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WATER QUALITY REPORT 1994

National Rivers Authority
Anglian Region

WATER QUALITY REPORT 1994

SUMMARY

The National Rivers Authority is a public body, charged with the duty of improving the Water Environment. Anglian is one of eight Regions.

This report gives trends over the past 10 years in the chemical quality of rivers. We demonstrate that water quality has improved since last year and by 34% since 1990.

This is matched by an improvement in the biology. The biological quality is easily the best we have recorded and showed a net improvement since last year and a net improvement of 26% since 1990;

The causes of the improvements in river quality are better effluent quality, and river flows that were higher than those from 1990 to 1992;

The number of reported Pollution Incidents increased by 5% from 1993 to 1994 though again there were fewer of the more serious incidents. The increase from 1992 to 1993 was 4%;

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

We produced maps of 145 Protection Zones for the Groundwater Protection Policy. We advised the Government on the boundaries of Nitrate Sensitive Areas and Nitrate Vulnerable Zones;

We outline the conclusions of the report by the National Audit Office on farm pollution;

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

We report trends for Bathing Waters since 1987. In 1994, six Waters failed. This is one more than 1993 and another setback since 1992. However the average levels of pollution have continued to improve steadily;

We give trends for the performance of discharges since 1982. 97.8% of the sewage treatment works operated by Anglian Water complied with their Consents, a little better than last year. We show how Consents have tightened since 1990;

The number of enquiries of the Water Resources Act Register has increased steadily since it opened in 1985. There were 1282 in 1994, an increase of almost 40% since 1993;

We used River Quality Indices and the Laboratory Information Management System to ensure efficient use of our monitoring resources;

We set up the NRA's National Centre on Toxic and Persistent Substances.

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 key events and issues in 1994. There is an Index and a Glossary at the back.

This section gives general background and an outline of recent and future activities.

1.1 Duties

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

Under the Water Resources Act (1991), we have duties that include:

- achieve 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 Controlled Waters.

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 work is low-key. It aims to protect the water quality in the face of widespread piece-meal attrition caused by the demand both for water and for the use of land.

To sustain success we must continue the cycle by which we audit compliance with standards, assess priorities and take action[1]. Past efforts have produced strong improvements.

During 1994, we met our recurring responsibilities for monitoring, reporting and regulation. We also:

- assessed the quality of our rivers and demonstrated that water quality had improved by 33% since 1990;
- assessed the biological quality of our rivers and showed a 10% increase over the last two years in the length of river in the top class;
- assessed the quality of discharges and demonstrated a 40% reduction, since 1989, in the ammonia load discharged to rivers from sewage treatment works;
- updated our calculations on the action needed to meet our River Quality Objectives for 7000 km of rivers;
- negotiated plans and priorities for investment by dischargers;
- ensured that Catchment Management Plans can produce proposals for Statutory Water Quality Objectives;
- produced maps of 145 Protection Zones for the Groundwater Protection Policy;
- advised MAFF and the DoE and took a leading part in the consultation on Nitrate Sensitive Areas and Nitrate Vulnerable Zones. (Three-quarters of the Region is covered by Nitrate Vulnerable Zones);
- produced a strategy for the Automatic Monitoring of Water Quality;
- implemented a programme of 1500 Formal Visits for Pollution Prevention including sites identified in Catchment Management Plans and in our Groundwater Protection Zones;

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1 *Anglian Region: Water Quality Reports: 1991; 1992; 1993*

- liaised with HMIP and completed our responsibilities for Authorisations for Integrated Pollution Control; since 1991, we have contributed to 130 sets of strategies for Integrated Pollution Control; more than £100m of investment by industry has been secured;
- established the National Centre on Toxic and Persistent Substances;
- took part in the study of Farm Pollution by the National Audit Office;
- increased our liaison with Waste Regulation Authorities as part of introducing the new Licensing Regulations and the charging scheme;
- implemented National Priority Projects within the Region, for example: Market Testing; Catchment Management Plans; and Information Systems;
- managed the consequences of the closure of our Laboratory and the transfer of the work to the National Laboratory Service;
- helped improve national Laboratory Information Management Systems;
- managed the consequences of the application of Market Testing to Microbiology; our analyses are now contracted out;
- carried out a review of how Water Quality is managed in the Region and implemented the recommendations;
- monitored, because of their strategic significance, the effects of phosphorus removal from discharges to the River Nene;
- achieved, through negotiation, an extra planned spend by Anglian Water of £42m for improvements to water quality;
- achieved, through negotiation, planned expenditure by Anglian Water which will deal with unsatisfactory intermittent discharges;
- planned a 16% cut in the routine monitoring of rivers in such a way as to preserve our ability to protect river quality;
- met an increased set of commitments for Directives;
- prepared for the Environment Agency.

All Regions contribute to the development of National Policy. We make a strong input to:

Water Quality Objectives;
National negotiations with the Water Industry on investment;
Implementation of the Directive on Urban Waste Water Treatment;
Policy on High Natural Dispersion Areas (HNDAs);
Policy 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;
Pollution Prevention;
The North Sea and the Paris Commission;
Toxic blue-green algae;
Pesticides and other Persistent Substances; and,
R & D on Toxic Algae, Pesticides and Groundwater Pollution.

1.4 Looking Forward to 1995 and 1996

All Regions are planning for the Environment Agency and will contribute to general and national initiatives. Within Water Quality we plan to:

- protect water quality by maintaining the recent improved quality of discharges;
- assess for OFWAT and the DoE, the results of past investment by Anglian Water;
- monitor for OFWAT and the DoE, the achievement by Anglian Water of agreed plans for future investment;
- translate our River Quality Objectives into the new national system for River Ecosystem;
- continue to plan and justify any further improvements that are needed in the quality of discharges and so achieve Water Quality Objectives;
- complete case studies on Cost Benefit Analysis for Water Quality Objectives;
- through preparations for the introduction of Statutory Water Quality Objectives, consolidate and justify our plans for water quality;
- evaluate the need and scope to improve water quality by the control of pollution by nutrients and pesticides;

- assess the likelihood that the removal of nutrients from sewage effluents will reduce eutrophication in the Cut-Off-Channel (a proposed Eutrophic Sensitive Area);
- continue to respond quickly and thoroughly to Pollution Incidents;
- reduce the number and impact of Pollution Incidents through a three-year programme of Pollution Prevention Visits;
- protect the quality of groundwaters by introducing Phase 3 of the programme for Groundwater Protection Zones;
- plan the measures needed to clean-up particular cases of groundwater pollution;
- continue to develop our systems for data management, and the audit of water quality, and so improve efficiency;
- achieve our monitoring programmes and manage our data in order to: preserve our ability to take good and quick decisions; achieve our statutory duties; meet our reporting deadlines; and satisfy our commitments for Directives and International Agreements;
- complete the monitoring for the 1995 Surveys of Biology, Chemistry, Aesthetic Pollution and Nutrients;
- manage for the Region the implementation of new national Information Systems;
- continue with research which aims to restore water quality in the Norfolk Broads; and,
- operate *Sea Vigil* to provide national and Regional data. Assist with national projects like LOIS and JONUS.

1.5 Catchment Management Plans

This involves the NRA and others in work which:

- identifies the current and potential uses of the catchment;
- sets targets and compares them with the current state of the catchment;
- identifies the options for meeting targets;
- consults on the uses, targets, issues and options;
- prepares a plan; and,

- implements the plan, monitors and reviews.

In 1994, final plans were issued for the combined Gipping and Stour catchments, the Ely Ouse, and the Lower Nene. Consultation started on the plans for the Yare, Bedford Ouse, Upper Nene, Blackwater, and Grimsby and drafts were started for North West Norfolk and the Lower Witham.

After consultation, plans are revised before publication. They then form the basis for our decisions. The plans look forward at least 10 years and will be reviewed, usually at five-yearly intervals.

1.6 Cost Benefit Analysis

We have contributed to a project being run by the Foundation for Water Research (FWR). The project will develop techniques for assessing the financial benefits of improvements to water quality.

We looked at the consequences of improvements to the River Tove in Buckinghamshire (see Part 4.2.11). Our work suggested that these improvements were justified financially.

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 1994 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	296	0	15	312
5 - 12	4	931	7	13	955
13 - 24	14	42	0	19	75
25 - 48	6	18	0	0	24
> 48	0	0	0	0	0
Totals	25	1287	7	47	**1366**

This monitoring allows us to characterise 4800 km of freshwater rivers. Over 15000 routine samples were used.

Samples of river sediments were collected at 80 sites, mainly for the Dangerous Substances Directive. The frequencies ranged from one to four per year.

Our routine programme for groundwater included 712 sites and 2879 samples. Sampling frequencies ranged from fortnightly to one per year, depending on the type of survey and the variability of water quality (see Part 2.12).

Table 8.1 in Section 8 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.

We reviewed the use of our stations and produced a strategy for their future use. We decided to close 7 of our existing stations and to install 4 new stations in the north of our Region.

2.2 River Quality Classification

2.2.1 General Quality Assessment

The chemical quality is reported by the General Quality Assessment (GQA).

The GQA is based totally on the results of analysis stored on the Public Register, and standard published methods of calculation. No subjective judgements are involved.

The GQA Grade for a particular stretch is determined exclusively on 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[1]	-	-	-

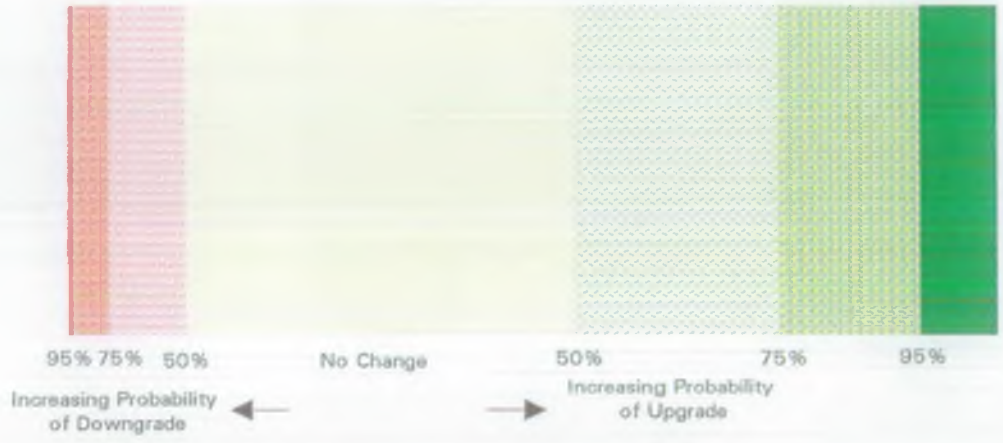
1 quality that does not meet the requirements of Grade E

The concentrations in Table 2.2 are 90-percentiles for BOD and Total Ammonia, and 10-percentiles for Dissolved Oxygen. This means that the river should contain less than the specified concentrations of BOD and Total Ammonia for at least 90 percent of the time, whilst the level of Dissolved Oxygen must not fall below the prescribed level for more than 10 percent of the time.

The Classification of rivers based on data collected from the three year period 1992-1994 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 34% (1526 kilometres) since 1990, and a 24% improvement (960 km) since 1993. Of the upgrades, 8% (376 km) are statistically significant, whilst only 0.3% (14 km) of downgrades are significant. Figure 2.1 illustrates the overall picture.

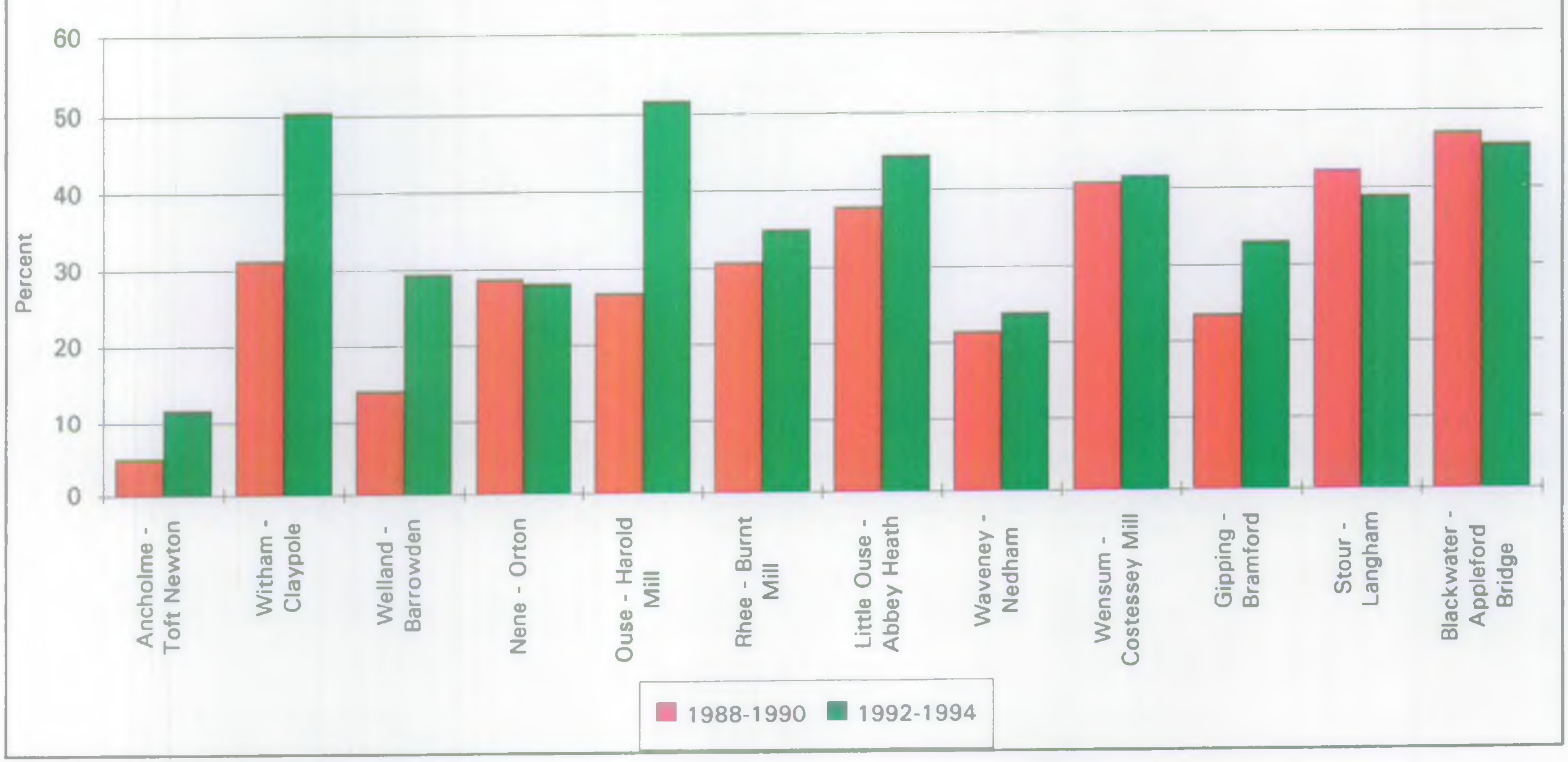
Figure 2.1: 1994 GQA Grade - Up and Downgrades



Increased flows in rivers following the end of the drought in 1992 have continued to have a positive impact on our rivers, and are a cause of some of the improvement seen since 1990. Another factor is the improved quality of the effluent from sewage treatment works (see Parts 4.2.5 and 4.3.5). Figure 2.2 shows river flows for a number of sites. In general, flows are higher in 1992-1994.

Some specific examples of changes are seen in the quality of the Sotherton Watercourse and the River Wang in Suffolk which have improved from Grade F in 1990 to Grades C and D, respectively. This followed improvements in quality of the effluent discharged from Bernard Matthew's factory. The improvement has been good enough to make it worth re-stocking the river with fish.

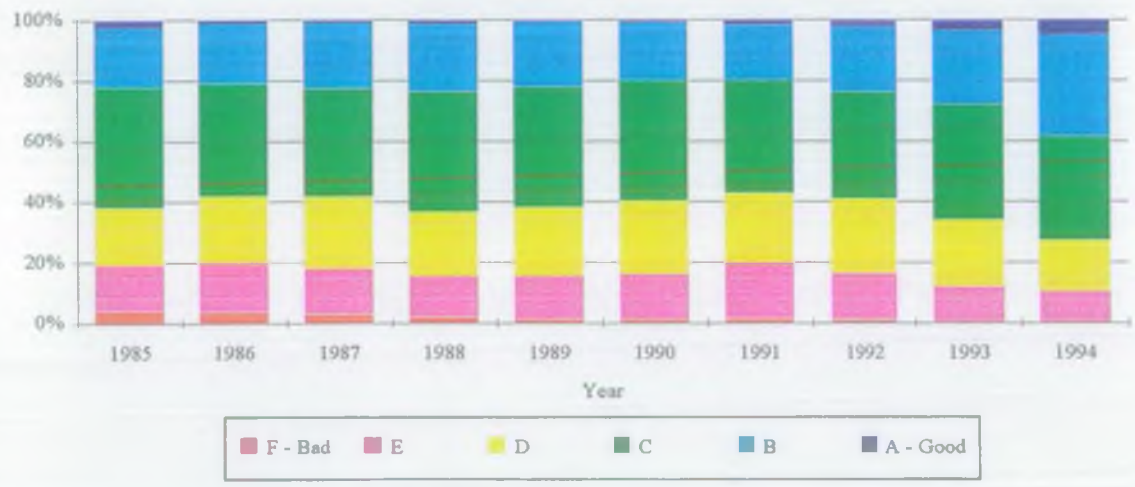
Figure 2.2: Percent of Long Term Average Flow



Several stretches of the River Nene in Northamptonshire have changed from grade E in 1990 to C and D in 1994. These improvements are due to a combination of higher flows in the river and improved effluent quality from Great Billing (serving Northampton) and Broadholme (serving Wellingbrough) sewage treatment works.

Looking further back, we have shown that river quality as assessed by the GQA showed a 3% deterioration from 1983/5 to 1988/90, and a 27% improvement between 1983/5 and 1992/4. This indicates that river quality today is the best since at least the early 1980s. Figure 2.3 shows the pattern.

Figure 2.3: GQA Grades 1985-1994
(for the 3320.9 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, that river quality in 1994 is better than it has been for at least 20 years. On the national scale, it may even be that this 20 year period can be pushed back into the late 1960's and, tentatively, into the 1950's - the first national survey was done for 1958.

The GQA Classification is a national scheme which caters for the very 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, and to spurious, elevated results. Consequently, the GQA Grades are pessimistic.

2.3 River Quality Objectives

The GQA Grades provide an absolute measure of water quality and are 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. Also some rivers of moderate quality may not need to achieve Grade A.

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

The RQOs in this Region cover the following Uses:

- Abstraction for Public Water Supply;
- Salmonid Fishery;
- Cyprinid Fishery;
- Amenity and Conservation;
- Abstraction for Industrial Water Supply;
- Spray Irrigation of Field Crops; and,
- Livestock Watering.

Following public consultation in 1979, the Anglian Water Authority assigned RQOs to 1350 stretches of river, totalling 7843 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.

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, metals and pesticides, is also assessed against the standards set down in the River Quality Objectives.

River quality is highly 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 Dissolved Oxygen, Biochemical Oxygen Demand and Ammonia are given in Figure 2.4. This 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 Quality Standards

For the three years ending in 1994, the percent of time spent within the limits was 90.4%, a significant improvement compared with 88.9% for the three years ending in 1993. Over the same period, 80.4% of river lengths were of the required quality. This compares with 72.8% for the three-years 1993. This improvement mirrors that reported above for the GQA.

As before, our performance figures for river quality are pessimistic because they are distorted by the effect of algae on the measurement of the BOD. If we ignore the effects of algae, the total length complying would increase to 84.9%, for 1993, and to 86.9% for 1994.

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 supporting indicators of change because they cannot be affected by extreme results or changes in sampling rates.

Results from median values for all the Region's samples taken each year are in Table 2.3. This table brings together the 172000 samples taken over 14 years.

TABLE 2.3 Median Values				
Year	BOD (mg/l)	Total Ammonia (mg/l)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Saturation)
1981	2.2	0.09	10.0	94.8
1982	2.4	0.14	10.2	94.8
1983	2.3	0.15	10.2	93.4
1984	2.5	0.14	10.1	95.8
1985	2.5	0.16	10.1	94.3
1986	2.5	0.16	10.1	92.2
1987	2.4	0.16	9.8	90.5
1988	2.4	0.15	9.8	89.4
1989	2.1	0.13	9.5	87.8
1990	2.1	0.10	9.4	88.7
1991	2.1	0.08	9.4	86.4
1992	2.1	0.07	9.7	91.4
1993	1.7	0.07	9.3	88.4
1994	1.3	0.08	10.5	93.0

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. Dissolved Oxygen had been depressed by the low flows of the 1990 drought.

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

2.4 Statutory Water Quality Objectives

As described above, we seek to protect and improve river quality using RQOs. The Water Resources Act extended this approach. Targets can now be underwritten by the Secretary of State for the Environment. When issued in this way the targets will be called Statutory Water Quality Objectives (WQOs).

The Regulations for the River Ecosystem Class, were issued in 1994[2].

The NRA will also use the River Ecosystem Class as its non-statutory targets. These will replace previous similar targets. During 1994 we drafted Rivers Ecosystem targets for all stretches of river that had targets based previously on our old RQOs.

The NRA uses Catchment Plans to prepare plans for meeting the new RQOs. We shall also use Catchment Planning to prepare proposals to transform RQOs into Statutory Objectives.

SWQOs will be introduced in "pilot" catchments. The Cam and the Gipping/Stour have been included on a list from which the Secretary of State will select the first batch. We would like the Cam to be included in this first batch (see Part 4.2.11).

Other Classification Schemes will follow the Government's timetable. Plans for water quality will be based on current objectives in the meantime.

2.5 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 8). The management of this workload is aided by a system of River Quality Indices (RQIs).

The Index summarises water quality and measures performance in the management of monitoring. Data are compressed into a simple number which discriminates between good and bad quality.

The Indices 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 2.5 shows changes in the RQI since 1988. No derogation has been made for algal-BOD in these values (see Part 2.3).

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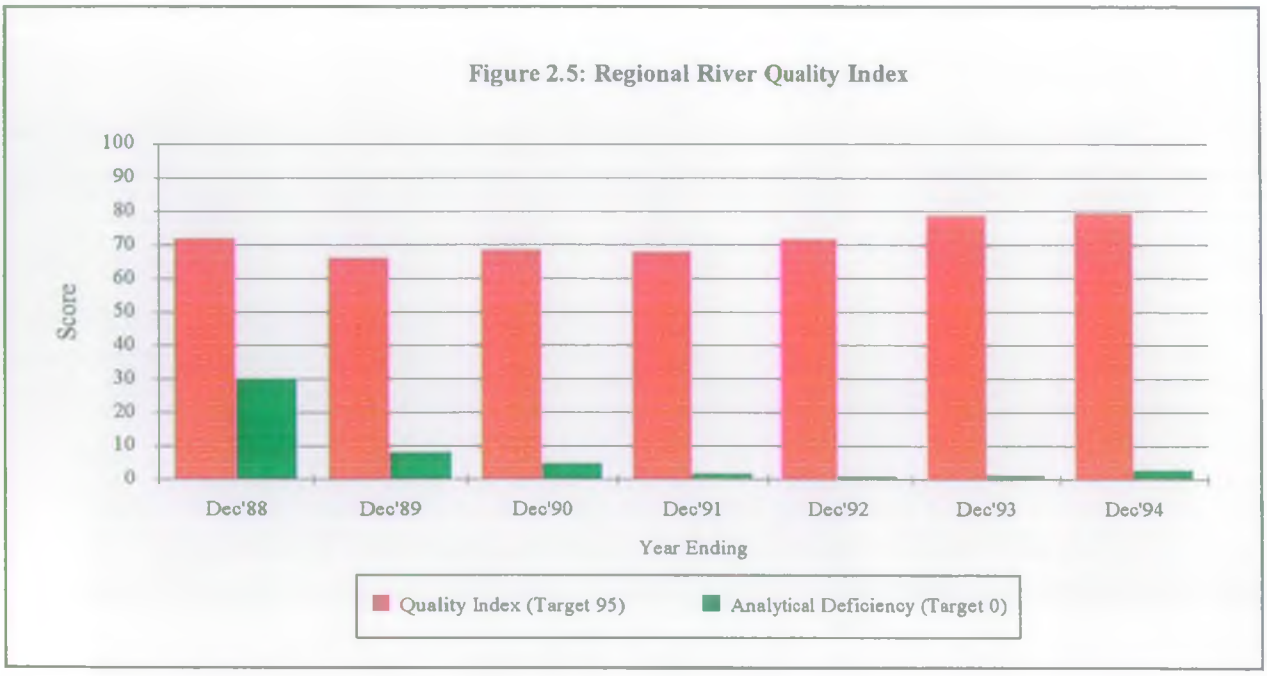
2 *Water Quality Objectives, March 1994*



The target for the Region is to see the Index rise progressively towards 100. Figure 2.5 also shows improvements since 1988 in our ability to achieve our sampling programme (in the reduction of scores for Analytical Deficiency).

2.6 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 for pollution incidents and as part of special investigations.

One special investigation carried out during 1994 involved the River Burn (in Norfolk). This suggested that the macroinvertebrates were severely affected in 1992 with some sections of the river drying up completely. Within two years the population has recovered almost back to where it was before the drought.

A variety of other work is carried out. A list is given in Appendix I.

2.6.1 Presentation of the data

Various systems are used to assess each sample. 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.

Long-term trends

A set of 240 sites has been sampled each year since 1980. These results can describe long-term trends. The ASPT scores for 186 sites common to all years from 1986 to 1994 have been given a rating according to Table 2.4.

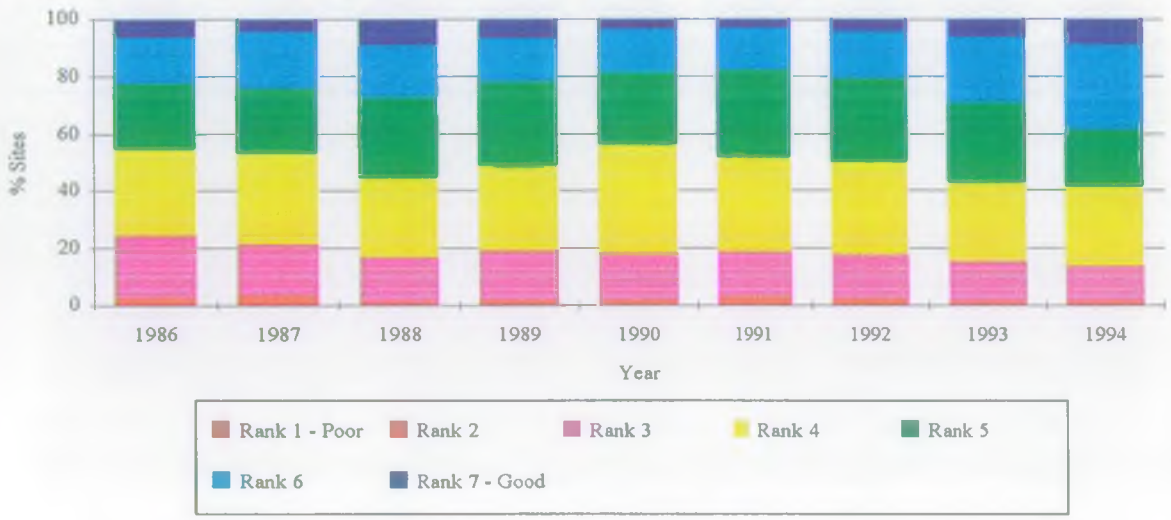
TABLE 2.4

ASPT ratings

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 percent of sites in each ASPT rating is shown in Figure 2.6. The impact of the drought can be seen in the years 1990 to 1992 as an increase in the percentage of sites in the lower ratings. The break of the drought at the end of 1992, coupled with better water quality, can be seen in the 1993 data. This improvement continued in 1994.

Figure 2.6: ASPT Ranks for National Reporting Sites 1986-1994



Classification

Rivers vary in their size, flow and in the background geology and topography. This means that the life found in rivers varies even when pollution is absent. It is useful, therefore, to describe the biology in terms of a shortfall from that expected under conditions of natural water quality. Damage to the biota can be assessed by comparing the actual biology with the biology predicted for natural conditions of water quality.

The DoE funded the development of a mathematical model that predicts the macroinvertebrates which should be found in a clean river. The model is called RIVPACS, an acronym for River InVertebrate Prediction and Classification System. RIVPACS was developed by the Institute of Freshwater Ecology.

If the BMWP predicted by RIVPACS is higher than the observed BMWP value then the results suggest that some form of pollution has occurred.

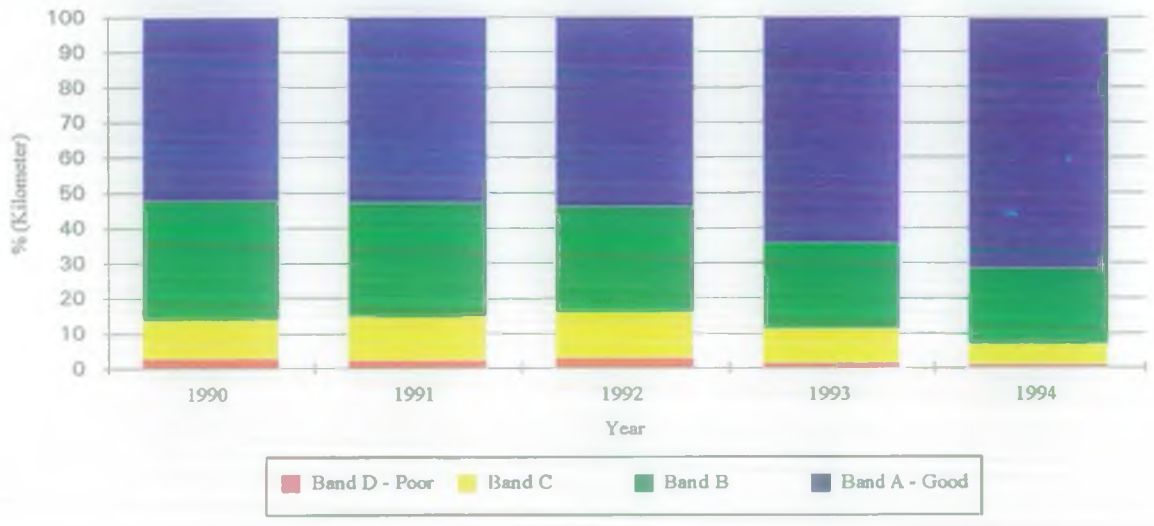
RIVPACS has been used to develop a Classification System. A site is placed in one of four classes, A to D. The classes are assigned on the basis of the ratio of observed and predicted BMWP, ASPT and Number of Taxa. Table 2.5 illustrates.

TABLE 2.5 Biological Classification			
Biological Class	Ratio ASPT	Ratio Taxa	Ratio BMWP
A	>0.89	>0.79	>0.75
B	0.77-0.88	0.58-0.78	0.50-0.74
C	0.66-0.76	0.37-0.57	0.25-0.49
D	<0.65	<0.36	<0.24

2.6.2 Biological Survey

During 1994 two samples were taken at each of 1180 sites. The results are shown on the map enclosed with this report. The percentage of river length in each class from 829 sites (representing 5,130 km) common to all years (1990-94) are summarised in Figure 2.7.

Figure 2.7: Biological River Quality 1990 - 1994



Biological quality has continued to improve. In 1994, 71% of the river length was in Class A, the best quality. This compares with 64.7% in 1993. Also, the percentage of river length in classes B, C and D was lower. Only 0.8% of the river length was in Class D. Table 2.6 gives the net changes by year for sites monitored in all years 1990-1994.

TABLE 2.6 Net changes by Year					
	1990 vs 1991	**1991 vs 1992**	**1992 vs 1993**	**1993 vs 1994**	**1990 vs 1994**
Upgrade	13.9	14.5	22.3	18.0	31.0
Downgrade	13.0	14.3	7.7	7.0	5.1

Improvements seen in 1993 have continued in 1994. The quality now exceeds that seen prior to the drought. This may be attributable to improvements in effluent quality (see Part 4.2.6).

Of the stretches which were classified in both 1993 and 1994, 16 changed by 2 or more classes. This is indicates a significant change.

What caused these changes?

Only 3 sites declined significantly and 13 improved from C to A. Many sites are showing responses to the effects of increased flow, such as Burlands Beck at Willoughby in Lincolnshire, the Ivel at Broom Mill near Biggleswade, and the Weybread Stream, a tributary of the Waveney, near Harleston.

Slade Brook at Glendon Hall Wood near Kettering has improved from Class C to A, possibly as a result of the completion of construction work on the A14.

One of the sites showing a decline in quality is on Grendon Brook in Northamptonshire This is thought to be due to outflow from an overstocked coarse fishery and is being investigated.

2.6.3 Macrophyte Surveys

River macrophytes (plants) help determine and monitor areas affected by nutrients. Certain species tolerate high levels of nutrients. The abundance of these may then increase. Diversity may decrease as a consequence.

During 1994, 76 surveys were carried out, both upstream and downstream of discharges. For each survey, we made a list of the plants, an estimate of the abundance of each, and an estimate and the total cover of the river channel.

Many of our rivers are fairly eutrophic and the impact of a single discharge is difficult to detect. The results from the monitoring, however, suggest that this technique will be useful in identifying Eutrophic Sensitive Areas (see Part 2.7.5).

2.7 Directives

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

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

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

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 Information; and,
- Standardised Reporting Directive.

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

Most of the Directives prescribe methods of assessing compliance with standards. Hardly any Directives take 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 to correct minor failure for the less significant pollutants.

We report annually to the DoE, which then reports to the Commission (see Part 2.7.7).

2.7.1 Dangerous Substances in Surface Waters

The Dangerous Substances Directive contains two lists of pollutants. List I includes materials which are particularly toxic, persistent, and which accumulate in the environment. List II covers pollutants with less serious effects.

2.7.1.1 List I Substances

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

We have also to control all major discharges of Listed Substances, either through the Consents, or by our input to 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 1994:

[a] There were no failures to meet the criteria in any of the 18 freshwater sites designated for Mercury, nor at the 38 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.

We continue to maintain close contact with the company. A treatment plant was commissioned during 1994. A Consent has been issued for the plant and, from August 1994, the discharge had to comply with Consent conditions that have been designed to prevent further failures in the river. However, the company has appealed to the DoE about some of the conditions. This appeal has not yet been resolved.

As there is some contamination of the sediments in the receiving watercourse, it is possible that there may be failures in the future.

[c] The single freshwater site designated for Carbon Tetrachloride passed the standard.

[d] We have no freshwater sites designated for Pentachlorophenol or DDT.

[e] Under the Drins Directive, three freshwater sites were monitored. One of these exceeded the criteria for Dieldrin and Total Drins. The site is located downstream of Calders and Grandidge where problems are being addressed as described in [b] above. There were no problems downstream.

[f] The remaining substances in the Drins Directive are Hexachlorobenzene (HCB), Hexachlorobutadiene (HCBD) and Chloroform. We have no discharges for which we needed to monitor freshwaters for HCB and Chloroform. We have one freshwater site at which we have recently started monitoring for HCBD.

[g] The environmental standards for the chlorinated solvents came into force in 1993. The two freshwater, discharge-related, sites monitored for tetrachloroethylene passed the standard. There were no such freshwater sites which needed monitoring for Trichloroethylene, Trichlorobenzene, or 1,2-Dichloroethane.

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

2.7.1.2 List II Substances

During 1994 we monitored the impact of 110 discharges to freshwaters. The following sites exceeded the standards:

[a] The Louth Canal at Alvingham Lock failed for Iron. This site is downstream of Louth STW. The effluent at this works has been treated with ferric sulphate for several years, in an attempt to reduce the phosphorus concentrations in the canal. Water from the canal is abstracted further downstream to Covenham Reservoir which has a history of algal blooms, related to high phosphorus concentrations. Our aim is to review the Consent for the sewage works and add a limit for Iron. (see Part 2.14.1)

[b] Mintlyn Stream and Middleton Stop Drain 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.

[c] The Pix Brook at Church End, Arlesey failed the standard for copper. This site is downstream of Letchworth STW which is known to receive copper from trade effluent discharges in the sewerage system. It is thought that the amount of copper from these discharges has increased recently. We will liaise with the Utility over inputs of copper to Letchworth STW and include a copper limit on the sewage works consent if necessary.

[d] Noblesgreen Ditch at Cherry Orchard Lane failed the standard for copper. This site is downstream of Rayleigh East STW, which receives copper in a trade effluent. We are addressing the issue in the South Essex Catchment Management Plan. There will be public consultation over this plan in late 1995.

Two sites which failed List II standards in 1993, now pass: The Willow Brook at Corby failed for Zinc, and the Hog Dyke failed for Copper.

2.7.1.3 Revisions to the Directive.

The Commission has begun work on a revision to the Dangerous Substances Directive. The proposals are still being discussed, but it is likely that the revised Directive will have a different purpose from the original. A proposed Directive on Integrated Pollution Prevention and Control (see Section 2.7.9) is aimed at control of point source discharges, whilst a revised Dangerous Substances Directive will probably concentrate on diffuse sources.

2.7.2 Groundwater

This Directive prohibits the discharge of List I Substances to groundwaters 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 2.7.7).

During 1992, the NRA received a Direction from the DoE requiring that we classify substances as List I or List II. This work continued to 1994, and the results will be made available for public examination.

The Council of Ministers has asked the Commission to progress an amendment of the Groundwater Directive which would incorporate the Directive within a general policy for the protection of freshwaters.

A group (which includes NRA representation) is drawing up proposals. The Council has asked to receive the proposals and action plan by March 1995.

2.7.3 Surface Water

Under this Directive, 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 water treatment provided.

As in previous years, several sites failed the nitrate standard. These exceedences reflect the impact of agricultural runoff on our catchments. Action on these failures is one of the provisions of the Nitrate Directive (see Part 2.7.6).

A few other standards were failed. None of these is believed caused by discharges.

2.7.4 Freshwater Fisheries

Standards for the protection of fisheries are specified under this Directive. In our Region, 400 km of salmonid (trout) fishery and 950 km of cyprinid (coarse fish) fishery have been designated.

Under the Standardised Reporting Directive (see Part 2.7.7) the results of the 1994 monitoring for this Directive will be reported to the DoE. A total of 371.5 km (93%) of salmonid fishery complied. This is an 6% improvement on 1993 (347 km). For cyprinid fisheries, a total of 941 km (99%) complied. This is a 2% improvement on 1993, when 923.5 km (97%) complied.

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

Obviously, 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 1994 have caused actual damage.

2.7.5 Urban Waste Water Treatment

This Directive 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 in cases where discharges are considered to contribute to eutrophication, or to elevated levels of nitrate in waters abstracted for drinking (see 2.7.3).

During 1994, the provisions of the Directive were incorporated into UK law via Regulations.

When the Directive is fully implemented, Consents will be varied to incorporate the provisions of the Directive. It is likely that dischargers will monitor their own effluents for the purposes of the Directive, and that we shall continue to monitor for the Water Resources Act (see Part 4).

2.7.5.1 Eutrophic Sensitive Areas

Waters that are eutrophic, or at risk from becoming eutrophic, can be designated as Eutrophic Sensitive Areas. Sewage treatment works may require nutrient removal if they serve more than the equivalent of a population of 10000 and if they discharge, directly or indirectly, to the Sensitive Area.

The DoE published a Consultation Paper in 1992 setting out criteria for deciding whether a water should be designated. Using these criteria we proposed candidates for designation by the Government. During 1993 we discussed our proposals with the DoE and Anglian Water Services.

In 1994, the DoE designated the first set of Eutrophic Sensitive Areas (SA[E]'s). A total of 33 were designated in England and Wales, 13 of which are in our Region. Table 2.7 lists these and the discharges that are required to have phosphorus removal by 1998.

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] - We have been asked by DoE to carry out further studies on phosphorus inputs to this catchment, including agricultural inputs, before coming to a view on which inputs it would be most effective to reduce.

At four year intervals, designations will be reviewed, and further designations will be considered We are collecting information for this review. We are monitoring the 13 designated SA[E]'s, and a further 27 freshwaters, and 15 estuarine stretches, which we consider to be candidates for future designation.

As part of our 1994 monitoring we carried out surveys of aquatic plants (see Part 2.6.3).

When the Cut-Off Channel was designated, the DoE asked us to determine the inputs of phosphorus, and whether nutrient removal would have an effect. We have begun to carry out this study, using our SIMCAT model (see Part 2.17).

2.7.5.2 Sensitive Areas for Nitrate

This applies to surface waters used for water supply which have abstraction points subject to high concentrations of nitrate. Sewage Treatment Works that serve more than the equivalent of 10000 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 provisions of the Nitrate Directive (see Part 2.7.6). 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. It is likely that DoE will announce the designations of Sensitive Areas for Nitrate during 1995.

2.7.6 Pollution of Waters by Nitrates from Agriculture

This Directive 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 in accordance with a Direction from the Secretary of State. Further monitoring will be required for a review of the affected waters every four years.

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

During 1993 we identified the extent of Polluted Waters upstream of river abstraction points, and the hydrological boundaries of the catchments draining to them. This information was used by MAFF and the DoE to define the boundaries of the Zones.

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

Groundwater NVZ's are likely to be based around boreholes that are used for Public Water Supply. Work on this is being linked to the implementation of our Groundwater Protection Policy (see Part 2.12.2).

Due to the intensive agriculture and low rainfall, Anglian has nearly two thirds of the total land area proposed to be in the NVZ's.

During 1994, the proposed surface and groundwater NVZ's were the subject of public consultation. Hundreds of representations were made to MAFF. Each was

answered individually.

Action Programmes must be established and implemented within six years of designating the Zones. The Programmes will detail the mandatory restrictions on agriculture within the NVZ's. The draft content of the UK's Programmes is being decided by DoE and MAFF. The draft Programmes will be 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.

More details on nitrates are given in Part 2.13.

2.7.7 Standardised Reporting

Last year was the second year for which the Directive on the Standardised Reporting of Environmental Directives applied. This Directive lays down requirements for reporting to the Commission. For Water Quality, the first date for reporting is 1996.

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.

Some Directives had no previous reporting requirement (Surface Water Abstraction). Others will now require annual reports (Freshwater Fisheries).

We now 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.

2.7.8 Freedom of Access to Information

The aim is to ensure access to the information held by public bodies on environmental matters. The Directive sets out the conditions on which such information should be made available.

In 1992, the Government introduced Regulations which put the requirements of the Directive into UK law. These Regulations give instructions and advice on who is affected by the Directive, the scope of information that has to be made available, instances when requests may be refused, and the right of appeal against this.

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

The number of enquiries made under this Directive during 1994 was 133.

2.7.9 New Directives

The following are proposed:

- Ecological Quality of Surface Water:

  Proposals were published by the Commission in 1994. There may be a framework Directive. This which would allow Member States to set up their own systems to assess surface waters. Member States would then have to define targets, and implement Action Plans to achieve them.

  Our process of Catchment Planning (see Section 1.5) and Statutory Water Quality Objectives (see Section 2.4) might be the way to implement some of the Directive. Once the Directive is adopted (which is likely to take several years) the Directives on Freshwater Fisheries, Shellfish Waters, and possibly, Surface Water Abstraction, will be annulled.

- Integrated Pollution Prevention and Control.

  This Directive was proposed during 1993. It 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. However, the current proposals would include more industries than are currently controlled by IPC.

Several other Directives have been adopted, or are proposed, which, although not specifically related to water quality, are likely to have some impact on the management of water quality:

- Landfill of Waste;
- Hazardous Waste;
- An amendment to the Pesticides Authorization Directive.[3]

Progress on the revision of Directives, or on the adoption of new Directives, will depend on the Member State holding the presidency of the Commission.

2.8 Pollution Prevention

In 1994, formal targets for site inspections were set for the first time. Targets were set, and specific visits planned according to local priorities within the categories of

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3 *This will establish principles for considering whether to authorise a pesticide. The Directive (the "Uniform Principles Directive") includes provisions designed to ensure that significant quantities of an authorised pesticide do not appear in the aquatic environment.*

farms; groundwater protection; known water quality problems; and others (revisits, schools, hospitals). A site may fall into several categories so each inspection is classified according to the main reason for visiting the site.

Site visits entail a full and thorough inspection of the whole site. This may take 1 to 2 hours for a simple, straightforward site, or several days for a complex site. For each inspection, a report of site information is made. The site owner is informed of the outcome by letter which includes details of any illegal discharges, potential sources of pollution, and other relevant matters.

For serious problems, where illegal discharges are being made (or suspected), site owners are required to carry out remedial work. Work to resolve potential sources of pollution, such as unbunded oil storage tanks at industrial premises, can only be recommended. We lack the legal powers to enforce these.

Table 2.8 shows the targets and numbers of inspections achieved.

TABLE 2.8

Site Inspections in 1994

REASON FOR VISIT	TARGET	ACHIEVED
Farm Inspection	383	483
Groundwater Protection	437	408
Known Water Quality Problems	389	319
Other [1]	151	303
Total	**1340**	**1513**

1 Other includes revisits, schools, hospitals and similar sites.

One of the most important aspects of pollution prevention is to produce and distribute guidance and information, and to identify best practice. In order to ensure a nationally consistent approach, the development of a Pollution Prevention Manual (PPM) was instigated in 1994. The manual includes guidance on a range of topics. It is intended mainly for internal use but is also available to the general public.

External guidance has been developed as a series of Pollution Prevention Guidelines (PPG). Eighteen have now been published, covering topics ranging from storage of oil to the use of pesticides. Several more are being developed. PPGs have proved to be an efficient way of dealing with enquiries about best practice and pollution prevention. As they are National documents, they also help to provide a consistent quality of advice. Anglian Region has had a significant input into the development of PPGs (a full list is given in Appendix II) and the PPM.

Another development has been the release of a video, *Pollution Prevention Pays*. This is available free of charge. The video gives advice, for a large range of sites,

about reducing the risk of causing pollution

2.9 Farm Pollution - Investigation by the National Audit Office

In 1994, the National Audit Office (NAO) studied how the NRA deals with pollution, using farms as an example. Farming accounts for about 12% of pollution incidents.

The final report issued in March 1995 can be summarised as "NRA is doing a good job in managing farm pollution".

The report acknowledges that on a national basis:

- we respond promptly to most farm pollution incidents;
- we took appropriate action against polluters and obtained remedial action to stop the pollution continuing;
- major incidents from farms have significantly reduced since a peak in 1985, and farm incidents as a proportion of all incidents has dropped from 17% to 9%;
- response time targets for attending farm incidents were met in 75% of cases; targets are being modified to reflect the severity of the incident;
- prosecution success rates are high but fines are well below the maximum. (The report does not make it very clear that the level of fine is a matter for the courts and not for NRA).
- the value of pollution prevention visits to farms (see also Section 2.8)

Two areas where improvements could be made were identified: the recovery of NRA costs of dealing with incidents, and the targeting of pollution prevention visits. These have now been considered and improved systems put in place.

The report has few direct comments on our Region. There is reference to Anglian securing the highest fines, making good use of pesticide data, establishing the TAPS Centre (see Part 3.7), and using a pollution prevention database in one of our Areas.

2.10 Pollution Incidents

Formal records of reported 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 onto computers as they carry out their investigations.

A proportion of the reported incidents are due to factors other than pollution

(temperature induced changes in river conditions, for example) and therefore, incidents are categorised into *substantiated* and *no pollution*. Substantiated incidents are split further into 3 groups according to their severity. These are: Category 1 (major), Category 2 (significant) and Category 3 (minor).

During 1994, the Region dealt with 3693 reported pollution incidents, which represents an increase of 5.4% over 1993. The number of substantiated incidents was 2819 (76%). (All further references to incidents, in this Section, refer to **substantiated incidents**).

In 1994, only 12 (0.4%) were classified as Category 1, compared with 15 (0.4%) in 1993. These are shown in Table 2.9

TABLE 2.9

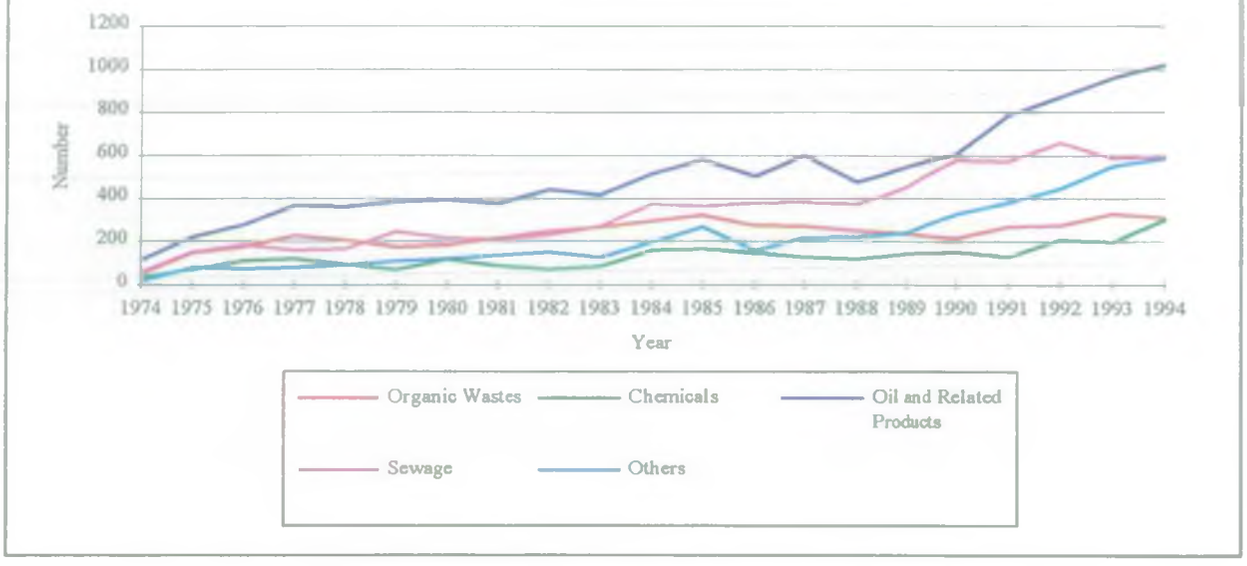
Category 1 Pollution Incidents

Oil	1
Sewage	2
Chemicals	4
Organic Wastes	2
Others	3
Total	12

Category 2 incidents make up 21% of the total, with the remainder, 78% in Category 3.

In 1994, a new national system for classifying incidents was introduced. This categorises incidents by five sources of pollution: agriculture, industry, sewage and water related, transport and "other" sources. The nature of the pollutant is classified into five basic types: oil, sewage, chemical, organic wastes and "other". Historic data have been classified using this system and Figure 2.8 shows the number of incidents reported annually since 1974.

Figure 2.8: Number of Pollution Incidents by Type of Pollutant



Oil accounts for the majority of incidents (1023), with incidents caused by sewage being the next largest type.

Examples of pollution incidents during the year include:

- An oil spill on the River Tiffey occurred in February. A number of ducks and grebes were contaminated. Farms and Domestic Oils Ltd was found guilty under the Water Resources Act 1991 Section 85 and were fined £4,000 with £1,151 costs.

- In July, Bedford Fire and Rescue attended an agrochemical fire and requested NRA presence as contaminated fire water had entered the River Ivel. A cocktail of pesticides was found in the river. Anglian Water Services was informed and consequently closed Offord Water Intake to Grafham Water until the pollution passed.

- A road traffic accident on the A1096 in May resulted in 1000 litres of milk being spilt which was then washed down with water and entered Parsons Drove Drain in St Ives (Cambridgeshire). Following the incident, discussions were held with the police about how to prevent this type of incident occurring again.

- 350 litres of chromic, phosphoric, sulphuric and hydrofluoric acid entered a tributary of the River Ise as a result of a chemical fire in April at a garage in Wellingborough. The fire brigade (using breathing apparatus), the police, and the Health and Safety Executive were called in.

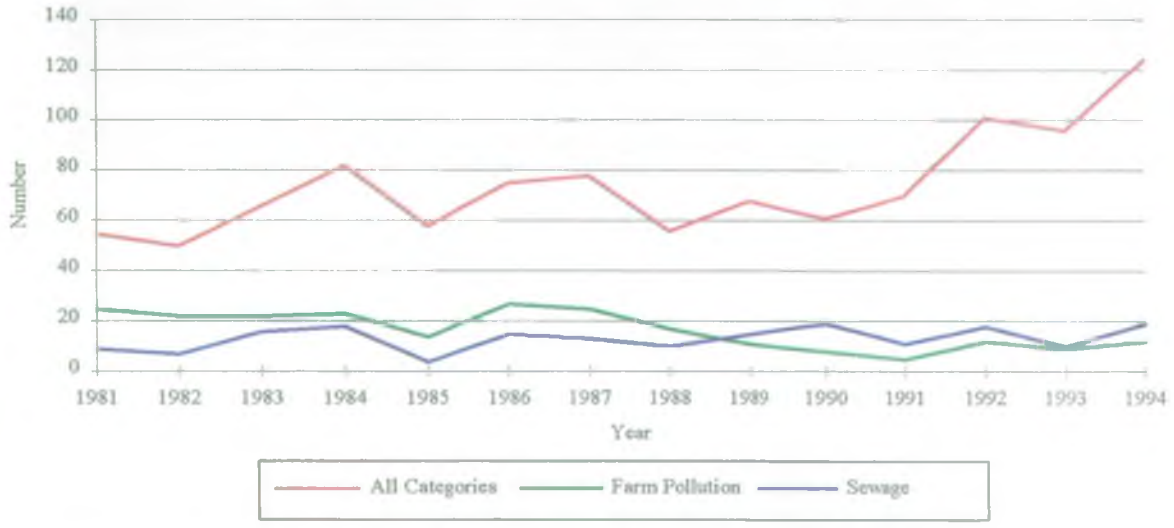
- Glemsford Silk Mills was found guilty at Sudbury Magistrates Court of

polluting the River Glem tributary with a dye which turned the whole watercourse pink. The fine was £750 with costs of £779.

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

Figure 2.9 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.

Figure 2.9: Number of Pollution Incidents Resulting in Fish Mortalities



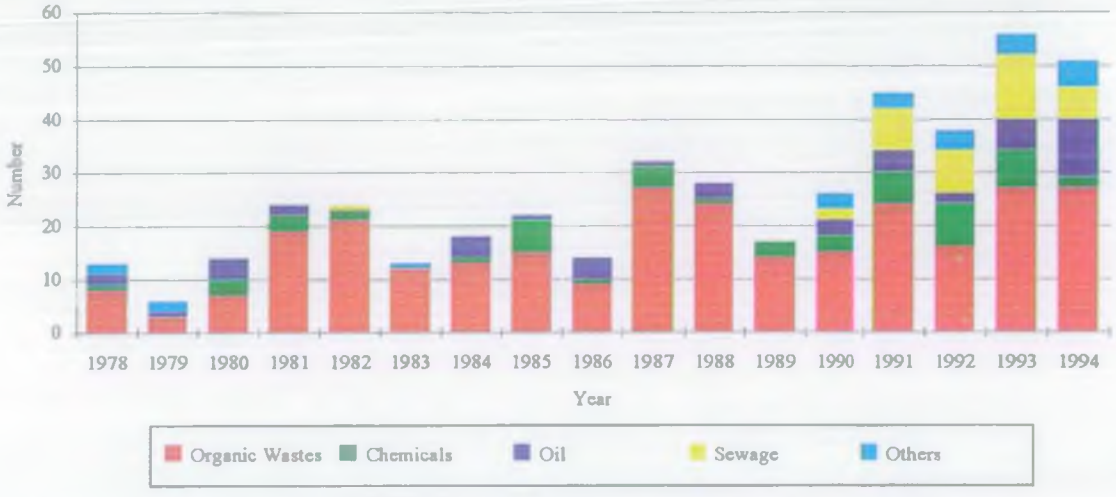
Better use of legislative powers and our growing effectiveness at pollution prevention can reduce the number and impact of incidents. However, any decrease in the number of incidents continues to be offset by increased public awareness resulting in the reporting of a higher proportion of incidents.

2.11 Prosecutions for Pollution Incidents

Under the Water Resources Act 1991 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. Evidence can include chemical and biological sample data, photographs, witness statements and direct evidence from investigating officers.

This means that the number of prosecutions is a small fraction of the total number of pollution incidents, and some prosecutions are not brought to court until the following year. The cases brought to court in 1994 are listed in Appendix III, and trends in the prosecutions over the last 17 years are shown in Figure 2.10. In 1994, 51 prosecutions for pollution were undertaken in the Region.

Figure 2.10: Number of Prosecutions for Pollution Incidents by Type of Pollutant



For the first time, Anglian Region has 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 addition to prosecuting, the NRA is able to 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 alleged offender to acknowledge guilt. In 1994 there were 30 Formal Cautions issued (see Appendix IV).

2.12 Groundwater

Half of the public supply of drinking water in the Region is taken from groundwaters. In most cases these 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.

2.12.1 Monitoring

Currently, we routinely monitor 900 points. Analytical suites range from simple

tests, to lists including metals, pesticides and microbes (see Part 8). Most of the major boreholes are owned by Water Companies, and we regularly obtain their data, to supplement our own.

Based on new national guidelines, a monitoring strategy has been developed. It will be implemented over the next three years.

2.12.2 Protection

Protecting the quality of groundwaters is important because pollution is very difficult to remedy once it has occurred. Our Groundwater Protection Policy gives a technical framework for protecting quality and quantity. This framework is used to achieve our own duties and to influence others, for example, in response to consultations in the planning processes of Local Authorities.

The document also describes the importance of our groundwaters and the geological classification of strata. It also gives NRA contacts.

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 Aquifers are further classified as High, Intermediate, or Low Vulnerability. Maps at 1:100,000 scale of Humber Estuary (No. 13), North Northamptonshire (No. 24), West Norfolk (No. 25), North Essex (No. 32), and West London (No. 39) were published during 1994;

ii) **Source Protection**. This applies to boreholes, wells and springs that are used for water supply.

By the end of 1994, 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 2.7.5.2 and Part 2.13.2) and Nitrate Vulnerable Zones (see Part 2.7.6).

There are several hundreds of sources to be zoned. We have now planned the next phase for these sources, due to start in 1995.

Activities which pose a threat to groundwaters are grouped together:

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 is governed by whether it is located in any Source Protection Zone.

We have continued to press site operators to prevent leachates causing damage to Controlled Waters. For new and proposed Landfill Sites, we stipulate systems for the containment and extraction of leachates, according to guidelines formulated by the national Waste Disposal and Contaminated Land Group.

2.12.3 Remediation

We work closely with Local Authorities to investigate and improve the situations around a number of contaminated sources. These include boreholes at Mildenhall, Beck Row, Letchworth, Birchmoor, Quidenham, Cambridge, Sculthorpe, and Etton. 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.

We have continued to monitor and evaluate groundwater pollution around Helpston and the implications for abstractors in the area. The pollution source has been identified as former landfill sites. We completed work needed to formulate a management plan. This will be finalised during 1995.

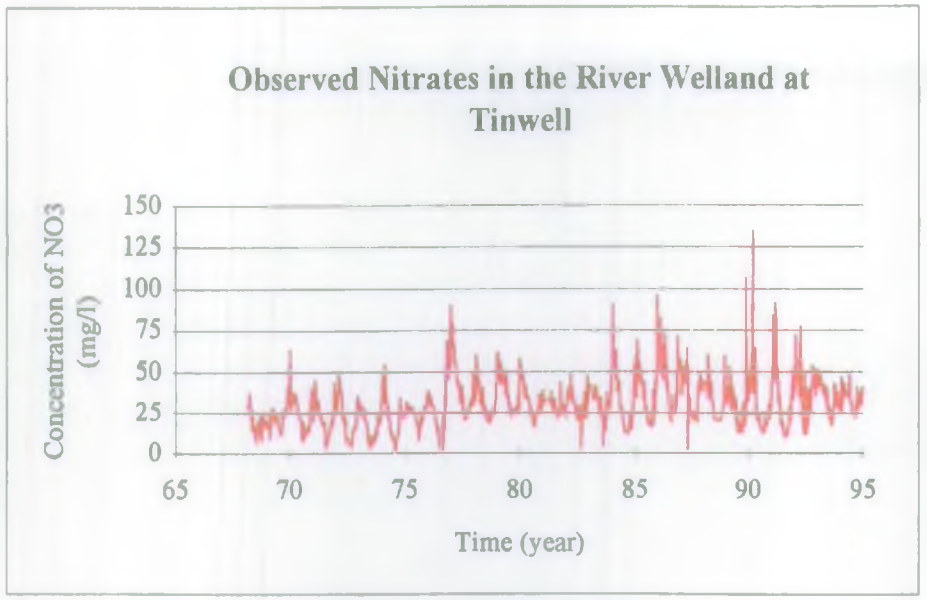
At Sawston, Cambridge, following the judgement by the House of Lords in favour of Eastern Counties Leather (ECL), and the action carried out by ECL, we continued to monitor so that the remaining pollution can be prevented from spreading further and affecting springs and other abstractors. We are using Sawston as a case study in a national project to determine options for cleaning similarly polluted sites. We shall assess the effectiveness of the work being carried out at Sawston.

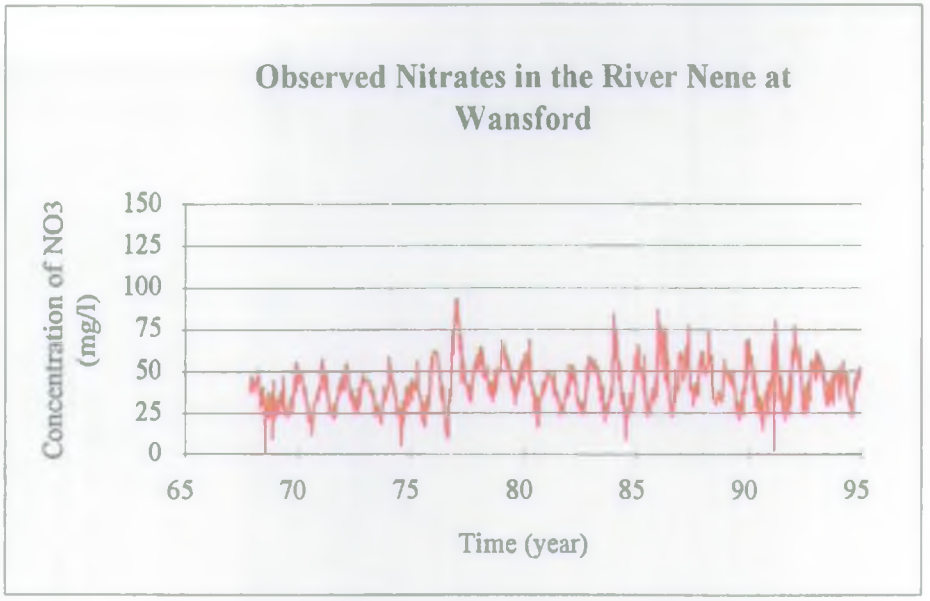
2.13 Nitrate

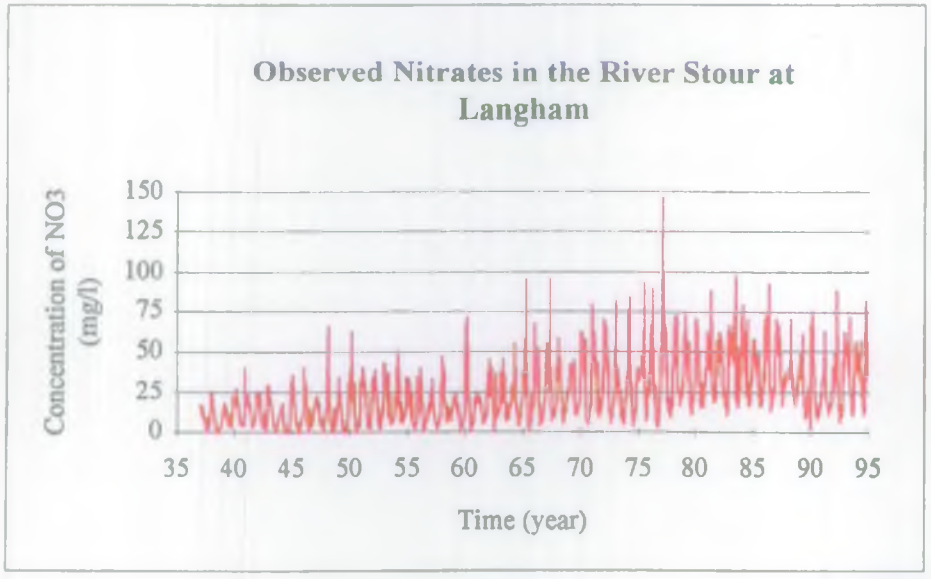
2.13.1 Nitrate in Rivers

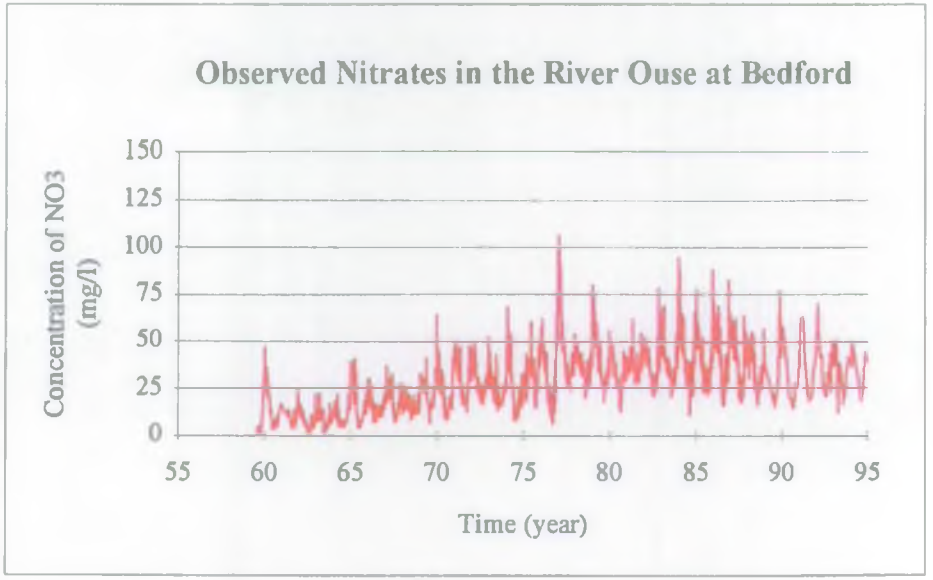
Figure 2.11 illustrates the variability of nitrates at points where water is abstracted for public supply. It suggests that since 1976, an upward trend has levelled off.

Figure 2.11


Observed Nitrates in the River Welland at Tinwell
Concentration of NO3 (mg/l)
150
125
100
75
50
25
0
65 70 75 80 85 90 95
Time (year)


Observed Nitrates in the River Nene at Wansford
Concentration of NO3 (mg/l)
150
125
100
75
50
25
0
65 70 75 80 85 90 95
Time (year)


Observed Nitrates in the River Stour at Langham
Concentration of NO3 (mg/l)
150
125
100
75
50
25
0
35 40 45 50 55 60 65 70 75 80 85 90 95
Time (year)


Observed Nitrates in the River Ouse at Bedford
Concentration of NO3 (mg/l)
150
125
100
75
50
25
0
55 60 65 70 75 80 85 90 95
Time (year)

2.13.2 Nitrate Sensitive Areas

The Water Resources Act 1991 allows for the designation of Nitrate Sensitive Areas (NSAs). These are areas of land in which it is desirable to reduce the movement of nitrate into ground and surface waters.

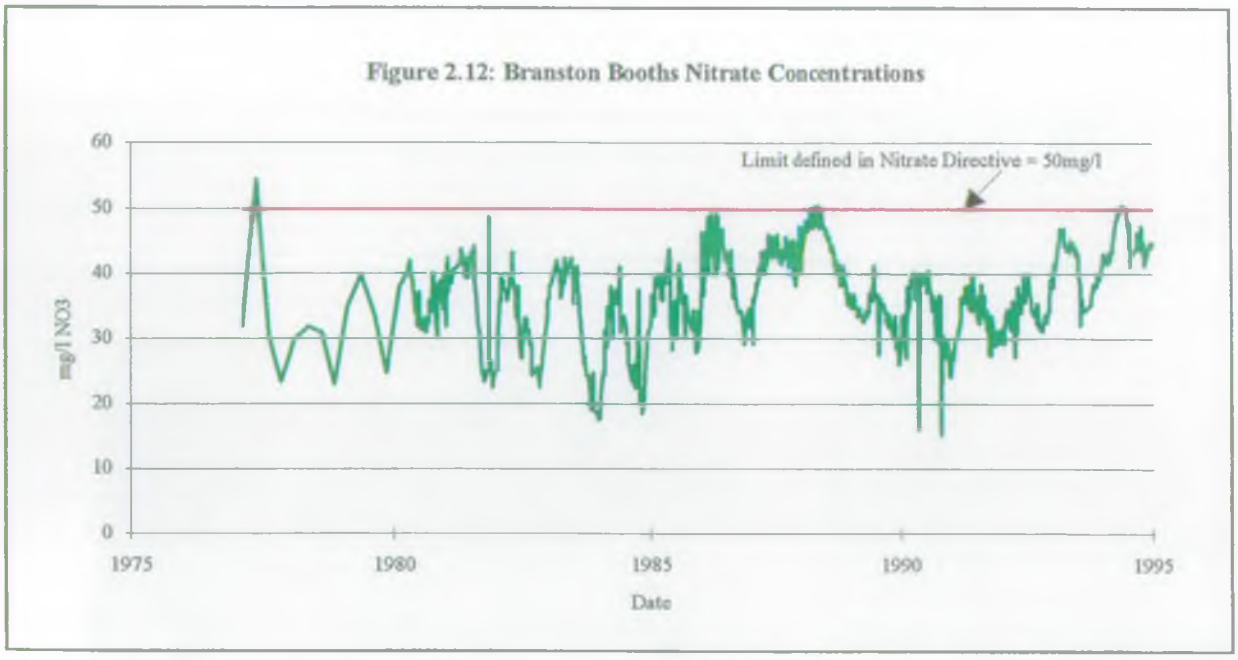
In 1990, following notification to the NRA of Candidate Areas, and after consultations with farmers, MAFF established 10 Pilot NSAs. Two are in Anglian Region, one at Sleaford and the other at Branston Booths, near Lincoln.

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. As the 1990 Scheme was coming to the end of its life, MAFF also started consultation on a scheme for continuing of the Pilot NSAs. The net result for Anglian Region will be 7 NSAs, 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).

The various NSA schemes are different in detail, but they all aim to reduce nitrate concentrations by encouraging changes to farming. The schemes are voluntary and run initially for five years. Farmers are paid different rates of compensation depending on the scale of the changes that they make in the management of their land. The options range from modest reductions in fertiliser use, right up to taking arable land out of production and converting it to ungrazed grassland. Virtually all the land in the Pilot NSAs was entered into some part of the initial scheme. It is not known yet what interest will be shown in the new schemes.

In conjunction with the Water Companies (whose boreholes are being protected by the NSAs), we are monitoring nitrate concentrations within the NSAs and at the boreholes themselves. The results are sent, through MAFF, to the farmers involved and are available on the our Public Register. A plot is given in Figure 2.12.

The apparent reduction in nitrate starting in 1989 is due to the effects of the recent, prolonged drought. The dry winters of 1988, 1989, 1990 and 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 2.12 indicates that concentrations are similar to those observed before the NSAs 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.



2.14 Blue-Green Algae and Eutrophication

Since the problems experienced at Rutland Water in 1989, blue-green algae have continued to be an issue. The Toxic Algae 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 re-occur 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 1994, 39 waters were sampled for the first time. Of these, 18 (46%) contained populations of potentially toxic species at densities sufficiently high for us to warn owners. In addition, 21 waters which were sampled in previous years were also sampled in 1994, 15 of which exceeded the warning level and contained blooms or scums.

The Group is currently co-ordinating work on Action Plans. There is no universal solution to the control of blue-green algae.

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 then used to identify the options. These options are assessed and the best can then be selected and, following consultation, implemented.

2.14.1 Ferric Dosing

Anglian Water has continued to dose a number of reservoirs with ferric sulphate. This controls algae by creating a phosphate-rich floc which settles to the bottom, reducing phosphorus concentrations in the water, and providing a cover to reduce further release of phosphorus from sediments..

We have monitored the effects of dosing at Covenham Reservoir, Grafham Water, Pitsford Reservoir and Rutland Water. The results indicate that dosing has damaged the invertebrate communities near the discharge point of some reservoirs. It is not known whether this is caused by toxicity or blanketing.

Grafham Water has not been dosed since August 1992. Monitoring has suggested that once dosing has stopped the benthic communities recover quickly.

For the last ten years Anglian Water has dosed Ardleigh and Alton Reservoirs via lagoons and bunded areas, respectively. The floc does not enter the main water body and there is no build up of iron on the bottom of the reservoir.

We are continuing with several research projects. These cover the effects of ferric sulphate dosing, the impact of eutrophication on water quality, and a study to quantify the effects of phosphate removal from sewage treatment works discharging to the River Nar.

Anglian Water is looking for alternative long term strategies, and phosphate stripping was initiated at the large sewage treatment works discharging to the Rivers Nene and Great Ouse, upstream of Rutland Water and Grafham Water respectively. Our monitoring has shown that, although phosphorus concentrations in the receiving waters declined, there was no appreciable change in the flora and fauna, and the decline was not enough to reduce algal growth in Grafham Water. The Company has now stopped phosphate stripping at works in the Ouse catchment. Phosphate stripping is continuing for the River Nene and we are monitoring changes in the chemistry and biota of the rivers and reservoir.

In another programme of research we identified rivers which contain low concentrations of nutrients. Such rivers are uncommon in our Region but are thought to support characteristic plants and invertebrates. We are now identifying the communities characteristic of these rivers to assist in determining target groups to aim for following phosphate control.

2.15 The Norfolk Broads

In conjunction with the Broads Authority and Anglian Water Services, we continued working towards restoration.

The research established during 1993, part funded by the EU LIFE Programme, has shown that, by controlling the inputs of nutrients, and by reducing the population of

fish, we can return lakes to clear water, even if nutrient concentrations in the water remain high.

Work at Crome's Broad showed that submerged aquatic plants provide an important refuge for zooplankton from predation by fish. This means there are more zooplankton to graze on algae.

During 1994, the growth of aquatic plants increased in a number of the Broads, particularly at Cockshoot Broad and Crome's Broad. This is an indication that, although delayed, the recovery of vegetation can occur naturally once nutrient inputs have been reduced. As part of the LIFE project, further work is being undertaken in collaboration with researchers from the Netherlands. This will look into why the establishment of plants takes so long.

Investigations have continued into the release of phosphorus from sediments. We have continued to monitor phosphorus inputs, principally at sewage treatment works.

Following the Periodic Review (see Part 4.2.11), £4m will be invested over the next 5 years to provide or enhance phosphorus removal at nine sewage treatment works discharging to the rivers Bure and Ant.

2.16 **Pesticides**

2.16.1 Pesticide Monitoring

Pesticides are used to control a wide range of micro-organisms, weeds, animals and insects. Many pesticides find their way into surface and groundwaters. With increasingly accurate analytical techniques, many 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 some 450 Approved Pesticides in the UK and it is not possible to monitor for all of them. Historically, monitoring has concentrated on the older organochlorine and organophosphorus insecticides. More recently we have monitored for the most commonly used modern products, mainly herbicides. During 1994 we analysed for 106 pesticides and obtained over 38,000 results. This list is reviewed to ensure that we are looking for those pesticides which are most likely to be present in the water environment, as well as any new pesticides that become available.

Mathematical models can predict pesticide concentrations in surface and groundwaters. FARMSTAT is a commercial service using models which, for example, identified Bentazone as a pesticide likely to be found in surface water despite its relatively low usage. Consequently Bentazone was added to the list of analyses in 1993. In 1994 over 7% of the results for Bentazone exceeded the Drinking Water Directive standard (100 ng/l).

2.16.2 Regional Pesticide Database

A further development is the Regional Pesticide Database (RPD). This contains pesticide data from the NRA and Anglian Water. Data from 1991 onwards are held on the database.

The RPD allows us to examine trends over any time period, for example, at selected stretches of river, and for specific pesticides. We can also extract data within defined boundaries, such as catchments or Groundwater Protection Zones. This helps identify the pesticides that are important and helps us plan our monitoring.

2.16.3 Pesticide Monitoring Results

Figure 2.13, derived from the RPD, shows the percent of samples exceeding 100 ng/l for a number of pesticides. This is the limit that drinking water has to meet (after treatment) and we use it as a reference level for environmental waters. Some of the exceedences, for example Dieldrin, are due to known point sources while others, such as Isoproturon, come from diffuse sources.

The frequent detection of Trichloracetic Acid (TCA) (over 40% of samples exceeding 100 ng/l in 1993) was primarily in treated water samples. It is likely that TCA is produced during the chlorination at water treatment since TCA is currently out of production. Also Dichlobenil has a high detection rate but only eight samples were analysed, of which two exceeded 100 ng/l.

Known point sources on the Lower Witham cause failures for environmental standard of the List 1 Substances, Lindane and Dieldrin. (see Part 2.7.1.1)

Of the diffuse inputs, exceedences for Atrazine have fallen since 1991 possibly due to the ban on its use outside agriculture. Simazine has also shown a drop in exceedences for similar reasons. Conversely Diuron appears to have increased slightly possibly reflecting its use as an alternative to Simazine and Atrazine.

Only one major pesticide pollution incident was reported in 1994. A fire at an agrochemical store on a farm at Langford, Bedfordshire released a mixture of pesticides which entered the River Ivel. (see Part 2.10) Incidents such as this are rare. The training of users, the provision of guidance and the implementation of strict measures to prevent pollution mean that this type of incident is largely preventable.

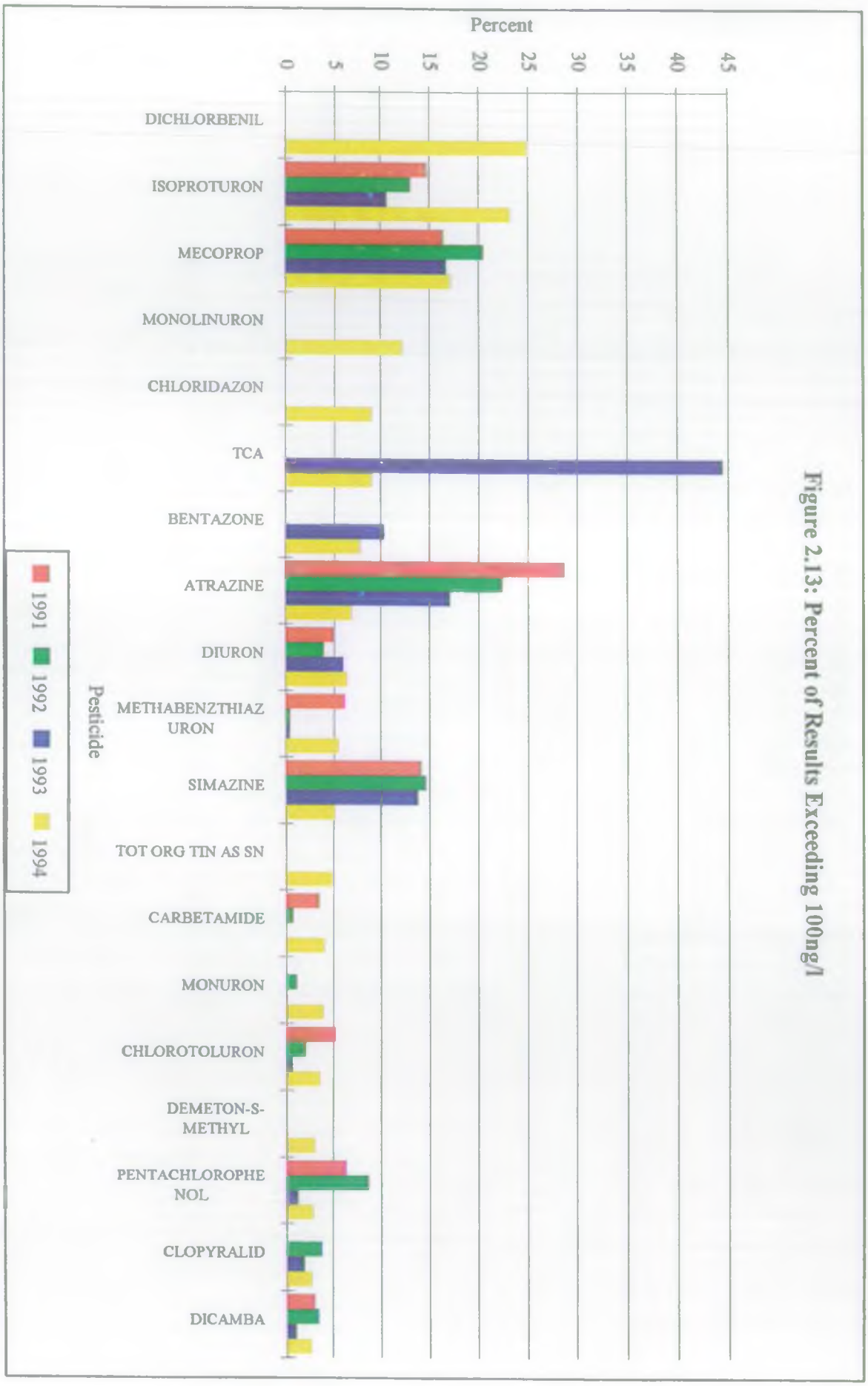


Figure 2.13: Percent of Results Exceeding 100ng/l

2.17 Mathematical Modelling

SIMCAT, our river water quality model, describes the quality of river water throughout a catchment. SIMCAT is used to help to plan the measures needed to improve water quality. SIMCAT has special features which enable it to produce results quickly whilst controlling the effect on decision-making of statistical uncertainties associated with water quality data.

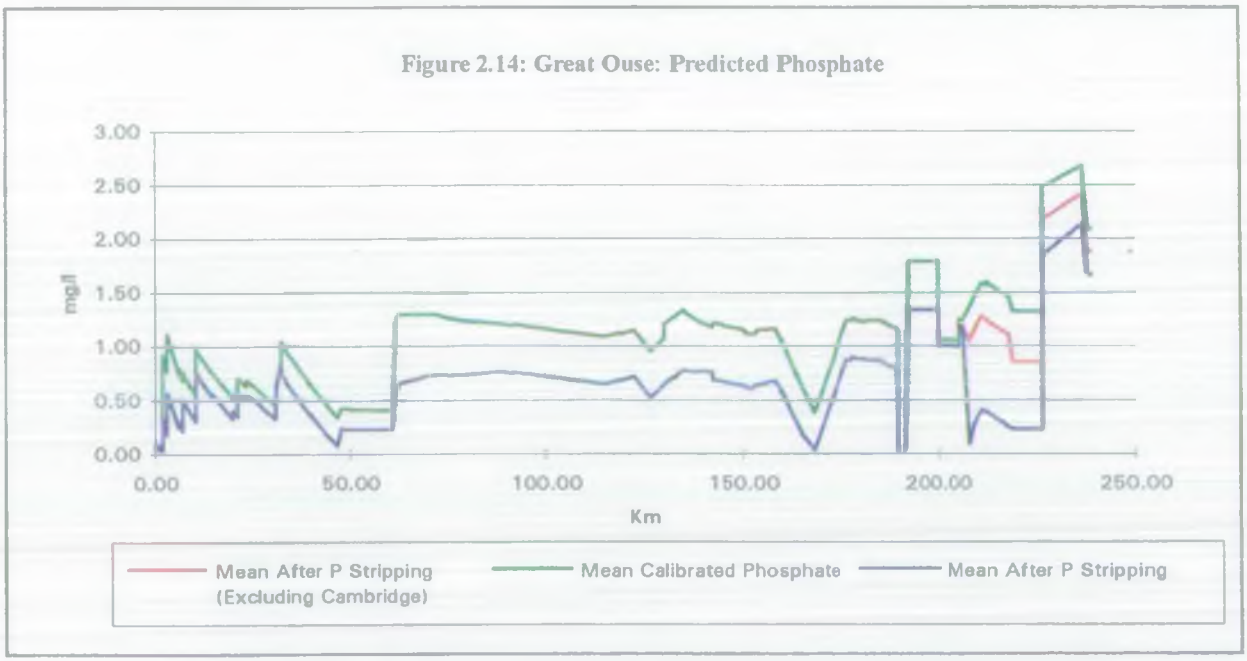
Data files have been produced or updated for the following rivers:

Blackwater, Cam, Chelmer, Deben, Gipping, Great Ouse, Ivel, Lark, Little Ouse, Mardyke, Nene, Ouzel, Stour, Thet, Waveney, Welland, Wensum, Wid, Wissey and Witham.

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, Nene, Stour, Blackwater, Chelmer and Wid, of removing phosphorus from the effluent from sewage treatment works.

In 1994 we set up the biggest ever SIMCAT datafile which covers the whole Great Ouse catchment. It includes the Bedford Ouse, Ouzel, Ivel, Ely Ouse, Cam, Lark, Little Ouse and Wissey sub-catchments. The catchment is divided into 96 reaches and includes about 250 data sets each of river flow, river quality, effluent flow and effluent quality (see Part 2.14.1). Figure 2.14 shows predictions for phosphate and the effect of phosphorus removal at sewage treatment works in the Great Ouse.

Figure 2.14: Great Ouse: Predicted Phosphate



PART 3: ESTUARIES AND COASTAL WATERS

3.1 Monitoring

During 1994, we worked on 22 estuaries and most of our coastal waters. Routine sampling was performed at 532 sites, including the 33 Bathing Waters. Additionally, 11 sites were sampled for special surveys. Frequencies ranged from annual to weekly. The total number of samples exceeded 5700.

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 270 sites, 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 monitor the 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

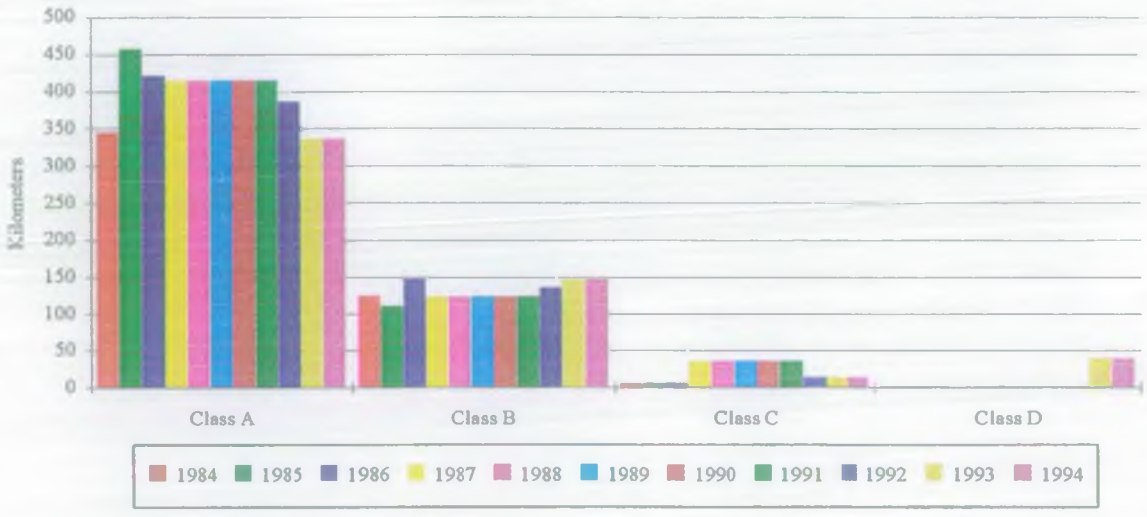
We use the Classification of Estuaries Working Party (CEWP) System to assess the qualities of 580 km of our estuaries, including the whole 65 km of the Humber.

A summary of the results for 1994 is given in Figure 3.1 with data for previous years for comparison. Most of our estuaries (67%), are in Class A, with 25% 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.

There has been no change in estuary water quality since 1993. Most lengths of estuary are of good quality although there are localised areas of pollution around some outfalls.

Our coastal waters have some of the strongest tides in the whole of the North Sea. In some areas the tidal 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 2574 marine biological samples was analysed in 1994 compared with 4416 in 1993 (Appendix I). They were collected for a variety of reasons including routine monitoring and as part of the NRA's National Monitoring Programme (NMP).

Surveys were also carried out to assess the impact of discharges affected by the Titanium Dioxide Directives (see Part 3.4.3).

We surveyed of the Stour and Orwell estuaries. The results suggested a degree of pollution of the inner Orwell, but there were no excessive populations of those species which thrive in highly polluted conditions.

Work on the Nene estuary over the past few years has identified problems associated with industrial discharges, particularly between West Walton and Sutton Bridge. During 1994, sediment from the estuary was tested for its toxicity to a small animal, *Corophium*, which lives in it. The tests suggest that the sediment is toxic to this animal, although it is not yet possible to identify the cause.

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 resembles sewage. This can lead to aesthetic problems.

In 1991, the NRA established a monitoring programme for algae at sites sampled for

the Bathing Water Directive. Algal material is collected for analysis whenever algal blooms are visible. This programme was repeated in 1994. In addition we also monitored in response to inquiries about particular waters. Of the 54 sites which were monitored, 19 of these were found to have blooms. The information was used to notify the public and Local Authorities.

3.3.2 Measurement of Stress Effects in Mussels

Low growth in mussels provides one of the most sensitive measures of stress. The Scope For Growth (SFG) Test has been developed, by Plymouth Marine Laboratory, to use this to indicate the presence of chemical contamination.

In 1990, a DoE study indicated that the Scope for Growth in the North Sea decreased progressively at sites sampled southwards from Scotland to the Thames. Results for sites near Hunstanton in the Wash and in the Humber Estuary also showed low Scope for Growth.

In 1994, we asked the Plymouth Marine Laboratory to investigate three sites in the Wash. Detailed chemical analyses were also carried out on the shellfish tissue.

The results confirmed the previous low levels at Hunstanton and that mussels from sites influenced by the Great Ouse estuary had lower Scope for Growth than those close to the Nene.

Preliminary chemical analysis of the tissues has not revealed any contaminant that could account for the observed effect. Further analysis is being undertaken.

3.4 Directives

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

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

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 Health;
- Pollution of Waters by Nitrates from Agriculture;
- Freedom of Access to Information (see Part 2.7.8).

Directives affecting Freshwaters are described in Part 2.

3.4.1 Dangerous Substances

The scope and objectives of this Directive are outlined in Part 2.7.1. All our sites passed the List I Standards for metals, pesticides and chlorinated solvents.

We monitored waters downstream of 38 discharges that contain List II Substances. Four sites exceeded the quality standards:

- Fenn Creek (Crouch estuary) south of Eyotts Farm for Copper;
- Hamford Water at The Twizzle, off Titchmarsh for Copper;
- The River Orwell at Woolverstone Marina for Copper; and,
- The River Orwell at Landguard Point, Felixstowe for Copper.

No single cause has been identified for the failures in Fenn Creek, Hamford Water, and the River Orwell. 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. We will use the South Essex Catchment Management Plan to address the failure in Fenn Creek.

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. It also 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 2.7.7) we must report the results of monitoring carried out in 1994 to the European Commission (via the DoE). There were six exceedences of the Mandatory Standards.

Exceedences of the DoE's suggested standard for zinc were recorded at four sites:

- Pyefleet Channel at North Farm Hard;
- River Blackwater, Off Marconi Sailing Club Stansgate;
- Hamford Water, The Twizzle off Titchmarsh; and,
- River Roach, East End Paglesham.

Most of the sample points are close to marinas, or in areas with a lot of boats. It is likely that the source of the zinc is the sacrificial anodes on boats. These are designed to dissolve and prevent corrosion of other metal fittings.

There were copper failures 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 a Consent which includes a limit on copper.

There was also a failure for Dissolved Oxygen at this site. This not believed to have caused any damage to the shellfishery.

3.4.3 Titanium Dioxide

Waste from the Titanium Dioxide industry is harmful to the environment, mainly because of its iron content and high acidity.

The Directives on Titanium Dioxide require that factories discharging such waste should 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 would be much greater. A survey in 1989 confirmed that the new outfalls had produced a substantial reduction in the area affected by pollution.

In 1994 monitoring of the receiving waters 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.

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

The Harmonisation Directive, lays down timescales for the reduction and elimination of pollution from the discharges. The provisions came into force during 1993. The DoE is drafting Directions to the NRA, which will place the new Directive within UK Law.

Both companies have constructed treatment plants as part of their plans to meet the timetable imposed by the Directive. These should result in environmental improvements over the next few years.

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 1994, 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 to Local Authorities and are displayed on posters on the beaches.

Of the 33 Identified Bathing Waters in our Region, 27 passed the standards as assessed by the DoE criteria during the 1994 bathing season. This compares with 28 out of 33 in 1993 (See Table 3.1).

The six sites which failed were Cleethorpes, Cromer, Great Yarmouth South, Great Yarmouth Pier, Gorleston Beach, and West Mersea. The Waters at Cleethorpes, and Great Yarmouth South also failed in 1991, 1992 and 1993, and Gorleston Beach and West Mersea also failed in 1991 and 1993. Great Yarmouth Pier also failed in 1993. Capital schemes planned by Anglian Water will improve water quality at all of the above sites over the next few years.

The method of assessing compliance with the Directive is volatile and leads 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 plots the median quality for each Water over eight years against the proportion of Waters with a median less than that particular value. Essentially the further the plot is to the right for a particular year, then the better the quality.

There has been a steady improvement since 1987. The percentage of waters with a median Faecal Coliform value that is less than 100 per 100 ml has risen to 72%, approximately 2% more than in 1993, and the highest in the eight years since 1987. For 1994 then, the stable estimate of trend given by median values still shows an underlying improvement. This contrasts with the more volatile estimate provided by the Number of Failed Bathing Waters, which has deteriorated from 5 to 6.

TABLE 3.1

Bathing Water Directive

Compliance with Standards for Total and Faecal Coliforms

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

* These sites have had at least one failing sample.

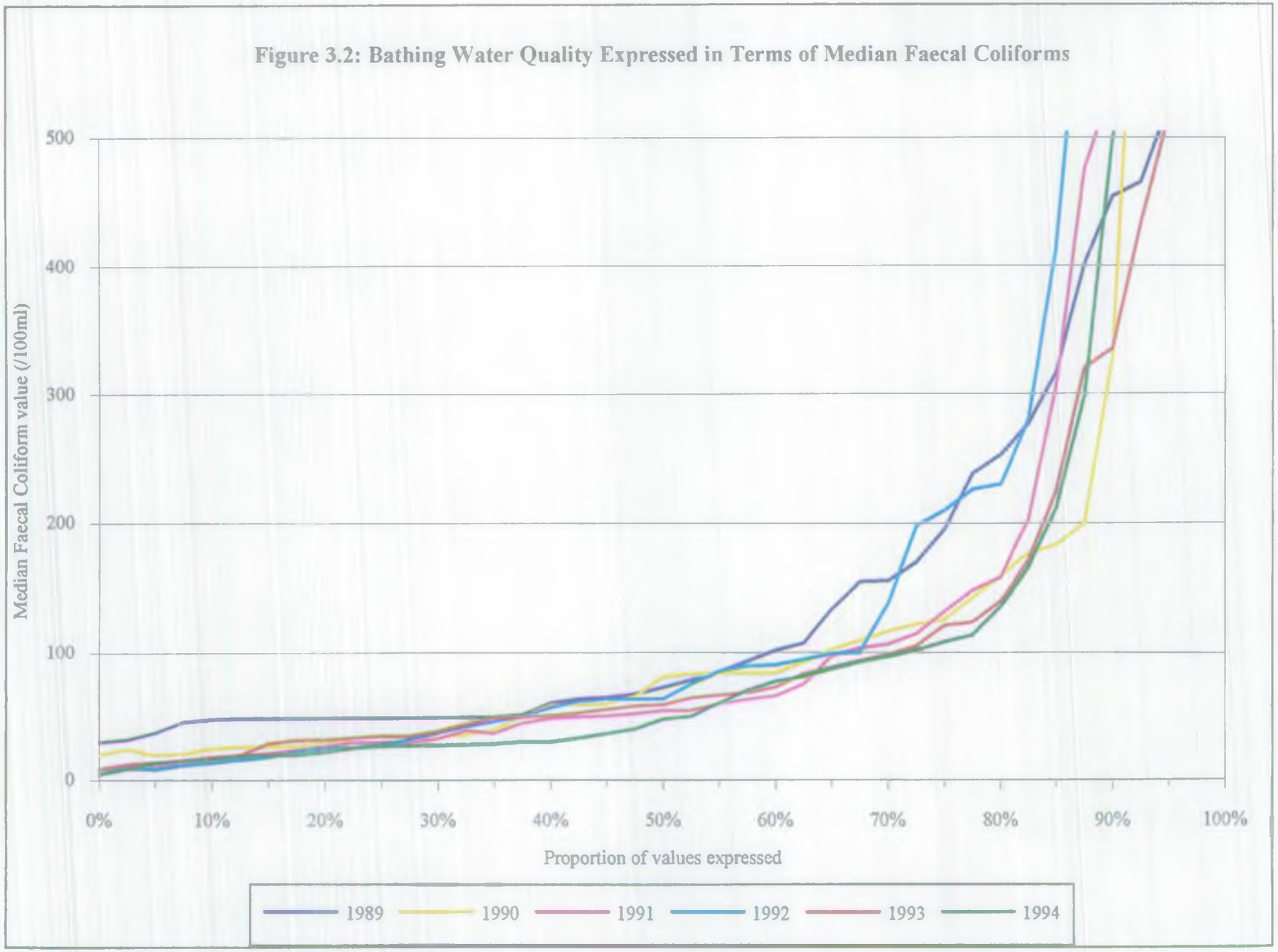


Figure 3.2: Bathing Water Quality Expressed in Terms of Median Faecal Coliforms
Median Faecal Coliform value (/100ml)
500
400
300
200
100
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Proportion of values expressed
1989
1990
1991
1992
1993
1994

This improvement since 1987 had been attributed to a combination of capital expenditure by Anglian Water, together with dry, sunny summers from 1989 to 1991. The latter caused increased die-off of bacteria and less discharge of storm-water. Although 1992, 1993 and 1994 were wetter, cooler summers than the previous three, the improvement in quality was sustained and advanced. This suggests that capital expenditure, and not the weather, is the main cause of the improvement.

During 1994, a new Bathing Water was identified by the DoE as falling within the terms of the Directive. This is Clacton Groyne 41. As the identification came after the end of the bathing season, the water was not monitored during 1994. However, it will be included in our 1995 bathing water monitoring.

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 points of the 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 proposed revision to the Directive. This work has included assessing the likelihood of Bathing Waters complying with the new standards, and liaising with Anglian Water over the costs of schemes to ensure compliance. In addition, we have considered the implications to the NRA for monitoring.

If the proposals were adopted in their current form there would be a drop in compliance. However, the discussions between Member States and the European Commission on the proposals are likely to last at least another year. 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 2.7.5). 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 and 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 obtain 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 will be the basis of all Comprehensive Studies carried out in the UK.

In May, 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 have defined the estuary/coastal boundary for the Humber to be the Humber Bridge.

We are maintaining close contact with dischargers on their Comprehensive Studies. The studies and Designations will be reviewed in 1997.

3.4.6 Shellfish Health Directive

Previously known as the Shellfish Hygiene Directive, this was formally 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 dischargers and Regulators in 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 help from the NRA. To date 76 Harvesting Areas have been identified nationally, with 17 in our Region.

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

Many commercial shellfisheries have fallen into categories which will require the relaying or purification of the molluscs prior to marketing. As a result there may be pressure to initiate 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 NRA to establish the impact of discharges on shellfish quality. In anticipation of this, we have identified, for each Harvesting Area, 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.

3.4.7 Pollution of Waters by Nitrates from Agriculture

The scope of this Directive is outlined in Part 2.7.6. It applies equally to fresh and saline waters. Under the Directive, Vulnerable Zones had to be designated by the end of 1993. No Vulnerable Zones have yet been designated by the UK, although there was a period of public consultation over the proposed Zones during 1994. The actual designations are likely to be made during 1995.

Although none of the proposed Zones are related to related 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 Government participates in the international North Sea Conferences. Nutrients, eutrophication and toxic and persistent pollutants are topics of concern to the Conference, 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.

3.5.1 Coastal Survey Vessel

1994 was the third year in which our coastal survey vessel, *Sea Vigil*, was fully operational. During 1994, *Sea Vigil* comfortably exceeded its targets for working hours. Details are in Figure 3.3.

Much of the boat's time is spent collecting nutrient data. During 1994, we issued reports on the Humber, the Wash and the East Coast. A report on the Lincolnshire Coast was issued in 1993. Figures 3.4 shows the location of the sampling points used for these surveys in the Wash.

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 noticeably lower at all sites north of Lowestoft than at sites to the south.

NRA Engineers investigating coastal processes used *Sea Vigil* to measure currents in a number of estuaries, using advanced equipment borrowed from North West Region.

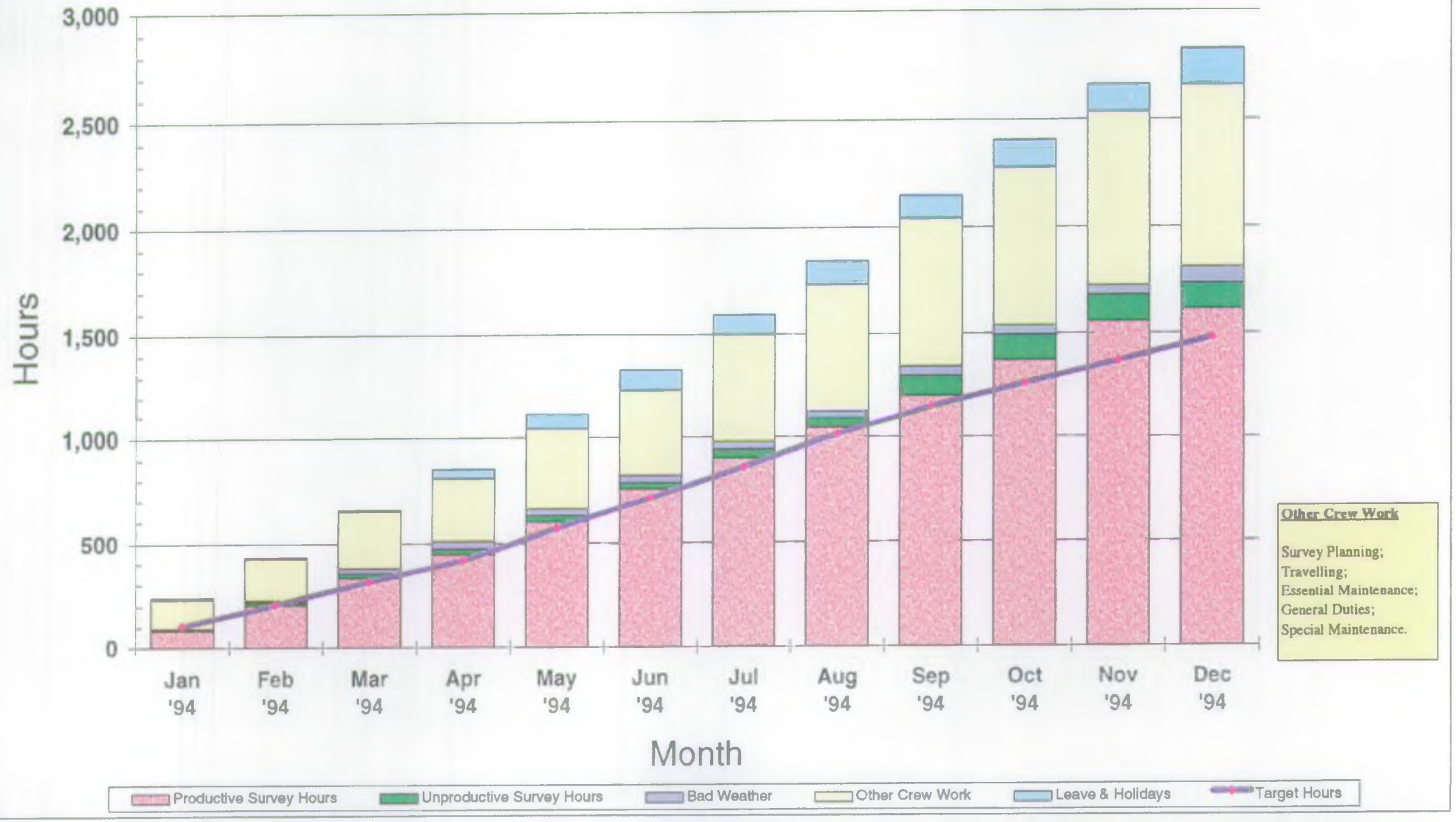
3.5.2 National Coastal Monitoring Study

We contribute to the NRA'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 4 to 5 km offshore while, at the same time, an aircraft flies overhead. Images collected by the aircraft 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 1994. The results are published by the NRA's National Centre for Instrumentation and Coastal Surveillance.

Figure 3.3: Cumulative Utilisation of "*Sea Vigil*" - 1994.

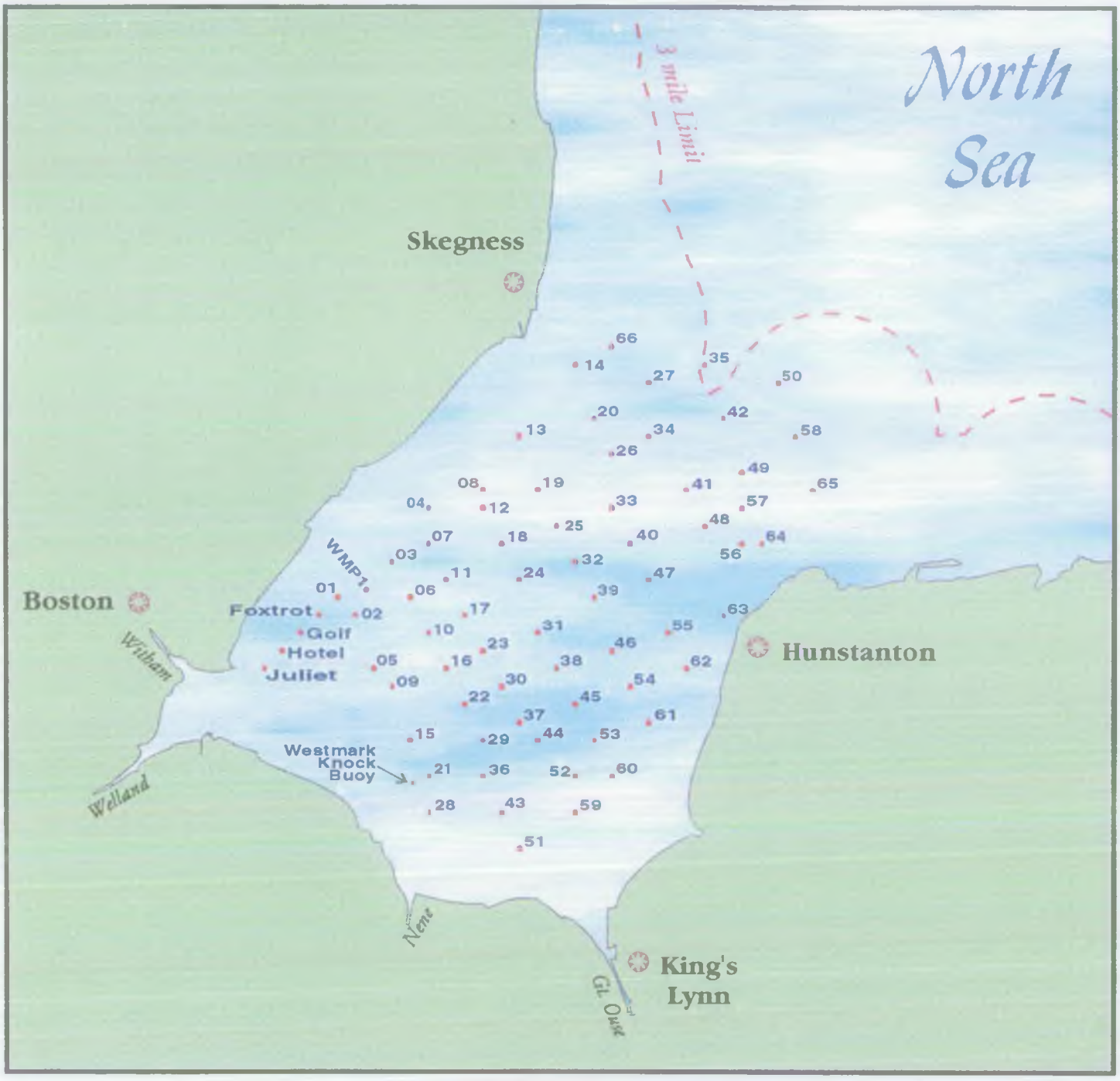
Target Hours Adjusted for -
8.8 hr/day May to September
6.4 hrs/day October to April



Other Crew Work

Survey Planning;
Travelling;
Essential Maintenance;
General Duties;
Special Maintenance.

Figure 3.4 : Wash Grid Sampling Points



3.5.3 The Joint Nutrient Study (JoNuS)

This study has gathered information on the transport of nutrients through the Humber and Wash estuaries to the North Sea. We contributedt by providing nutrient data for the estuaries and by supporting a research project at the University of East Anglian, on phosphate recycling in estuaries.

3.5.4 The Land Ocean Interaction (LOIS) Project

LOIS is a national project that aims to gain an understanding of, and an ability to predict, environmental change in the coastal zone of the UK. Each month during 1994, *Sea Vigil* assisted the Plymouth Marine Laboratory with its sampling of the Humber Estuary.

3.5.5 Annex 1A

The third North Sea Conference (held in 1990) identified a list of 36 Dangerous Substances, known as Annex 1A, the loads of which should be reduced by 1995 to 50% of the amount being discharged in 1985. In England and Wales, the NRA has the responsibility for ensuring that this reduction is met.

Since 1991, we have collected data on all substantial inputs of Annex 1A substances to estuaries and coastal waters. All of the data for England & Wales are processed in Anglian Region. Action to achieve reductions in load is dealt with by individual Regions.

Figure 3.5 shows the proportion of the national loads discharged to the North Sea from our Region during 1993. Anglian contributes a small proportion of the total for most substances. This reflects the lack of heavy industry and our small rivers. Three substances stand out: chromium, zinc and Dichlorvos.

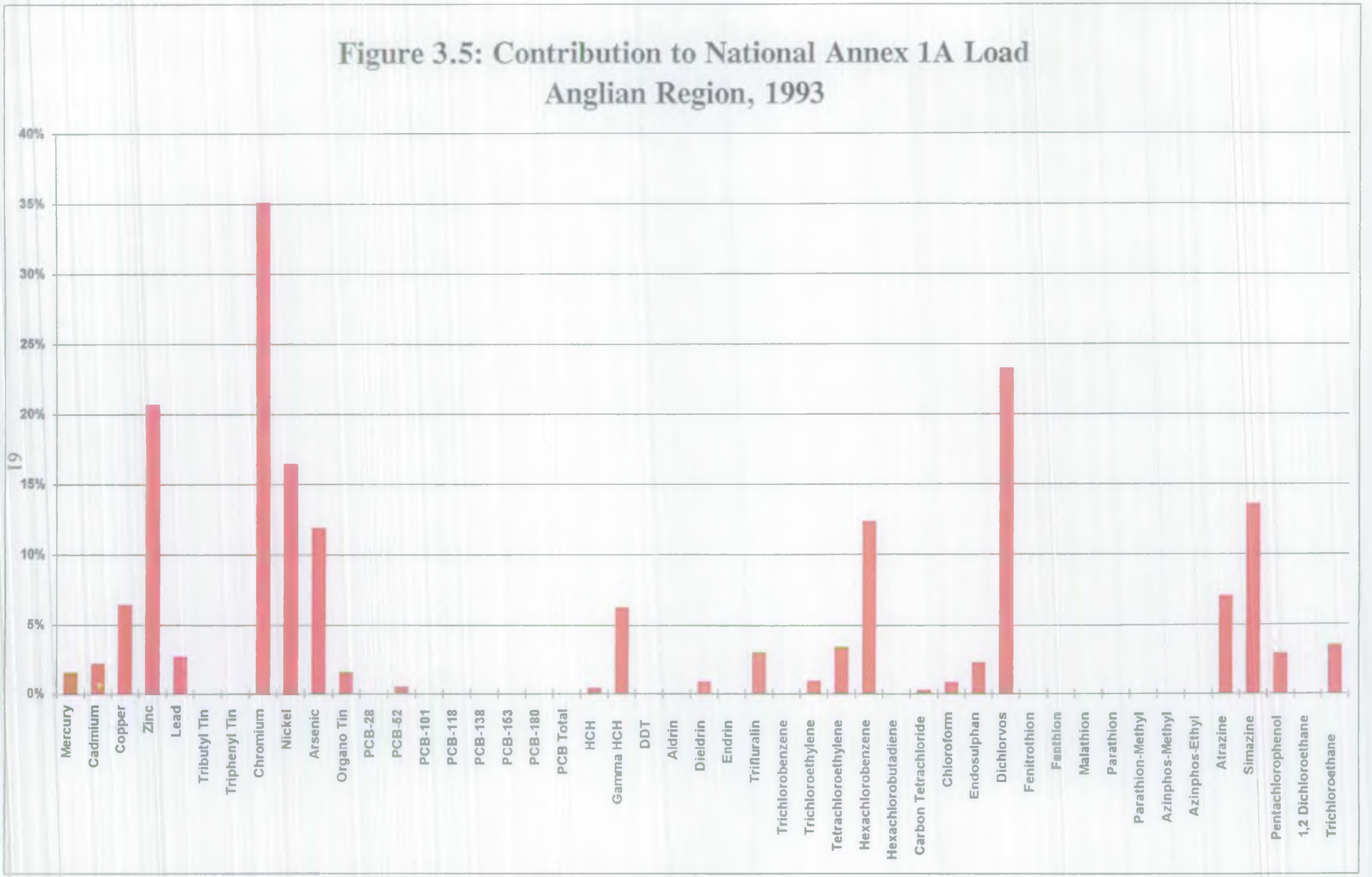
Chromium and zinc are industrial in origin and are associated with industries on the South Humber Bank. Discussions have started with the industrialists about ways of reducing their input and new treatment plants are being brought into use.

Dichlorvos is an insecticide that is detected only sporadically in environmental samples. The result for 1993 is corrupted by one high value which is not attributable to any specific cause. We are continuing to monitor the situation.

3.6 Paris Commission (PARCOM)

In 1978, the Convention for Marine Pollution from Land-based Sources set up the Paris Commission. Since then, monitoring of pollutants entering the sea has been carried out more or less continuously. In 1988, the Paris Commission implemented an annual survey. The aim is 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 Load
Anglian Region, 1993



We monitor discharges from 17 rivers, 14 sewage treatment works and 8 industrial sites. Rivers are monitored close to their tidal limits. Major industrial and sewage effluents below these tidal limits are also monitored. Figure 3.6 shows the proportions contributed by these sources in 1993. Two substances stand out: zinc and total oxidised nitrogen (TON). Zinc originates mainly from industry on the South Humber Bank and reduction measures are in hand. Nitrate is the principal component of TON and the agricultural nature of the Region accounts for its presence.

3.7 National Centre for Toxic and Persistent Substances

In 1993 the NRA decided to create a National Centre to meet current and future commitments for Toxic and Persistent Substances (TAPS). The business case for the Centre was approved by the NRA Board in 1994.

The Centre is manned by 14 staff based at Anglian Region and at a satellite unit in Thames Region. It became fully operational at the end of 1994.

The centre works on:

i) guidance on the control of substances, identifying issues and best practice, and recommending policy.

ii) collecting data on pesticides, substances associated with the North Sea Conference (Annex 1A) and the Paris Commission, establishing national databases, and calculating loads and identifying the main contributors.

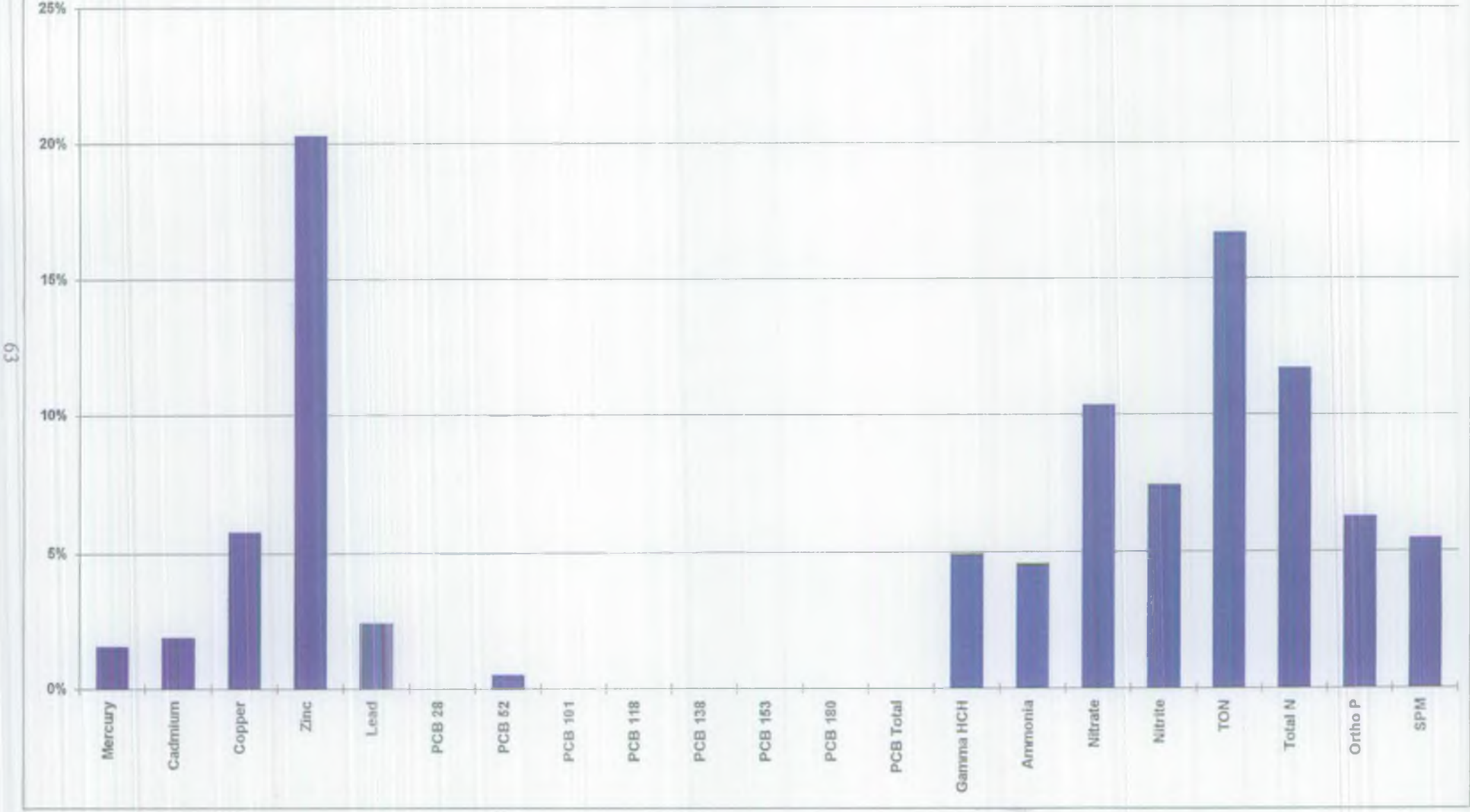
iii) implementing the pesticide strategy and targeting monitoring.

iv) providing advice on ecotoxicology and environmental standards.

v) developing and implementing the Eutrophication Strategy including action for the control of Blue-green Algae.

vi) recommendations for R&D; the management of the R&D programme; liaison with others to ensure that their research and the NRA's is complementary.

Figure 3.6: Contribution to National PARCOM Load
Anglian Region, 1993



3.8 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

3.8.1 Estuaries

During this year, a model of the Humber Estuary was completed by the Water Research Centre (WRc). It allows us to predict the behaviour of pollutants both along the length and across the width of the estuary.

In 1994, WRc also completed a model of the Wash, including the Great Ouse, Nene, Witham and Welland estuaries. Figure 3.7 gives a view of the estuary showing the components of the model.

With Essex University, we have used the Colne Model to investigate nitrogen compounds. The work suggests that Colchester STW, which discharges near the head of the estuary, is the main source of ammonia and organic nitrogen, whilst most of the nitrate enters from the freshwater Colne. Work at Essex University suggests that at least 50% of the nitrogen compounds entering the estuary disappears before the estuary enters the North Sea. This has important implications for the North Sea and Paris Commission (See Parts 3.5 and 3.6).

3.8.2 Coastal Waters

We have a suite of mathematical models which cover our Bathing Waters. The work on models is funded mainly by Anglian Water. The studies are managed by a Steering Group comprised of Anglian Water, the Water Research Centre, and our Region.

We have copies of the models on our computers. We have made enhancements to the output, so that animated displays can be shown. We use them to predict the concentration and dispersion of bacterial pollution from outfalls. The output is produced for different degrees of effluent treatment to build up a picture of pollution and how it might affect, for example, Bathing Waters or shellfish beds. We also use the model to check the Consent Limits requested by dischargers.

Figure 3.7: The Wash Water Quality Model Components

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 need to 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 NRA 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).

National Policy was consolidated with the introduction of the Consents Manual. This manual will 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

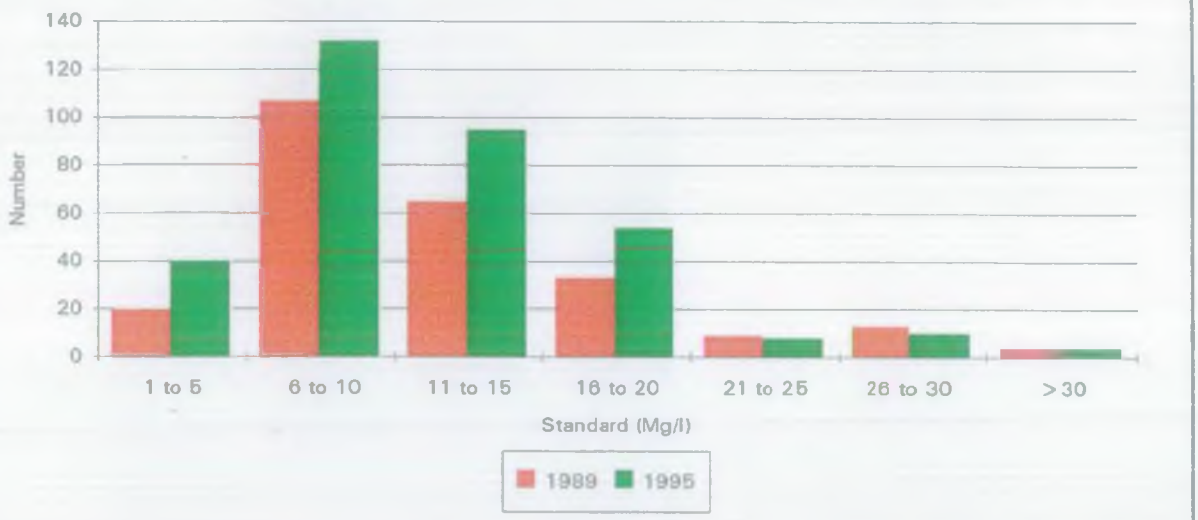
4.2.1 Types of Consent

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). In itself, it has no legal force, but a number of Legal Consents (about 33%), are equivalent in all respects to the River Needs Consent, and 89% of discharges comply with their River Needs Consents (See 4.2.5).

As a result of past and recent activity, sewage treatment works in this Region have, on average, the tightest standards in the United Kingdom. Figure 4.1 shows that since 1989, the number of Legal Consents containing ammonia standards has increased.

Figure 4.1: Anglian Water Legal Consents with Ammonia Standards



At the end of 1994, of Anglian Water's sewage treatment works, 692 had Legal Consents which included numeric limits on the quality of the effluent. Descriptive Consents applied to 344 small works and a few large coastal outfalls.

4.2.2 Processing of Application and Appeals

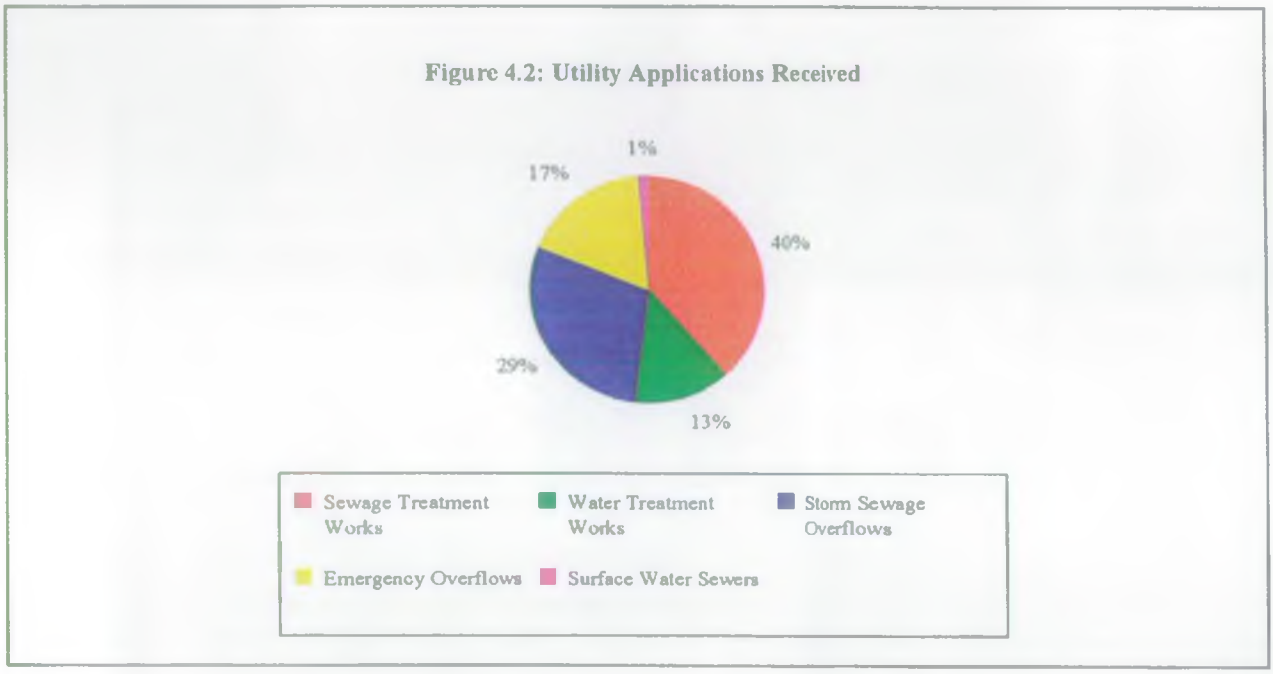
Under the Water Resources Act 1991, the person who applied for a Consent may appeal to the Secretary of State against the conditions imposed. The Utility started to appeal against some of the conditions early in 1991 and a backlog of over 460 Appeals built up at the DoE by the end of 1994.

During 1994, the Secretary of State issued guidance but this still leaves several issues outstanding. Of the 460 outstanding appeals about 370 can now be resolved.

The number of Applications in 1994 was 75. The proportions of Applications in

different categories are shown in Figure 4.2. We issued 100 Consents, including 37 for sewage treatment works.

Figure 4.2: Utility Applications Received



4.2.3 Numbers of Discharges

At the end of 1994, Anglian Water was responsible for the 4238 discharges:

Sewage Treatment Works	1076
Settled Storm Overflows	329
Storm Sewage Overflows	1226
Emergency Overflows	1018
Surface Water Sewers	375
Water Treatment Works	153
Miscellaneous	21

4.2.4 Monitoring

The minimum frequency at which a discharge is sampled is governed mainly by its size. This is a key factor governing the potential impact of the effluent on the environment. The sensitivity of the receiving water is also used to determine the sampling rate.

Maximum frequencies ranged from weekly, for works serving in excess of 100000 people, to quarterly for those serving fewer than 250 people.

Some Legal Consents contain criteria for Dangerous Substances. We monitor effluents for these at least monthly.

We aim to inspect works with Descriptive Consents annually. Descriptive Consents include the need to refer to the state of the receiving water, so monitoring is co-ordinated with the inspections of these waters.

We collected 10912 samples in 1994, almost the same as in 1993.

4.2.5 Compliance

Two summary statistics are used to compare performance of effluent qualities 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%.

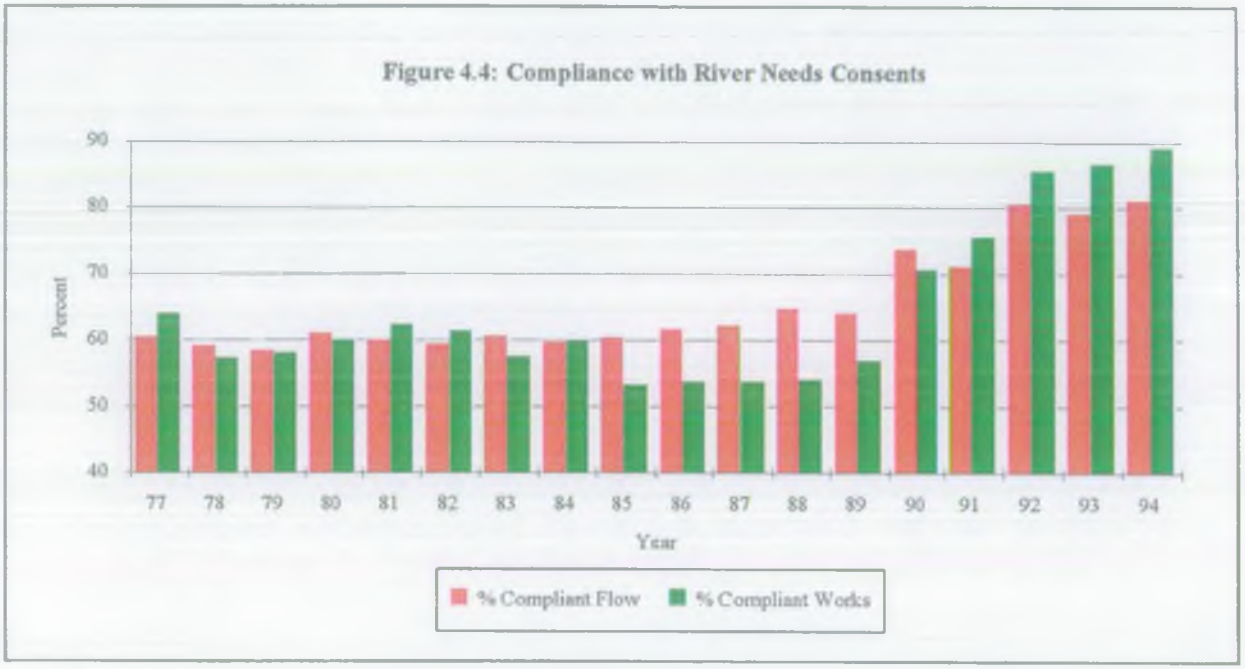
The definition of compliance allows a certain number of sample results to exceed the limit. If the number of exceedences is more than the permitted number, then we are 95% certain that the failure is not due to chance. We then report the discharge as having failed its Consent. The numbers of permitted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

4.2.6 Performance against Consents

Figure 4.3 shows the performance of works against the percentile limits in Legal Consents. Against this measure, performance again exceeds the target of 95%.

Figure 4.3: Compliance with Legal Numeric Consents

Performance against River Needs Consent gives an indication of the action needed to cater for growth and acheive Water Quality Objectives. Figure 4.4 shows that, since 1993, the Percent of Compliant Flow judged against River Needs Consents has improved from 79.2% to 81.2%, and the Percentage of Compliant Works has improved from 86.7% to 89.2 over the same period. The figure was only 54% in 1988.



Can we see these improvements in absolute terms?

Nitrification is a good indicator of performance. Table 4.1 gives the overall ammonia load (as nitrogen), discharged by effluents to controlled waters and shows a reduction of 29%.

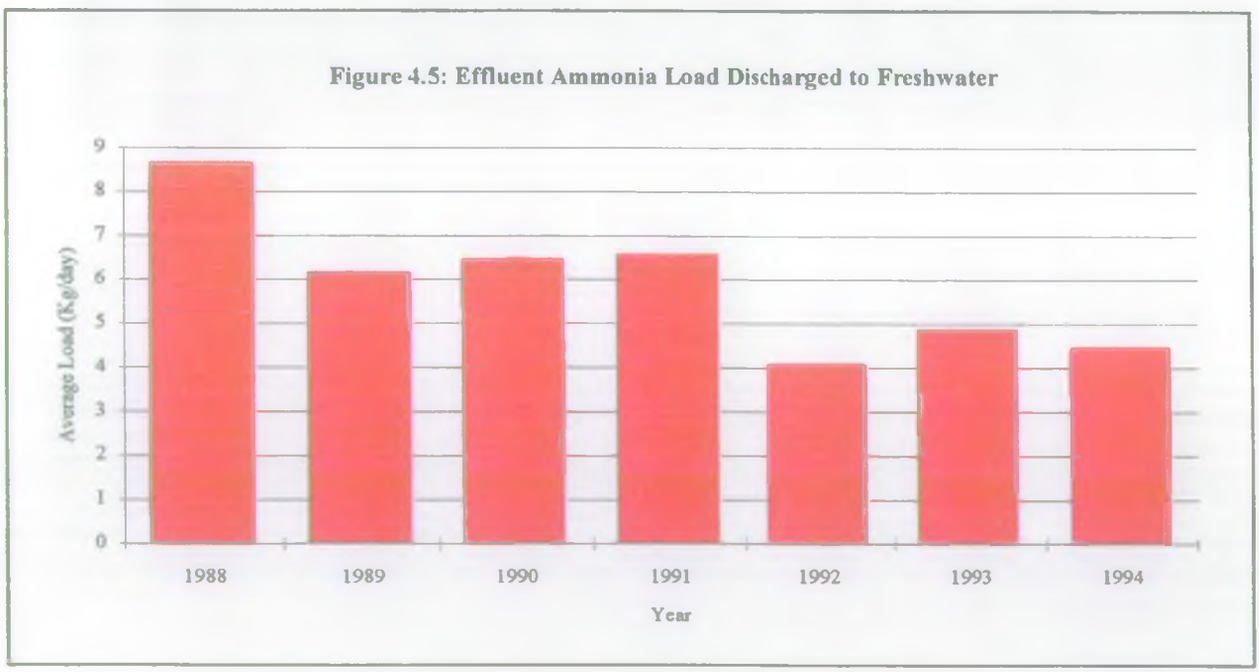
TABLE 4.1 Effluent Ammonia Loads		
	YEAR (Number of discharges)	
	1988	1994
Tonnes Ammonia/day	10.70 (671)	7.60 (687)

If we focus on works which Anglian Water targeted for effluent improvements, the reduction in ammonia load approaches 40%.

Improvements in effluents are also indicated in the median values of ammonia (Table 2.4).

We have also estimated loads in effluents of other substances. Figure 4.5 shows that there has been a decrease in loads of BOD, Ammonia, 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 Discharged to Freshwater



4.2.7 Tidal and Non-Tidal Waters

Table 4.2 summarises the proportions of discharges to Non-Tidal and Tidal Waters. Although only 6% of discharge are to Tidal Waters, they account for around 20% of the flow, and more than three quarters of load of pollution (see Part 4.2.6). 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	
		1993	1994	1993	1994
Non-tidal	655	97.2	98.0	92.5	93.8
Tidal	37	97.3	97.3	91.0	91.7
Total	692	97.2	97.8	92.1	93.2

4.2.8 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.

The percent of discharges which fail the Upper Tier Limits in their Consents is now 2.4 (2 discharges), compared with 4.8 percent(4 discharges) at the end of 1993.

4.2.9 Non-standard Determinands

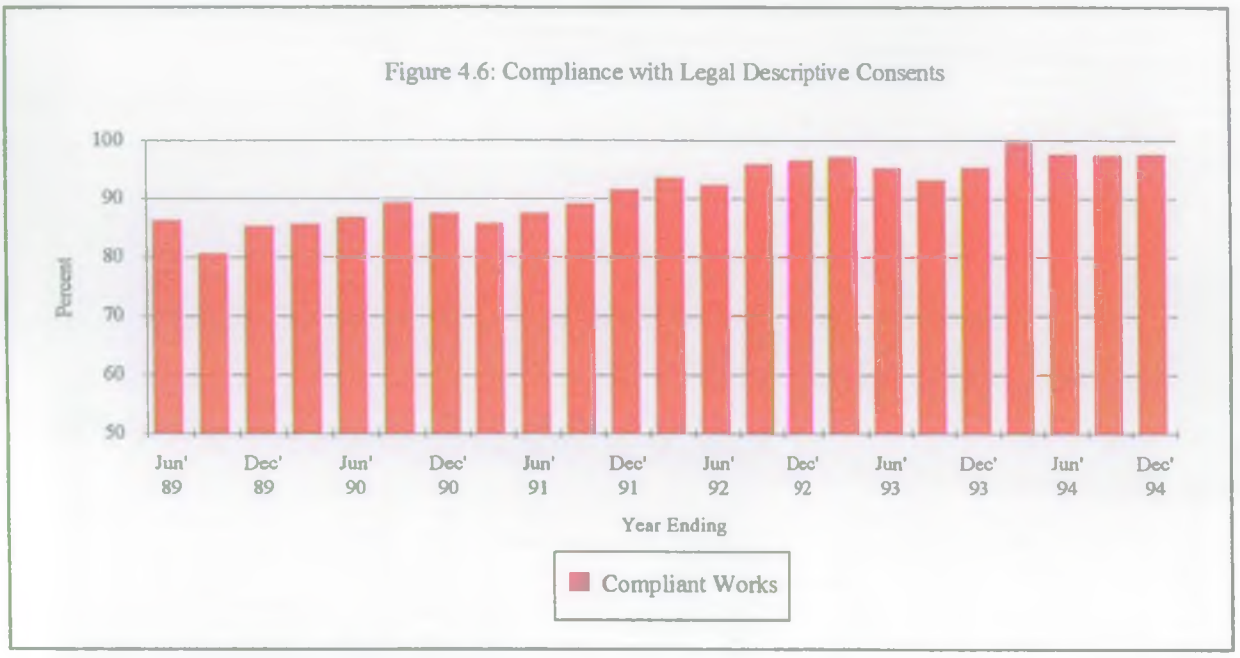
Non-standard determinands, include nutrients and List I and II metals. In 1994, Legal Consents for 43 discharges included criteria for non-standard substances, almost all expressed as Absolute Limits.

Royston Sewage Treatment Works had single failed results for Mercury and Copper. The problem was traced to an industrial discharge to foul sewer. Negotiations are underway with Anglian Water to decide the best way to prevent a recurrence.

4.2.10 Descriptive Consents

At the end of 1994, 344 small discharges had Legal Descriptive Consents. 310 were inspected at least once during the year, compared with 300 in 1993.

Figure 4.6 shows how the compliance of these discharges has altered over the last two years. The proportion which complied at the latest inspection is 98% (303 discharges).



4.2.11 Asset Management Plans

During the year, the Director General of Water Services (OFWAT) asked the NRA to report on the progress that Utilities had made since 1989, on their first Asset Management Plan (AMP1).

Elsewhere in this report, we have reported improvements associated with investment over this period. (Table 2.4, Figure 3.2, Figures 4.3 and 4.4, Part 4.2.6, Table 4.1 and Figure 4.5).

Most of these improvements reflect the impact of investment under AMP1 and the outcome of negotiations with Anglian Water on standards for discharges.

During 1994, the Director General set charges for the ten years from 1995-2004. Anglian Water reviewed its Asset Management Plan for these years (AMP2), and assessed the costs of existing obligations and possible future additions.

The Plan was sent to OFWAT in March 1994. It included work for environmental improvements, as agreed between us and Anglian Water.

In our discussions with Anglian Water, we identified our requirements for every sewage treatment works and intermittent discharge. The most critical aspect was the implementation of the Urban Waste Water Treatment Directive (see Parts 2.7.5 and 3.4.5)

Due largely to an estimate of the costs of this Directive, the DoE stated that no

investment should take place beyond that required for Directives and other statutory obligations. Subsequently, this stance was revised, and we provided the DoE with lists of schemes, called High Profile Schemes, that required investment beyond that for statutory commitments.

In July, OFWAT announced the charging structures. Anglian Water stated that its plans for meeting existing and new statutory requirements, should not be adversely affected by this settlement.

Discretionary Expenditure, for investment in the High Profile Schemes, was announced in the House of Commons in June. The amount of £42M for Anglian Water is the fourth largest of any company and is 70% of our original submission to the DoE. Schemes named in the announcement affect the Norfolk Broads, the Nene Estuary and the rivers Cam, Lark and Waveney.

Through continuing negotiations, and in order to achieve the greatest benefits within the limits of Discretionary Expenditure and the charging settlement, we are examining some of the targets and assumptions made during the AMP2 process. We are hopeful that more schemes will be affordable as details become clearer.

Our mandate from OFWAT now extends to overseeing the implementation of schemes during the period of AMP2. So, through the DoE and OFWAT, the NRA has requested that companies provide us with targets and timetables for all schemes.

4.3 Non-Utility Discharges

4.3.1 Types of Consent

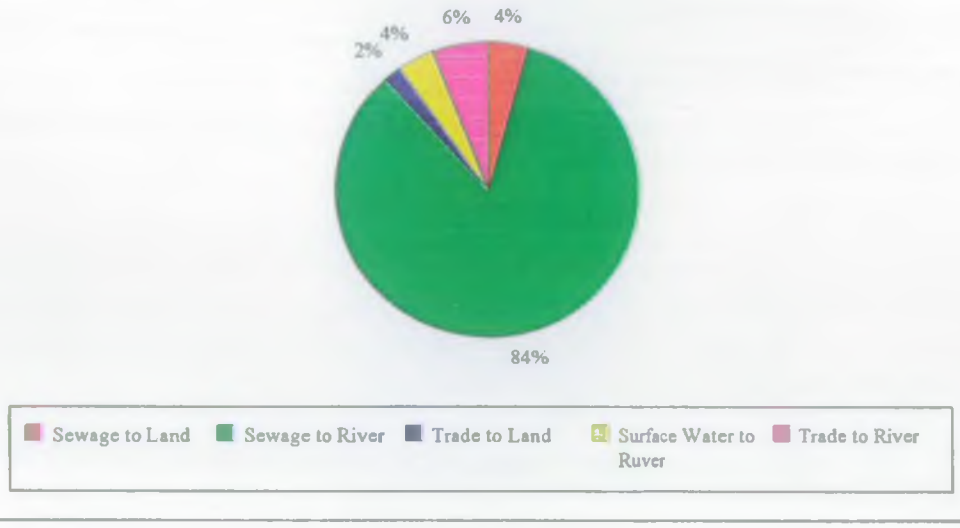
Consents for Non-Utility discharges are generally set to achieve the Quality Objectives for the receiving water. They equate to Legal River Needs Consents (see Part 4.2.1).

Discharges with the greatest potential to affect the environment have numeric limits in their Consents. 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 and these have Descriptive Consents.

4.3.2 Applications for Consent

The number of Applications decreased from 584 in 1993, to 550 in 1994. Of these, 486 were for sewage effluents. The proportions of applications in different categories are shown in Figure 4.7. During 1994, 546 Consents were issued.

Figure 4.7: Non-Utility Applications Received



4.3.3 Discharges

The total of 5522 Non-Utility discharges may be categorised:

Sewage Treatment Works	4077 *
Industrial Effluents	499
Surface Waters	695
Agriculture	41
Miscellaneous	210

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

Of the 400 "Private" sewage treatment works with numeric consent limits, 86% (345 discharges), were sampled in 1994. In addition, we sampled the 30 discharges made from Crown Property. These are the responsibility of the Property Services Agency.

Of the 49 Water Treatment Works with numeric consents, 96% (47 discharges) were sampled in 1994.

We have legal powers to control only those industrial discharges direct to Controlled Waters. Over 330 industrial effluents in this category were sampled in 1994, compared with 350 in 1993. Most discharges of effluent from traders' premises are made to foul sewers. These discharges are managed by Anglian Water Services. 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 51% (180 discharges), compared with 49% (165 discharges) in 1993. The proportion of monitored industrial discharges which were compliant increased from 49% (92 discharges), to 68% (230 discharges).

The figure for compliant discharges owned by the Property Services Agency was 70% (19 discharges), slightly better than 1993. For Water Treatment Works, 83% (39 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 gives figures for the Non-Utility discharges which may be compared with Anglian Water's RNC compliance which was 89% in 1994:

TABLE 4.3

Non-Utility Discharge
(% Compliance with Percentiles)

	1993	1994
STW	45	79
Industrial	83	88
WTW	91	100
Crown Properties	87	96

This comparison indicates that the performance of discharges from industry and Crown Properties is similar to that of the Utility. The performance of Private sewage treatment works is worse.

4.4 Toxicity Testing

These tests 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 toxicity is, therefore, a good method of monitoring quality.

We have 10 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 toxicity results are held on the Public Register (See Part 5).

At a national level, the NRA, HMIP and the Scotland and Northern Ireland Forum for Environmental Research have commissioned R&D to develop a strategy and procedures for the use of Direct Toxicity Assessment. The aim is to use this to help consent complex effluents. The project is due to finish at the end of 1995.

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 4.2.11)

4.6 Targeting and Tripartite Sampling

We use our monitoring to assess change and to check compliance with standards. Typically, 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 taking of Tripartite Samples. These are samples which are specially collected, documented and analysed. They provide the basis for legal proceedings.

A regular sequence of Tripartite Samples is 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

A scheme of charges for consented discharges has been introduced in stages since 1990. It recovers part of our costs on pollution control. There are two kinds of charge, an Application Charge, and an Annual Charge.

4.7.1 Application Charge

The charging scheme covers the processing of Applications for Consent. For 1994/5, the charges (including VAT) were:

Sewage effluents of less than 5 m^3/day	-	£ 84.60
Cooling water of less than 10 m^3/day	-	£ 84.60
Uncontaminated surface water	-	£ 84.60
All other effluents	-	£592.20

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 from 1 April 1994 to 31 March 1999.

The Annual Charge is calculated using a weighting based on the size, nature and location of the discharge The weighting is multiplied by the unit charge for the financial year, which is set in agreement with the Government. For 1994/5, it is £389.

Here are some examples for a full year:

Emergency overflow from a pumping station to stream -	£	155.60
Drainage from Trade premises to a watercourse -	£	389.00
Cooling water of high temperature, pH or chlorinity -	£	389.00
STW serving 1,000 people, discharging to estuary -	£	3,501.00
Large trade effluent, toxic substances, to estuary -	£	40,845.00

In 1994, charges were levied on 6090 discharges. Of these, 4226 are owned by Anglian Water.

4.8 Integrated Pollution Control

Integrated Pollution Control (IPC) was introduced in 1991 under the Environmental Protection Act 1990. IPC is administered by HMIP.

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. All new operations need to be Authorised immediately. The existing Prescribed Processes have been split into groups, and are being dealt with on a rolling programme. This will be finished in 1996. In 1994, applications were made relating to the Chemical Industry category; Acid Manufacture, Halogens, Chemical Fertiliser, Bulk Chemical Storage, and Inorganic Chemicals.

Before the introduction of IPC, all discharges to Controlled Waters required Consents from the NRA (see Part 4.1). Now, where the significant bulk of the discharge is from a Prescribed Process, an Authorisation replaces our Consent.

The NRA is a statutory consultee in the Authorisation process for sites where a discharge is made to Controlled Waters. We provide recommendations on the conditions that must be included in the Authorisation.

HMIP must ensure that the conditions of an Authorisation are at least as tight as the our recommendations, but HMIP can require more stringent limits based on two principles of IPC. The first is that the operator should use the "Best Available Technique Not Entailing Excessive Cost" (BATNEEC). The second that the operator should choose the "Best Practicable Environmental Option" (BPEO).

During 1994, we were consulted on 43 Applications, of which 20 were for Ciba Giegy. As a result, improvement programmes have been secured.

PART 5: THE WATER QUALITY REGISTER

5.1 Information

The Register contains 37000 Consent records. Of this total, 15000 are for current, active discharges (excluding septic tank discharges to land). About 700 Applications were added in 1994. Details are retained on the Register for five years after Consents are revoked.

Since June 1992, the Register has held copies of all Consent Applications and Authorisations issued by HMIP (see Part 4.8). To date there are records for 244 Prescribed Processes at sites in Anglian Region, together with paper records of analytical data supplied by HMIP.

The Register also makes available the results of analysis of 427000 environmental and effluent samples taken since August 1985 giving public access to several million analytical results. Results from new samples are being added at a rate of 50000 per year.

A computer-based mapping system is used to show the availability of information and to facilitate retrieval (see Part 9).

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

5.2 Enquiries

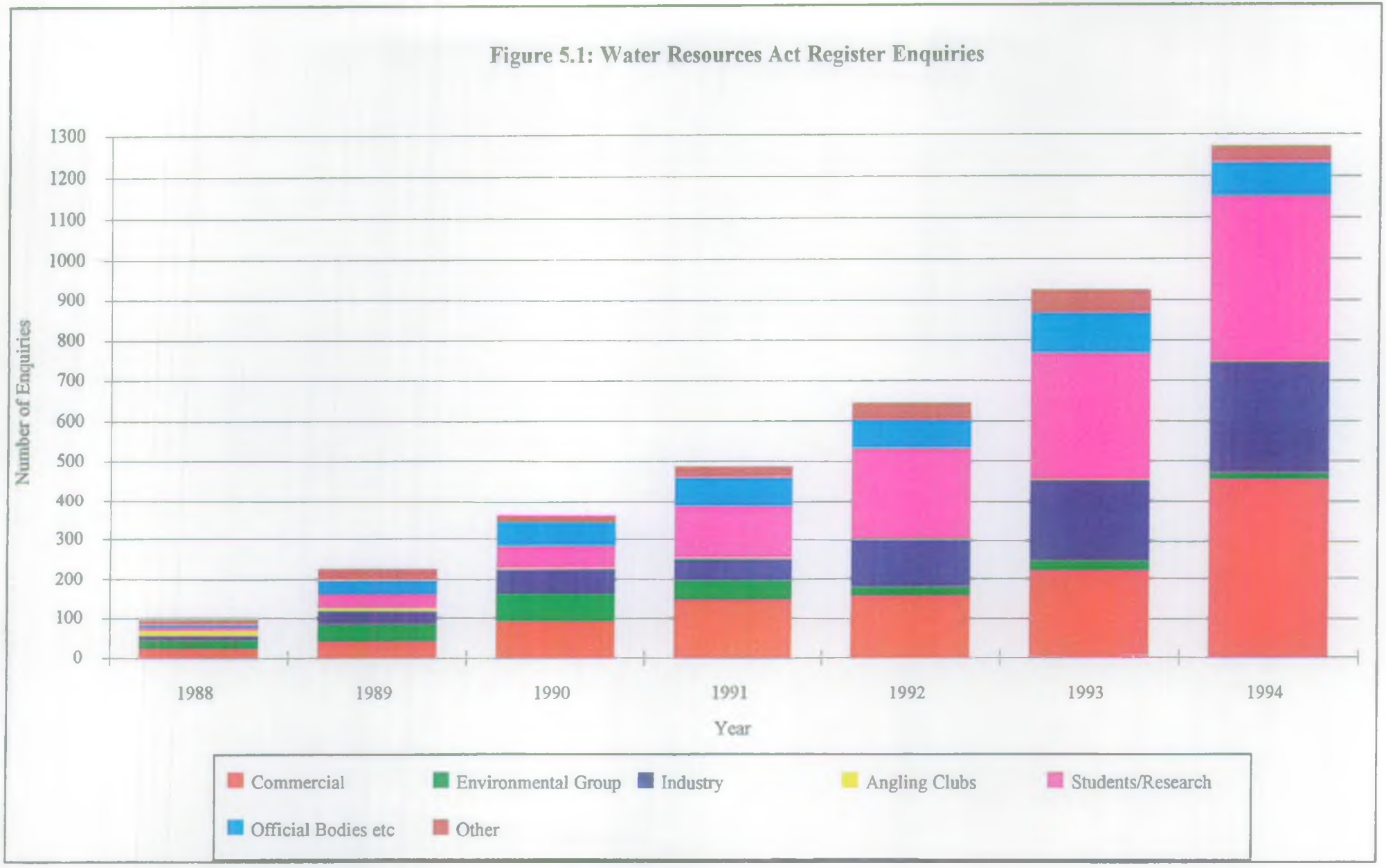
During 1994, 1282 enquiries were received, an increase of almost 40% since 1993. A large proportion of enquirers are students.

We saw an increase in the number of commercial enquiries, primarily from consultants. This was due largely to requests for nitrate data during the consultation process on Nitrate Vulnerable Zones, and increasing numbers of enquiries as part of environmental audits. Trends and categories of enquiries are shown in Figure 5.1.

5.3 Inspection of the Register

The Register is located at Peterborough and is open on weekdays (except Bank Holidays) from 9.30 to 16.00. 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. Full details of charges and the supply of Environmental Information are available on request.

Figure 5.1: Water Resources Act Register Enquiries



PART 6: CAPITAL PROGRAMME

The budget for 1994/95 was £371,000. 20 schemes were funded. Assets developed under these schemes are shown in Table 6.1. Figures for 1993/94 are given in parentheses.

TABLE 6.1

Capital Programme

Type of Asset	Number	Cost (£ 000's)
Water Quality Monitoring Stations	4 (3)	97 (96)
Pollution Control	10 (29)	180 (402)
Marine Survey Facilities	3 (4)	41 (38)
Scientific Equipment	2 (0)	35 (0)
Laboratories	1 (3)	18 (16)
Totals	20 (39)	371 (546)

These figures reflect continued commitment to investigating and remedying pollution, especially of groundwaters. The single item under laboratories was investment to enhance the Laboratory Information Management System.

PART 7: RESEARCH AND DEVELOPMENT

The NRA has a statutory duty to undertake Research and Development. The benefits include:

- new policy and procedures;
- knowledge;
- improvements to efficiency; and,
- collaborative links with other agencies.

We appraise projects to ensure that they are cost-effective. The options for each project are assessed by the Region's Project Assessment Board. Wherever possible, contracts are let via competitive tendering.

We undertake research through two distinct programmes. The National Programme addresses national issues, and the Operational Investigations cover projects which are specific to our Region.

In 1994 we maintained our commitment to the National Programme, with 30 staff leading 37 projects. We consolidated our position in managing projects concerned with Blue-green Algae, Pesticides and Eutrophication (see Part 1). Our part of the National expenditure was £585,000, which was the third largest of the Regions.

One notable project completed was a review of Dioxins in surface waters, the first to be undertaken in the United Kingdom. Also, a project was initiated to develop an alarm system to summon help to staff working alone out of doors.

We developed and managed 19 Operational Investigations. Expenditure was £270,000 compared with £452,000 in 1993.

Work is being undertaken jointly with the Broads Authority and the NRA's counterpart in the Netherlands, RIZA, on the restoration of the Norfolk Broads. The Netherlands has similar problems of over-enrichment of freshwater with nutrients, and there are benefits in sharing our experience (see Part 2.15).

PART 8: CHEMICAL LABORATORY ANALYSIS

Analytical work is carried out by the NRA's National Laboratory Service (NLS). Samples are transported by overnight courier to the laboratory at Reading, where they are registered and the majority of the analyses are carried out. Samples can be also transferred to other NLS sites for specialist analysis.

All of the NLS laboratories are NAMAS accredited and are required to undergo audit procedures to maintain accreditation. They also participate in national inter-laboratory quality control schemes.

The performance of all analytical methods is checked on a day-to-day basis.

We organise the analysis of ranges of determinands as sets or Suites. There are 200 of these. The most comprehensive Suite requires analysis for over 90 determinands.

The number of samples collected for routine monitoring are given in Table 8.1. A number of unplanned samples are also analysed. These may be taken, for example, in response to a Pollution Incident. The total number of samples processed in 1994 was 48608 (a decrease of 4.9% on 1993) and the total number of analyses was 543792 (a decrease of 2.4% on 1993). A breakdown of the total number of samples taken during 1994 is shown in Figure 8.1.

During the year, 380 Tripartite Samples (see 4.6) were analysed. This analysis, the handling of the associated documentation, and the appearances in court, create a big workload for Regional and laboratory staff.

TABLE 8.1

Samples Taken: Programmed and Actual

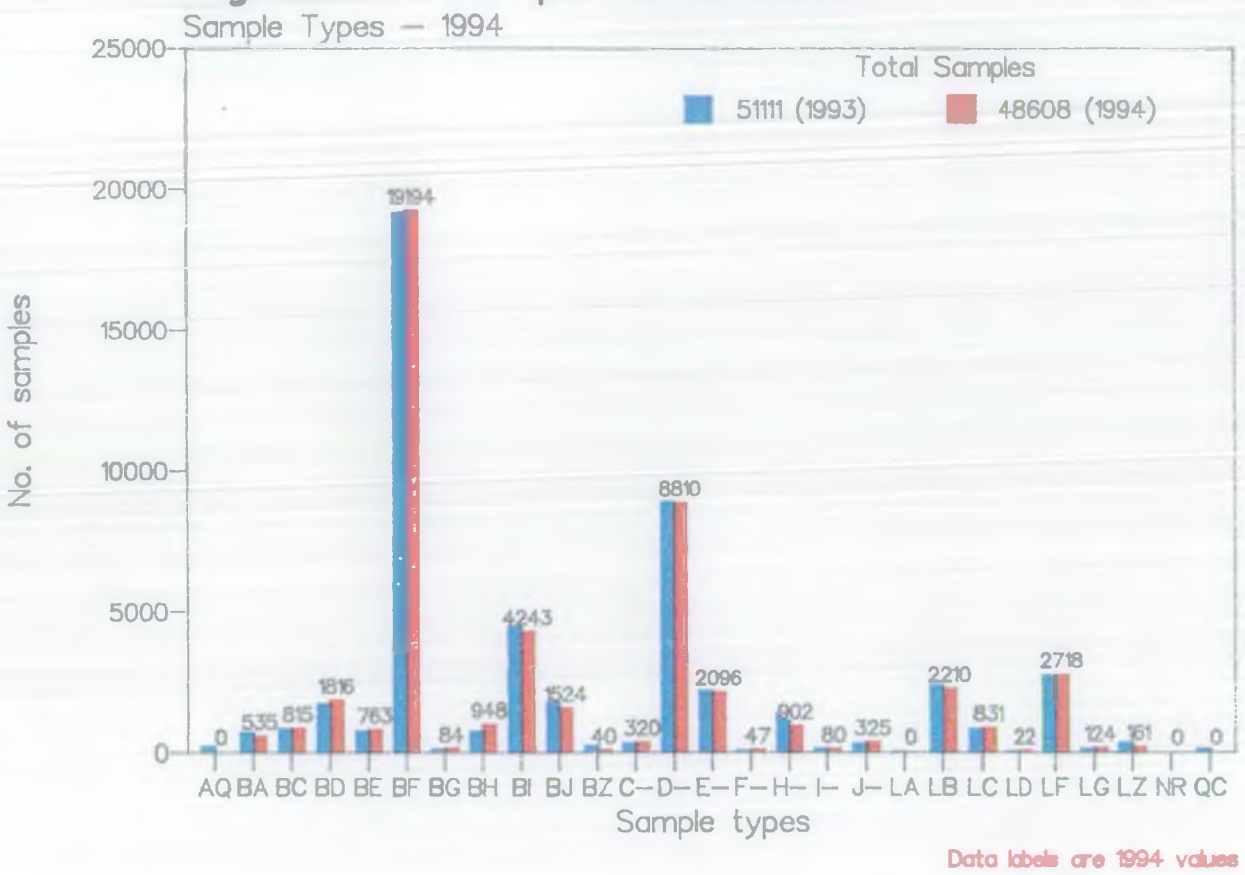
Type of Sample	Sites			Samples		
	Planned	Not Planned	Total	Planned	Not Planned	Total
Control Waters:						
Lakes & Reservoirs	79	66	145	1458	327	1785
Biota	34	17	51	58	22	80
Rivers	1149	377	1526	15317	4001	19318
Groundwaters	784	150	934	2877	535	3412
Freshwater Sediments	154	34	188	376	205	581
Estuaries	351	6	357	4107	136	4243
Coastal Waters	181	5	186	1472	52	1524
Saline Sediments	262	14	276	301	20	321
All Discharges	2303	253	2556	16081	1263	17344
Total	5297	922	6219	42047	6561	48608

Notes:

1) Non-programmed samples can be taken at both programmed and non-programmed sites.

2) Non-programmed samples will include: Pollutions Incidents, Special Surveys and Catch-up samples missed from the programmed routes.

Fig. 8.1 – Sample Breakdown



SAMPLE TYPES

AQ	Analytical Quality Control
BA	Reservior 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 Effluents
LG	Agricultural Effluents
LZ	Miscellaneous Discharges
NR	NRA - Samples from other NRA Regions
QC	Quality Control - Inter-Laboratory Calibration

PART 9: INFORMATION STRATEGY

We use computer systems to help manage monitoring programs and interpret and display our data.

We are involved with two national projects: the Water Archive and Monitoring System (WAMS) and the Sampling Programme Management System (SPMS). WAMS will be delivered to this Region in late 1995 and will enhance the storage and interpretation of data.

We use the Laboratory Information Management System (LIMS) to schedule our chemical monitoring. LIMS coordinates sampling and the delivery of samples to the National Laboratory Service (NLS), and receives analytical results electronically for subsequent transfer to our archive. In 1994 much work was involved in developing the electronic transfer of data, implementing bar-coded sample registration at Reading, and improving the access to the system by our Catchment Offices.

We use our Sampling Information Management System (SIMS) to handle details of monitoring requirements, and to convert laboratory data for analysis and display. We use our mapping and graphics software (EasyMap and LIMSgraph) to display and interpret data. (see Part 2.16.1) In 1994 both systems were enhanced in response to users' suggestions. All these systems were developed in-house.

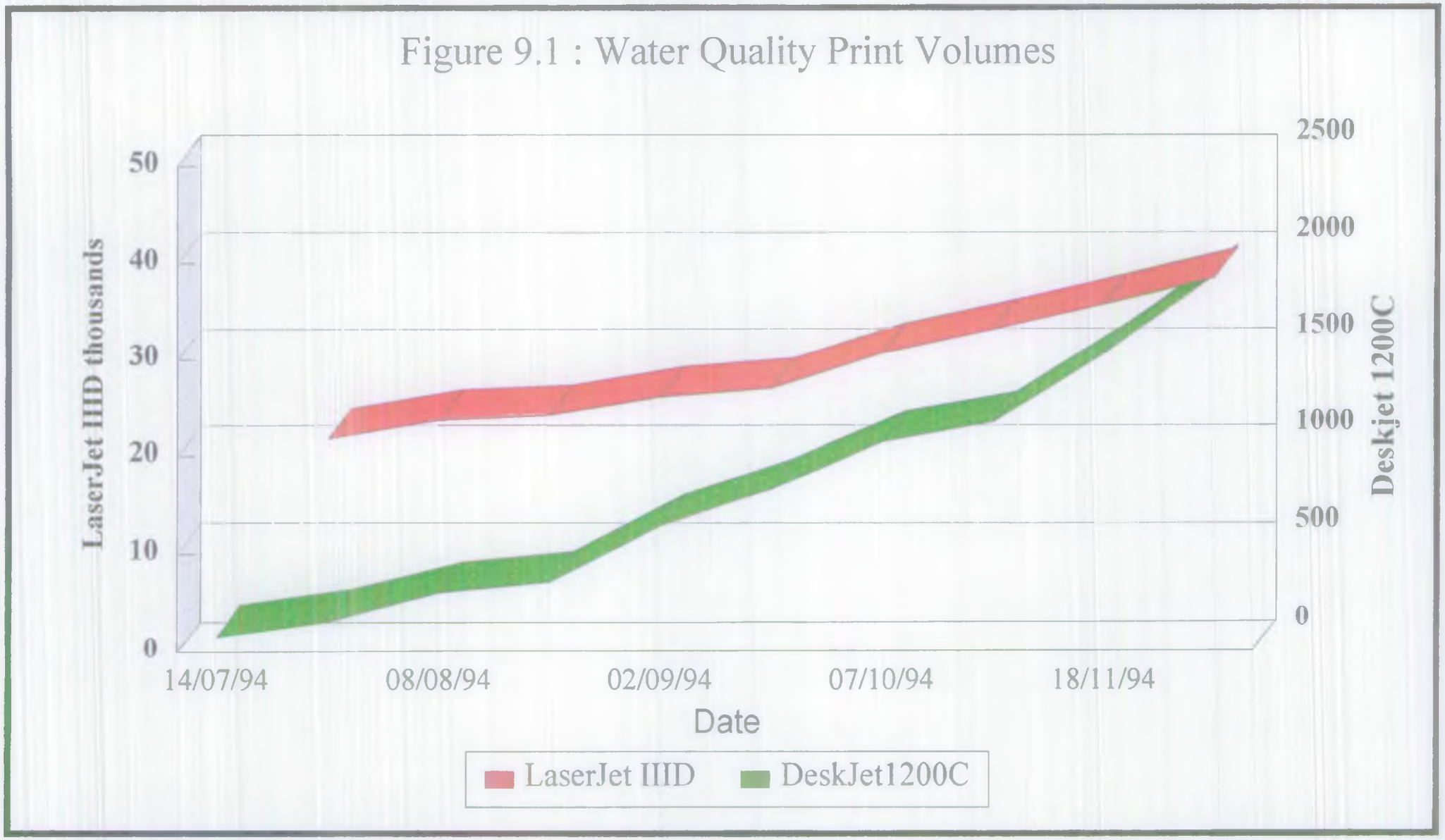
We run a number of computer models to predict the quality of water under different conditions (see Part 2.17 and 3.8). In 1994 we enhanced our in-house interpretation of the output of some of the models (see Part 3.8). We also developed software to run a program for predicting levels of algae (see Part 2.14), and we were involved in a national project to write software that predicts the immediate dilution of effluent which outfalls to coastal waters.

During 1994, we improved our efficiency by converting a number of systems from the Mainframe Computer to desk-top PCs. We developed new routines to assess compliance against new Water Quality Objectives (see Part 2.4), and to show performance of effluents from Water Treatment Works (see Part 4.3).

We work with our Information Systems (IS) section to ensure that our hardware and software are suitable and reliable. We monitor the volume of printing to plan maintenance and servicing (see Figure 9.1).

Computer security is critical. In 1994 we scanned every floppy disk and portable computer that entered the section. We found and successfully eradicated one computer virus that arrived on a diskette.

Figure 9.1 : Water Quality Print Volumes



APPENDIX I: BIOLOGICAL MONITORING

	Number of Samples	
1. Freshwater - Rivers	1994	1993
a. Macroinvertebrates		
Routine	2238	(2363)
Pollution	385	(310)
Special investigation	707	(505)
b. Macrophytes	110	(259)
c. Microbes	427	(558)
d. Phytoplankton/Blue-green algae	530	(345)
Total	4397	(4340)
2. Freshwater - Lakes		
a. Macroinvertebrates	935	(1313)
b. Macrophytes	829	(1036)
c. Microbes	10	(91)
d. Phytoplankton/Blue-green algae	1048	(854)
e. Zooplankton	1543	(1089)
Total	4365	(4383)
3. Estuary and Coastal waters		
a. Macroinvertebrates		
Intertidal	378	(502)
Subtidal	616	(991)
b. Microbes	1348	(2436)
c. Phytoplankton	78	(169)
d. Zooplankton	44	(44)
e. Beam trawl	38	(58)
f. Bioaccumulation	72	(202)
Total	2574	(4416)
4. Borehole		
a. Microbes	-	(14)

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

Currently in production:

PPG 19 - Scrapyards
PPG 20 - Airfields
PPG 21 - Timber Treatment Plants
PPG 22 - Garages

Proposed:

Fertilisers, Surface Water Disposal, Caravan & Camping Sites, Septic Tanks and Domestic Sewage, Motorway Service Areas and Roadside Restaurants.

APPENDIX III: PROSECUTIONS BROUGHT TO COURT

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into a tributary of Stour Estuary	10.1.94	Mr D.P. Hearne	Conditional Discharge (12 mths)	707.90
Trade effluent into Cadney Land Drain	11.1.94	Mr A.N. Kerr	1,500.00	843.35
Trade effluent into Stagsden Brook	17.1.94	Mr C.D. Tyler	1,500.00	320.75
Trade effluent into Stagsden Brook	17.1.94	Mr A.G. White	1,500.00	320.75
Trade effluent into tributary of River Colne	17.1.94	David James Bullard	2,500.00	950.00
Trade effluent into tributary of The Beck	27.1.94	L.E. Tuckwell Limited	5,000.00	934.72
Trade effluent into tributary of Suffield Beck	7.2.94	Alysham Growers Limited	800.00	791.10
Trade effluent into tributary of Salcott Creek	15.2.94	Clifford Henry Beauchamp	1,000.00	500.00
Trade effluent into Wollaston Brook	21.2.94	N B Potter (Haulage) Limited	1,500.00	627.27
Trade effluent into Stour Brook	23.2.94	Acorn Pet Products Limited	10,000.00 (2 x 5,000)	748.58

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into Starston Beck	8.3.94	Ark Foods Limited	1,000.00	1,000.00
Trade effluent into River Welland	16.3.94	Mr C L Parker	1,500.00	516.45
Trade effluent into tributary of Stour Estuary	21.3.94	Anglian Water Services Ltd	4,000.00	761.20
Trade effluent into tributary of River Nene	11.4.94	James Jackson	1,000.00	660.00
Keeping slurry in a system which did not comply with Control of Pollution (Silage, Slurry and Agricultural Fuel) Regulations 1991	12.4.94	Mr M S Blake	1,000.00	—
Keeping slurry in a system which did not comply with Control of Pollution (Silage, Slurry and Agricultural Fuel) Regulations 1991	12.4.94	Mrs M S Blake	1,000.00	—
Trade effluent into tributary of River Stour	12.4.94	Mr M S Blake	10,000.00 (2 x 5,000)	2,065.80
Trade effluent into tributary of River Stour	12.4.94	Mrs M S Blake	10,000.00 (2 x 5,000)	—
Trade effluent into tributary of Lyvedon Stream	15.4.94	J Robert Earl	2,000.00	373.40

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into tributary of Dickleburgh Stream	18.4.94	Mr J C Green	750.00	726.26
Trade effluent into tributary of Bourne Brook	19.4.94	Mr D T Lloyd	2,000.00	2233.00
Trade effluent into tributary of River Nene	25.4.94	L & H Polymers Limited	2,500.00	622.78
Trade effluent into Harpers Brook	9.5.94	Henry Metford Frost	2,000.00	751.38
Trade effluent into Waterland Drain	10.5.94	Caudwell (Piggeries) Limited	5,000.00	1,043.20
Trade effluent into tributary of River Stour	11.5.94	Newmarket Foods Limited	5,000.00	1,124.58
Trade effluent into tributary of Pickers Ditch	20.5.94	Tendring Hundred Water Services Limited	5,000.00	967.00
Trade effluent into tributary of Wells Drain	27.5.94	Spalding Potatoes Limited	5,000.00	500.00
Trade effluent into tributary of River Gipping	15.6.94	CPS Fuels Limited	800.00	779.60
Sewage sludge into tributary of Steeple Brook	8.7.94	Carcase Waste Disposal	2,500.00	919.07

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into River Witham	13.7.94	Christian Salvesen Food Services Limited	15,000.00	1,598.00
Oil into tributary of River Yare	14.7.94	Lewis & Hughes Limited	9,500.00	915.00
Trade effluent into Pix Brook	15.7.94	Anglian Water Services Ltd	2,000.00	872.30
Trade effluent into Black Leg Drain	19.7.94	UB (Ross Young's) Limited	10,000.00	966.38
Trade effluent into tributary of River Nene	22.7.94	William Tomkins Limited	2,250.00	1,230.99
Trade effluent into tributary of River Alde	28.7.94	Anglian Water Services Ltd	500.00	853.51
Trade effluent,sewage sludge into tributary of Roxwell Brook	9.8.94	Carcarc Waste Disposal Limited	3,000.00	945.53
Trade effluent into tributary of River Tiffey	11.8.94	Farm & Domestic Oils Ltd	4,000.00	1,150.90
Trade effluent, sewage sludge into Rettendon Brook	17.8.94	Carcarc Waste Disposal Limited	2,000.00	868.69
Trade effluent, pig slurry into tributary of Black Bourne	17.8.94	Mr James Miller	2,500.00	781.10
Causing waters to be poisonous or injurious to fish	17.8.94	Mr James Miller	1,000.00	—

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent,dye into tributary of River Glem	19.8.94	Glemsford Silk Mills	750.00	778.81
Trade effluent,oil into Pickers Ditch	2.9.94	Kenneth Straight	1,000.00	1,101.64
Farm effluent into tributary of River Welland	6.9.94	Dixon Smith Farms (Braintree) Limited	200.00	573.00
Trade effluent,abattoir waste into tributary of Tingewick Brook	9.9.94	Randall Parker	4,000.00	884.33
Trade effluent,dairy slurry into unnamed watercourse	19.9.94	Moulton College of Further Education	2,00.00	677.92
Trade effluent into an unnamed watercourse	19.9.94	Richard J Mitchell	1,000.00	853.52
Trade effluent, oil into River Blyth	29.9.94	J Breheny Contractors Ltd	1,000.00	958.29
Trade effluent into tributary of Little Ouse River	30.9.94	Cheeswood Produce (Shepherds Grove) Limited	9,000.00 (1 x 3,000 1 x 6,000)	1,849.50
Trade effluent, chlorine into Mow Beck	2.11.94	South Kesteven District Council	7,000.00	1,514.39
Trade effluent, pig slurry into tributary of Goxhill Haven	10.11.94	Ernest Frederick Pearcy	1,500.00	—

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Did cause poisonous, noxious or polluting matter to enter tributary of Smeath Lode	20.12.94	G R McKenna	1,500.00	400.00

APPENDIX IV: FORMAL CAUTIONS

INCIDENT	DEFENDANT	DATE ISSUED
Organic Farm Waste	J F Strathern	31.01.94
Agricultural (Oil)	Geo Adams & Sons(Farms) Ltd.	07.02.94
Organic Industrial Waste	Christian Salvesen (Food Services) Ltd.	07.02.94
Farm Waste Run-Off	Gary Fielding	13.02.94
Fish Farm Effluent (Unconsented)	Colchester Oyster Fishery Ltd.	28.02.94
Sewage and Trade Effluent	Northamptonshire Association of The Blind	21.03.94
Trade Effluent Consent Failure	J P Simpson and Company (Alnwick) Ltd.	21.03.94
Sewage	Anglian Water Services Ltd.	29.03.94
Farm Waste (Irrigation Run-Off)	Mr.D J Parsons	11.04.94
Piggery Effluent	Newsham Hybrid Pigs Ltd.	21.04.94
Farm Waste	Richard Burdett Coulson	11.05.94
Sewage	Jacks Hill Cafe Ltd.	10.06.94
Wood Primer	Ruddy Joinery Ltd.	27.06.94
Farm Waste (Manure Run-Off)	Moorhouse Farms Ltd.	01.07.94
Piggery Effluent (Run-Off)	David Griffin	14.07.94
Piggery Effluent (Irrigation Run-Off)	Mr P A Nielson	17.07.94
Landfill/Waste Disposal/Tip Leachate	Corby Borough Council	20.07.94
Farm Waste	J F Goodge	20.07.94
Oil (Industrial)	Mr R T Turff	15.08.94
Farm Waste (Irrigation Run-Off)	Mr E F Saunders	25.08.94
Sewage Effluent	Anglian Water Services Ltd.	29.09.94
Sewage Effluent	Suffolk Heritage Housing Association Ltd.	10.10.94
Organic Farm Waste	Lockwood Estates Ltd.	14.10.94
Agricultural (Diesel Oil)	Richard Hardy (Fishtoft)	17.10.94
Organic Farm Waste	Stephenson Farms Ltd.	17.10.94

INCIDENT	DEFENDANT	DATE ISSUED
Piggery Yard Washings	David Black and Sons Ltd.	07.11.94
Organic Farm Waste	Cottesbrooke Estates Company	09.11.94
Farm Waste	G G Bonner & Son	22.11.94
Sewage	Marston Thompson & Evershed Plc	28.11.94
Trade Effluent	Bedfield Foods Ltd.	22.12.94

GLOSSARY

Aquifer	Layers of underground porous rock which contain water and allow water to flow through them.
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.
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.
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.
Property Services Agency	The organisation that administers and maintains Crown 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.

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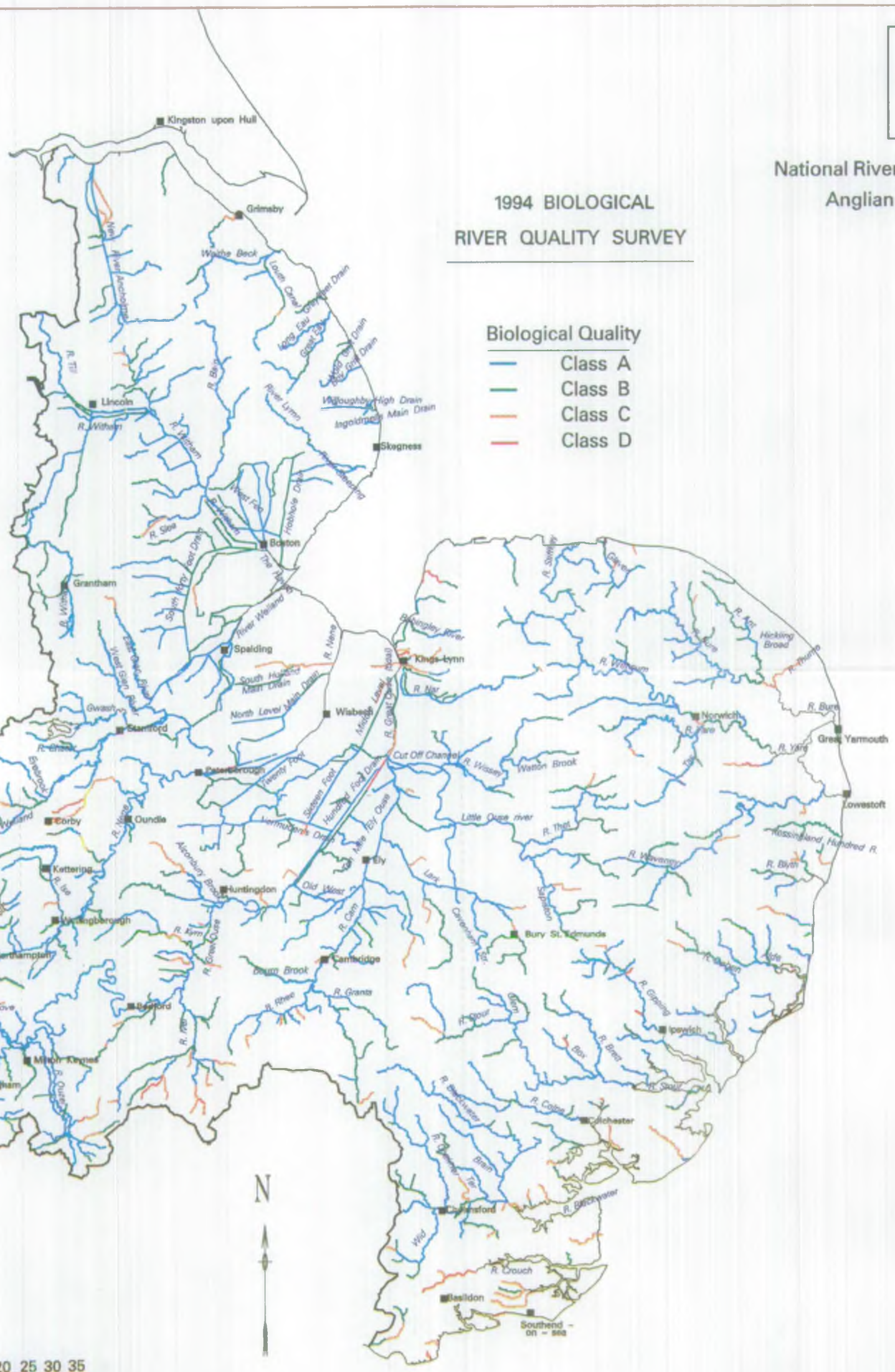

RIVER QUALITY SURVEY 1994

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

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