According to the
General Quality Assessment
(GQA) and Classification of Estuaries
Working Party (CEWP) Schemes



River and Canal Quality

- Grade A
- Grade B
- Grade C
- Grade D
- Grade E
- Grade F

Estuary Quality

- Class A
- Class B
- Class C
- Class D

Kilometres

5 0 5 10 15 20 25 30 35

MANAGEMENT AND CONTACTS:

The Environment Agency delivers a service to its customers, with the emphasis on authority and accountability at the most local level possible. It aims to be cost-effective and efficient and to offer the best service and value for money.

Head Office is responsible for overall policy and relationships with national bodies including government.

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

ENVIRONMENT AGENCY EMERGENCY HOTLINE
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ENVIRONMENT AGENCY

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